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3.Ethical complexities within the appearance and usage of social robots: A scoping review

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Ethical complexities within the appearance and usage of social robots: A scoping review

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Introduction

In this review, we explore the most prominent ethical complexities regarding the usage of social robotics in the social professions (childcare, elderly care, childhood education and nursing).

Context

The development of artificial intelligence (AI) and robotics has transformed practices in industry, professional settings and everyday life. Vastly expanded data processing capabilities, cloud computing, development of user-friendly interfaces and the possibility of seamless integration of diverse technologies through the Internet of Things, have opened new opportunities for the use of information technology. Social robots are types of information technologies that have seen an increased use in various application contexts within the social professions. Their entry into those fields has been accompanied by optimism and enthusiasm by some and skepticism and concern by others. Ethical considerations have been a prominent aspect in responses to this new technology. In this review we attempt to combine literature conducted within or close to the practice of the social professions, complemented by more foundational research on ethical perspectives on social robotics and engineering.

Goals

We will identify trends in the discussion of ethical issues in social robotics, focusing on prominent themes in the literature within the field. Through our reading of the source materials the aim is to (i) scope the field of knowledge regarding ethics and social robotics and (ii) point to potential knowledge gaps or still underexplored areas of interest.

What are social robots?

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Following Hegel et. al. (2009), social robots can be described in general terms as having a set of distinctive defining characteristics as well as combining both social and technical aspects, with the social aspects being at the core:

> *it implies the robot to behave (function) socially within a context and second, it implies the robot to have an appearance (form) that explicitly expresses to be social in a specific respect to any use* (Hegel, et al, 2009: 3)

Breazal et al. (2016) specifies this further:

> *social (or sociable) robots are designed to engage people in an interpersonal manner, often as partners, in order to achieve positive outcomes in domains such as education, therapy, or health, or task-related goals in areas such as coordinated teamwork for manufacturing, search and rescue, domestic chores, and more* (2016: 1349).

Social robotics are designed to facilitate and foster engagement with human users on an interpersonal level in a variety of use contexts, including medical, educational, entertainment, domestic or customer service settings. Social robots show varying degrees of initiative and autonomy in their interaction with human users. They come in different shapes, from the closely anthropomorphic (such as the sex-robot Roxxxy) to the traditional humanoid robots (such as NAO) to the zoomorphic (such as the elderly care robot Paro), and to more "techno- or robomorph" robots (such as the telepresence robot Giraff Plus).

Reidsma et al. (2021) present a pragmatic definition of core characteristics of social robots:

- A social robot operates in a "social space"
- A social robot has a physical embodiment
- A social robot operates on the sense/think/act paradigm, i.e. it has sensors to capture what is happening in the social space, processes this information, and performs an action in the social space on the basis of this information processing.

Whilst robots that interact with humans in a variety of contexts increasingly include some socially interactive functions, in this paper we focus on those robots whose function is primarily that of social interaction and engagement with a human counterpart in domains of activity typical to the social care professions.

What is robot ethics?

Robot ethics (or "roboethics") is an emerging field of interdisciplinary debate that considers ethical issues that arise with regard to the design, interpersonal use and societal impact of robots. The field of robot ethics can be subdivided into two areas of inquiry that address different kinds of ethical issues, one foundational, concerning questions about the nature and moral status of artificial moral agents (sometimes labelled "machine ethics" or "machine morality") and the other application focused, concerning questions about the design of robots, their implementation in practice, and societal responsibilities regarding the management and potential limitation of their use:

> *Robot ethics encompasses ethical questions about how humans should design, deploy, and treat robots; machine morality encompasses questions about what moral capacities a robot should have and how these capacities could be computationally implemented* (Malle, 2015: 243).

The purpose of this paper is to map ethical concerns that arise from the use of social robots in the social professions. The focus will be primarily on application contexts but will include some foundational perspectives to explore relevant ethical nuances and potential gaps within the research.

Professional ethics in the social professions

The social professions involve close engagement with persons who are in positions that could be characterised as vulnerable or in need of care, either because of the stage of their lives, because of specific health conditions or functional impairments, or because of social marginalisation or other specific risk factors. Social professional practice includes care for children in early childhood settings as well as other supportive and care environments such as education; long-term care of older persons; care of persons with disabilities at all life stages, or support of persons identified as disadvantaged or at-risk. Social professional practitioners may engage with persons in domestic, residential, educational or other institutional settings.

Engagement between professionals and vulnerable persons can raise complex ethical challenges. Given the variety of professions and specific professional practices under this umbrella, only a general outline of core professional values for these professions can be provided here. *Care* serves as a shared, prominent ethical concept for the social professions; the notion of care implies supportive engagement with the needs of others, often vulnerable and dependent others. Care ethics, as originally proposed by Gilligan (1982) and Noddings (1984), further developed by authors such as Tronto (1993) and Kittay (1999), highlights the importance of an individualised and relational understanding of ethical demands that arise in caring relationships. It acknowledges the importance of general ethical demands regarding the context wherein care is delivered, encompassing notions such as advocacy, respect for autonomy, fostering capabilities, confronting injustice and preventing exploitation. Care ethics has also found direct reception in the field of

robot ethics, for example in Van Wynsberghe's (2014) proposals around 'care-centred value sensitive design' (CCVSD), Stokes & Palmers' (2020) perspectives on the division of tasks between AI and humans or Hewitt's (2021) emphasis on care ethics in assistive care practices involving older adults.

From a theoretical standpoint, care ethics proposes a methodological alternative to universalistic approaches. In practice, the core values for caring professionals are, both in theoretical reflection and in the development of professional ethics guidance, frequently captured in the shape of principles.

Beauchamp and Childress' (2012) principles of healthcare ethics provide useful umbrella concepts that can serve to capture prominent core concerns in the field of the social professions:

- Non-maleficence (doing no harm), exemplified in adherence to professional best practice standards and organisational procedures, attention to client/patient safety and potential risk factors, and accurate handover and record keeping, where appropriate
- Beneficence (doing good), exemplified in attention to fostering client well-being, supporting the maintenance or development of clients' capabilities, and being attentive to their individualised care needs
- Respect for autonomy, exemplified in respecting clients' wishes, supporting skills of independent living, and respecting confidentiality
- Justice, exemplified in being an advocate for marginalised clients, and preventing and counteracting their discrimination and exploitation
- Integrity, exemplified in a personal and interpersonal experience of authenticity and congruence, and in remaining true to these values even in the face of social or environmental pressures.

A variety of theoretical frameworks can be used to underpin ethical reasoning with these specific notions. This variety transfers to the robot ethics debate where a wide range of methodological approaches is present. In this scoping review an attempt will be made to engage primarily with the identification of core concerns with direct impact on social professions or the teaching of such professions, rather than their theoretical underpinnings. In some cases, consideration of distinctive theoretical conceptualisations will be necessary to do justice to concerns whose significance is best captured in direct relation to these theoretical frameworks.

Methodology

The protocol for this review was developed using the methodological framework proposed by Arksey and O'Malley (2005). Before publication and external review, the proposal has been reviewed and revised internally within a broader research team.

3.1 Search strategy and data sources

One author conducted two comprehensive literary searches - in November 2018 and August 2021. The first search was conducted on the following nine databases: Psycinfo, Medline, PubMed, CINAHL, Academic Search Premiere, Applied Science & Technology Source, Scopus, Proquest Materials Science and Engineering database and ProQuest. The second search was conducted with the same parameters, in the following databases: Psycinfo, Medline, PubMed, CINAHL, Academic Search Premiere and ProQuest. Dates were restricted to 2000 or later, with the exception of Applied Science & Technology Source, where the search was restricted to 1990 or later to accommodate earlier standpoints from within the field of STS. No language, geographical or study design restrictions were applied. Search parameters are provided in Table 1.

We also searched Google for information on the conduct of scoping reviews and identification of relevant ethical working groups or guidance documents. In addition, we reference-scanned a relevant systematic review (Vandemeulebroucke, Dierckx de Casterlé, & Gastmans, 2018) and made use of a database of articles and reviews shared through personal communication within the broader research group.

Database	Date	Search-		Results
		Group 1: (social) Robotics/autonomous technololgies	Group 2: Ethics	
PSYCINFO	29-11-2018	(AB robot OR TI robot OR MM robotics OR TI "care robot*" OR AB "care robot*" OR AB "service robot*" OR TI "service robot*" OR AB "social robot*" OR TI "social robot*"))	(MW ethic* OR AB ethic* OR TI ethic* OR ((AB Machin* OR TI Machin* OR MW Machin*) AND (AB ethic* OR TI ethic* OR MW ethic*)) OR MM "Ethical issues")	168
	24-08-2021			258
Academic search premiere	29-11-2018	(AB robot OR TI robot OR MM robotics OR TI "care robot*" OR AB "care robot*" OR AB "service robot*" OR TI "service robot*" OR AB "social robot*" OR TI "social robot*"))	(MW ethic* OR AB ethic* OR TI ethic* OR ((AB Machin* OR TI Machin* OR MW Machin*) AND (AB ethic* OR TI ethic* OR MW ethic*)) OR MM "Ethical issues")	309
	24-08-2021			469
Applied STS source	29-11-2018	(MW robot OR AB robot OR TI robot OR (MW "care robot*" OR AB "care robot*" OR TI "care robot*" OR MW "service robot*" OR AB "service robot*" OR TI "service robot*" OR MW "social robot*" OR AB "social robot*" OR TI "social robot*"))	(MW ethic* OR AB ethic* OR TI ethic* OR ((AB Machin* OR TI Machin* OR MW Machin*) AND (AB ethic* OR TI ethic* OR MW ethic*)) OR MM "Ethical issues")	178
CINAHL	29-11-2018	(AB robot OR TI robot OR MM robotics OR TI "care robot*" OR AB "care robot*" OR AB "service robot*" OR TI "service robot*" OR AB "social robot*" OR TI "social robot*"))	(MW ethic* OR AB ethic* OR TI ethic* OR ((AB Machin* OR TI Machin* OR MW Machin*) AND (AB ethic* OR TI ethic* OR MW ethic*)) OR MM "Ethical issues")	58
	24-08-2021			120
PUBMED	29-11-2018	Robot*[Title/Abstract] OR "robotics*"[MeSH] OR social robot*[Title/Abstract] OR care robot*[Title/Abstract] OR service robot*[Title/Abstract]	"ethics"[Mesh] OR ethic*[Title/Abstract] OR Machine ethics[Title/Abstract] OR ethical issues [MeSH] OR EPSRC [Title/Abstract]	293
	24.08.2021			556
MEDLINE	29-11-2018	(AB robot OR TI robot OR MM robotics OR TI "care robot*" OR AB "care robot*" OR AB "service robot*" OR TI "service robot*" OR AB "social robot*" OR TI "social robot*"))	(MW ethic* OR AB ethic* OR TI ethic* OR ((AB Machin* OR TI Machin* OR MW Machin*) AND (AB ethic* OR TI ethic* OR MW ethic*)) OR MM "Ethical issues")	191
	24-08-2021			333
PROQUEST	29-11-2018	ab(Robot* OR "robotics*" OR social robot* OR care robot* OR service robot*)	ab("ethics" OR ethic* OR Machine ethics OR ethical issues OR EPSRC)	311
	24-08-2021			446
ProQuest Materials Science and Engineering database	29-11-2018	ab(Robot* OR "robotics*" OR social robot* OR care robot* OR service robot*)	ab("ethics" OR ethic* OR Machine ethics OR ethical issues OR EPSRC)	281
SCOPUS	29-11-2018	TITLE-ABS-KEY (robot* OR robotics OR "care robot*" OR "service robot*" OR "social robot*")	TITLE-ABS-KEY (ethic* OR 'Machin* ethics*" OR "ethical issues')	164

Table 1 Search parameters

Eligibility criteria and study selection

Based on preliminary search parameters, post hoc inclusion and exclusion criteria were generated (Arksey & O'Malley, 2005). The following types of papers were included:

1. All literary reviews (including other scoping reviews and systematic reviews)
2. Research papers including conference papers, journal papers or grey literature
3. Book chapters and reviews;
4. Policy and guidance documents.

The content parameters of the initial search were kept wide to allow for greater inclusion, by including all domains of ethical aspects of social robotics. After removal of duplicates, the initial search in 2018 yielded 782 results, whilst the final search of 2021 provided 1262 results, pointing towards an immense research production over the span of under three years.

Selection of articles for the review went through two stages. One author reviewed abstracts for relevance based on these criteria. For round 1 of the selection, the content of abstracts was reviewed to include any articles that substantially addressed ethical concerns in social robotics that appeared relevant for the social professions, widely understood, excluding those concerned with robots that had no likely application in the field, such as surgical, industrial or military robots, or where ethical concerns were not clearly addressed. This first selection round provided 504 results.

In round 2, these results were reviewed for strict relevance on the basis of the full text documents. The criteria for this review were: whether the applications discussed had direct relevance to the social professions, whether ethical issues were substantially addressed, and whether an original contribution rather than a mere overview of commonly known themes was provided. Book reviews, brief introductory overview articles and contributions where these issues were only addressed tangentially were thus excluded. Articles with a primary focus on foundational questions in philosophy, such as the status and rights of artificial moral agents (50 items), were excluded as being insufficiently practically relevant. Articles addressing applications adjacent to social care or education, such as hospital care, mainstream education or childcare, were reviewed for practical relevance, and retained if they shed light on ethical aspects relevant to the social professions. Articles that addressed macro-level legal, policy and governance issues of social robotics and AI (30) were excluded from the main body of the analysis, although some content derived from this literature has been used to set the context. The final selection presented 171 items addressing ethical concerns.

Methodological quality

We did not appraise the quality of the methodology nor risk of bias of the included articles. This is consistent with accepted practice for scoping reviews (Arksey & O'Malley, 2005).

Charting the data

After the final set of studies were selected, the authors proceeded to extract relevant information pertaining to the research questions. When scoping the publications with a view on their potential relevance to the field of social professions, several distinct fields of interest emerged:

1. **Ethical relevance of the morphology and materiality of robots** (Adams, Encarnação, Rios-Rincón, & Cook, 2018; Coeckelbergh et al., 2016; Pearson & Borenstein, 2013; Peca & Coeckelbergh, Simut, Costescu, Sebastian Pintea, Daniel David, Bram Vanderborght Costescu, Sebastian Pintea, Daniel David, and Bram Vanderborght, 2016; Chesher & Andreallo, 2021; Richardson et al., 2018; Tsun,

Theng, Jo, & Hui, 2015; Coeckelbergh, 2009; Damiano & Dumouchel, 2018; Damiano, Dumouchel, & Lehmann, 2015; Fujita, 2001; Ishiguro, 2006, Thomas Arnold & Scheutz, 2017; Pearson & Borenstein, 2014; Nyholm, 2020; Yew, 2020)

2. **Robots that fulfil care or companionship tasks, with regard to older persons** (Bendel, 2015, Baisch et al., 2018; Bogue, 2013; Coeckelbergh, 2016; Draper & Sorell, 2017; Espingardeiro, 2014a; Frennert & Östlund, 2014; Jenkins & Draper, 2015; Klein & Schlömer, 2018; Lehoux & Grimard, 2018; Locsin, Purnell, Tanioka, & Osaka, 2011, Łukasik, Tobis, Wieczorowska-Tobis, & Suwalska, 2018; Metzler & Barnes, 2014; Metzler, Lewis, & Pope, 2016; Misselhorn, Pompe, & Stapleton, 2013; Pilotto, Boi, & Petermans, 2018; Rigaud et al., 2011; Sharkey & Sharkey, 2011; Sharkey & Sharkey, 2012a; Sharkey & Sharkey, 2012b; Sorell & Draper, 2014; Sparrow & Sparrow, 2006; Tanaka & Ghosh, 2011; Tobis, Salatino, Tapus, Suwalska, & Wieczorowska-Tobis, 2017; Vandemeulebroucke, de Casterlé, et al., 2018; Vandemeulebroucke, Dierckx de Casterlé, et al., 2018; Vandemeulebroucke, et al, 2020; Wu, Fassert, & Rigaud, 2012; Wu et al., 2014; Lindeman, et al, 2020; Battistuzzi et al, 2020; Suwa et al, 2020;)

3. **Robots that fulfil care or companionship tasks, with regard to children** (Belpaeme & Morse, 2010; Castellano & Peters, 2010; Etzioni & Etzioni, 2017; Feil-Seifer & Matarić, 2010; Mercer, 2010; Pearson & Borenstein, 2014; Petters, Waters, & Schönbrodt, 2010; Ruiz-del-Solar, 2010; Amanda Sharkey & Sharkey, 2011; N. Sharkey & Sharkey, 2010; Tanaka & Kimura, 2010; Torras, 2010; VallèsPeris, Angulo, & Domènech, 2018)

4. **Social robots for educational tasks** (Tolksdorf, et al, 2021; Génova & González, 2017; Heerink, Vanderborght, Broekens, & Albó-Canals, 2016; Tanaka, 2014, Fridin, 2014), especially in the education of persons with special needs such as autism (Adams et al., 2018; Coeckelbergh et al., 2016; Pearson & Borenstein, 2013; Richardson et al., 2018; Tsun, Theng, Jo, & Hui, 2015; McBride, 2020).

5. **Use of sex robots for persons with disabilities or impairments** (Döring, 2017; Di Nucci 2016, Wolbring & Yumakulov 2014, Bendel 2015; Headland et al, 2020)

6. **Reflection of relevant ethical considerations for social robotics in regulation and legislation** (Fosch-Villaronga & Heldeweg, 2018; Fosch-Villaronga & Beste, 2020; Pagallo, 2018; Yueh-Hsuan Weng, 2010; Ienca, et al, 2020; European Commission, 2021) and guidance and policy documents,

such as EPSRC's principles of robotics (Boddington, 2017; Müller, 2017a; Szollosy, 2017; Voiculescu, 2017; Sætra, 2020),

In the following, each field will be explored in more detail and elements of practical significance for social care will be highlighted. We will also point to potential gaps in knowledge and literature, based on the field of research.

Ethical relevance of the morphology and materiality of robots

Since the inception of social robotics, substantial attention has been paid to the physical features of robots, largely motivated by the interest in ensuring robot accessibility and acceptability to the intended users. Physical characteristics of robots influence human attitudes and expectations towards them. The appearance of a robot impacts whether and for how long users are willing to engage and whether they find the interaction enjoyable (Damiano, Dumouchel, & Lehmann, 2015; Fujita, 2001; Ishiguro, 2006; MacDorman & Ishiguro, 2006). Accordingly, designing aesthetic features of robots has potential ethical implications (Kerruish, 2016; Pearson & Borenstein, 2014).

HRI research has long established that human users have strong tendencies to perceive and react to robots as if they were animate beings, even though they may, at the same time, understand fully that they are merely cleverly programmed technical devices (Fridin, 2014; Turkle 2011). Turkle (2011) thus describes robots as "relational artefacts" that function as "liminal objects" (see also: Prescott, 2017) - to capture this implicit tension as simultaneously animate and inanimate. While acceptability increases consistently with greater similarity to humans or animals, if robots begin to resemble human beings *too* closely, without completely eliciting normative human-like forms of interaction, they begin to be perceived, in most cultures, with the possible exception of some parts of Asia, as 'uncanny' (Freud, 1919/2003) and thus less acceptable (Mori, 1970; MacDorman & Ishiguro, 2006).

When robots look like humans (anthropomorphic) or animals (zoomorphic) certain projections occur in the use of, and interaction with the technology (Coeckelbergh, 2009; Damiano & Dumouchel, 2018; Damiano, Dumouchel, & Lehmann, 2015; Fujita, 2001; Ishiguro, 2006; Giger, et al., 2019). Damiano & Dumouchel (2018) describe this as "anthropomorphic projection" that can be evoked on the basis of quite different characteristics, from physical-morphological features to functional features:

> *[It] … can be exemplified with three kinds of robots: (i) robots like Paro, whose realistic animal-like appearance encourages anthropomorphic projections, in spite of its limited social AI; (ii) robots like Jibo, whose appearance is not conducive to anthropomorphism, but which nonetheless gives rise to*

> *such projections because of its sophisticated social performances; and (iii) robots like Affetto, whose anthropomorphic appearance is matched by high level social AI* (Damiano & Dumouchel, 2018: 3).

The expectations associated with these projections include assumptions about the qualities, processes of thought, and general capabilities of robots (Coeckelbergh, 2009; Damiano & Dumouchel, 2018; Fridin, 2014; Fujita, 2001; Ishiguro, 2006; Oriel, 2014; Giger, et al., 2019). HRI research has shown these projections to be extremely common (Turkle, 2011). The more autonomous the robot is in interaction, the more likely is the ascription of higher abilities and the definition of the relationship as different to that with other objects. It is thus more ethically significant (de Graaf, 2016).

In cases involving children, research shows that the robot will consistently be attributed substantively human characteristics such as emotions, free will and preferences as well as a male gender (Bumby & Dautenhahn, 1999; Tung, 2016). Especially emotional features have been shown to impact on how a robot is perceived; this raises the question whether and under which circumstances it is ethical to design for emotionality in robots (Nitsch & Popp, 2014; Novikova & Watts, 2015; Vallverdú & Casacuberta, 2015; Weber-Guskar, 2021). Affect-aware social robots (that can detect emotional signs) may also bring in additional challenges such as privacy and manipulation of users. These need to be addressed in the design process (Wilson, Scheutz, & Briggs, 2016; Weber-Guskar, 2021). One might ascribe such combinations of physical and emotional characteristics, expectations, projections and general capabilities of and towards robots to entanglements of human-robot materiality (Barad, 2007; Harraway, 1997; Butler, 2011; Søndergaard, 2019), so acknowledging and ascribing agency to both robot- and human materiality:

> *matter itself entails entanglements – that this is its very nature. By 'entanglement' I don't mean just any old kind of connection, interweaving, or enmeshment in a complicated situation* (Barad, 2007: 160).

Entanglements provide a theoretical framework concerning concepts of care, compassion and empathy (Søndergaard, 2019). They also include concepts of causality, materiality and agency in the interconnectedness of subjects as well as objects in the world (Barad, 2007) and should furthermore be a part of ethical considerations (Søndergaard, 2019).

More closely related to practice, Fridin argues that *'children and adults can and often do establish meaningful and robust social conceptualizations and relationships with a robot that they recognize as a technology'*(2014: 263). Projections or mediation of certain human materiality towards physical objects such as robots become potentially more ethically complex in cases where the users are children (Fridin, 2014) or lack full capacity, such as persons with dementia (Sharkey & Sharkey 2012, Sharkey & Sharkey

2010; Koh, et al., 2021). This raises the ethical issue of deception (see also Matthias, 2015). In such cases, users may genuinely misunderstand the nature of the robot and attribute capacities for mutuality and care to them that the robots do not have (e.g. taking Paro to be a pet that develops a mutual relationship with them or treating robotic dolls as 'babies'). Coeckelbergh argues, however, that it may be inappropriate to understand these phenomena as "deception", as this would lead to distinctions of real vs not-real. Rather, ethical analysis on whether the performance, understood as a relational process, is good or not, are more contextually relevant (2018).

A similar point is made by Gunkel (2015) who considers whether we should respond to robots more as objects or as entities that users would be justified in genuinely caring about. The notion of the 'caring' robot is further explored by numerous authors, without necessarily reaching a consensus (De Togni, et al, 2021; Coghlan, 2021; Yew, 2020). Intercultural research indicates that there might be cultural differences in how these relationships are conceptualised (H. R. Lee, J. Sung, S. Šabanović, & J. Han, 2012; Chesner & Andreallo, 2021). Metzler and Barnes argue that engagement with robots might have a significant impact on how we understand ourselves (2014). The materiality of both humans and robots then becomes mutually entangled in their agency. Robust and meaningful relationships to robots that are established through an anthropomorphic production of human potentiality and materiality, calls for more ethical angles wherein materiality, agency and expectation are analysed alongside potential deceptions of users (Sharkey & Sharkey 2012; Yew, 2020). Within some of these perspectives the robot becomes both what they are to the user, and what they are as a physical material being (or what they are not/cannot do), the two not necessarily conjoined but at least entangled. This calls for a research methodology wherein such ethical complexities are accounted for (Harraway, 2016; Hasse & Blond, 2017; Chimirri et al, 2018).

It is important, then, not to limit perspectives on agency solely to the intentionality of production or complete human agency and so to disregard the multifaceted materiality of the technology. Such a limitation, within research involving technology, would risk: '*analytically devitalizing parts of the more comprehensive apparatus that (co-)produces the risks and dysfunctions in focus'* (Søndergaard, 2019, pp. 5).

The functionality of social robots in and of themselves seems to also produce a materiality mediated within the human-robot interaction: *"some soldiers have emotionally bonded with the bomb-disposing PackBots that have saved their lives, sobbing when the robot meets its end"* (Lin, et. Al. 2010: 947). Furthermore, users' attachment to robots in general may potentially become ethically problematic (Fridin, 2014; Huber, Weiss, & Rauhala, 2016), especially if robots are withdrawn from users after a trial period (Beyan, Felzmann et al. 2015). An ethical framework would then need to entail and accept the produced materiality of robots

in their intra-agency with a human counterpart, as well as the potential emotional consequences for said human (in a neo-technophilosophical perspective, potentially the robots as well). Such an ethical framework, as Lin et. Al. pointed to in 2010, is still underrepresented in the literature. It is furthermore unclear whether replacing a human relationship with that of a robot can cause psychological harm to the end user, when such a robot is ascribed a certain agency.

Robots that fulfil care or companionship tasks

Care-related functions make up some of the core features of current social robots, even though their practical effectiveness is still limited (Buhtz et al, 2018) and their embeddedness in real life care settings encounters challenges (Cresswell, Cunningham-Burley, & Sheikh, 2018; Vandemeulebroucke, de Casterlé and Gastmans, 2021). More interdisciplinary and socially sensitive research is needed to allow for a good understanding of public and user attitudes and of the reality of robots in care settings. It is also a necessity for a well-grounded assessment of these technologies and for adequate ethical assessment (Battistuzzi et al., 2020; Decker, 2012; Decker et al., 2011; Decker, 2008; Del Casino, 2016; Enz, Diruf, Spielhagen, Zoll, & Vargas, 2011; Espingardeiro, 2014a; Feil-Seifer, Skinner, & Matarić, 2007; Laryionava & Gross, 2012; Lehoux & Grimard, 2018; Ljungblad, Nylander, & Nørgaard, 2011; Lindemann, et al. 2020; Moon, Danielson, & Loos, 2012; Pilotto et al., 2018; Rantanen, Lehto, Vuorinen, & Coco, 2018; van der Plas, Smits, & Wehrmann, 2010; van Kemenade, Hoorn, & Konijn, 2018; Wu et al., 2014; Suwa, et al, 2020; Hewitt, 2021). Robot assisted care of vulnerable persons is associated with significant ethical concerns, but also opens up new possibilities of realising care (Coeckelbergh, 2015; Aimee van Wynsberghe, 2013; Pirni, et al, 2021).

Discussions of ethical concerns relating to the use of social robots are particularly prominent with regard to specific vulnerable groups of care recipients:

(i) robot assistance of *older persons*, especially those who suffer from dementia or are otherwise frail

(ii) robot care and entertainment of *children* in various care settings

Most discussions on ethical issues with care robots relate to the care and assistance of older persons, especially the care of persons with dementia (Baisch et al., 2018; Bogue, 2013; Coeckelbergh, 2016; Draper & Sorell, 2017a; Espingardeiro, 2014a; Frennert & Östlund, 2014; Ienca et al., 2017; Ienca, Jotterand, Vică, & Elger, 2016; Jenkins & Draper, 2015; Klein & Schlömer, 2018; Lehoux & Grimard, 2018; Łukasik et al., 2018; Metzler & Barnes, 2014; Misselhorn et al., 2013; Pilotto et al., 2018; Rigaud et al., 2011; Sharkey & Sharkey, 2011; Sharkey & Sharkey, 2012; Sharkey & Sharkey, 2012; Sorell & Draper, 2014a; Sparrow &

Sparrow, 2006; 'SMER, 2017; Tobis et al., 2017; Vandemeulebroucke, de Casterlé, et al., 2018; Vandemeulebroucke, de Casterlé & Gastmans, 2021; Wu et al., 2014; Portacolone, et al, 2020; Bradwell et al, 2020). Motivating factors underlying this prominence are demographic developments towards an increasing number of old and very old persons in the population of developed countries (WHO, 2015; United Nations, 2019) and the dramatic projected shortages of carers that will be available for the care of these older persons (e.g. Matarić, 2006). Social robots are seen as a potential solution to this coming issue, and substantial resources are being put towards the development of care robots, for instance by the European Commission.

A second much discussed area of ethical concern is the use of robots to provide care or entertainment for children, much of it related to a primary contribution by Sharkey & Sharkey in 2010 on 'robot nannies' (Tolksdorf, et al, 2021; Belpaeme & Morse, 2010; Castellano & Peters, 2010; Etzioni & Etzioni, 2017; Feil-Seifer & Matarić, 2010; Mercer, 2010; Pearson & Borenstein, 2014; Petters et al., 2010; Ruiz-del-Solar, 2010; Sharkey & Sharkey, 2011; Sharkey & Sharkey, 2010; Tanaka & Kimura, 2010; Torras, 2010; VallèsPeris et al., 2018;). Robotic applications for children are researched extensively in HRI and social robots for children with entertainment functions are widely available commercially as toys. Turkle (2011) raises some ethical concerns about the risks of the emotional draw of such robots as pleasing relational artefacts at the expense of real-life interactions for children and adults alike; these concerns were not widely represented in the literature reviewed and there was only limited evidence of their discussion from an ethical perspective.

The development specifically of care, rather than educational, applications for children appears less developed than for older persons and their discussion is mostly restricted to the discussion of the hypothetical scenarios presented in Sharkey & Sharkey (2010). Tolksdorf et al (2021) do attempt to create a more systematic approach to addressing ethical issues involving children and HRI (2021), that involves both laboratory and real world contexts, but this is primarily focused on kindergarten settings, and is thus limited. Petters et alb(2010) raise concerns with regard to attachment to robots in light of psychological attachment theory. Castellano & Peters (2010) emphasise the issue of manipulation of children by robotic care systems on the basis of the potential for sophisticated recognition of emotional clues. One particular concern in this context is the elicitation of false beliefs to increase bonding in children. Ethically, this also raises the question of deception of vulnerable persons, further underlined by Tolksdorf et al (2021). At the same time, as Belpaeme & Morse (2010) highlight pretend play as a dominant feature of young childhood and therefore the treatment of robots as full interaction partners at that age might not be considered unusual or worrying.

One of the core ethical concerns in this area mirrors concerns found in the elderly care domain, namely the replacement of humans by robots. Etzioni & Etzioni (2010) support van Wynsberghe (2011, 2014) and others that the appropriate use of robots should be as 'partners' in care, working alongside humans and enhancing human care, rather than as replacements of carers. Feil-Seifer and Mataric (2010), Baisch et al. (2018) and Pearson & Borenstein (2013) contend that in most current robotic research in the field, robots are designed as adjunct to human carers to be used jointly, not as replacement. Palm et al (2013) argue that rather than applying a simple replacement paradigm, the nature of care is likely to change in complex and unpredictable ways in response to the use of care robots. Others argue that a comparatively high degree of robot autonomy may nevertheless be important to achieve viable use of robots in the pursuit of caring goals (Esteban et al., 2018).

Others argue that the risk of withdrawal of attention from children when technology is employed in their care is a more general concern that is not specific to robots alone. Ruiz del Solar (2010), who takes Sharkey & Sharkey's (2010) concerns to be significant, emphasises the need to develop both a better evidence base and to begin the development of relevant regulations. One interesting approach in robotics for children that engages practices of care is the use of the 'mutual care' paradigm, where robots are designed to engage children in caring activities towards them (see also; Martin, et al, 2020). These are usually conceived primarily for purposes of education or entertainment, rather than specific care functions (Tanaka & Ghosh, 2011; Tanaka & Kimura, 2010).

Within these care domains, functionalities of social robots may include companionship, cognitive support, cognitive activation, physical activation and exercise, and social inclusion (via telepresence). From an ethical point of view, it may be helpful to classify these functions according to their ethically relevant goals, as they come with different ethical potentials and risks:

1. Protection from harm
    a. of users: safety and risk monitoring, reminders
    b. of others: parenting skills (e.g. robot baby)
2. Increasing well-being and supporting daily living
    a. physical: exercise, hygiene, compensation of impairments
    b. cognitive: support, compensation of deficits

c. social: social connectedness, affection, remembrance

d. support of carers

3. Enhancement of independence

While these general categories of functions are in keeping with core-established principles of healthcare ethics, they may nevertheless conflict with each other in certain circumstances. For instance, protective and monitoring functions may be realised in a manner that is intrusive and unduly paternalistic.

Protection from harm

Robots have to be safe and not cause harm to humans during their use; this is regulated through safety standards (Hasebe et al, 2014) and CE approvals. The risk of over-trust in automated systems is a significant challenge (Wagner, Borenstein, & Howard, 2018). Robots also should not discriminate, a problem that has been recognised as a serious issue for information technologies such as the U.S. justice system's use of AI technologies that discriminate against racial minorities (Howard & Borenstein, 2018).

Protection from harm refers to the purpose of actively using robots to prevent certain types of harm for users. Assistive technologies, especially for older persons, often include functions that are meant to reduce risk and protect vulnerable users from harm. These may include monitoring and surveillance via GPS trackers (Meiland, et. al. 2017; Rashidi & Mihailidis, 2012) or provision of reminders based on results from monitoring i.e. pill dispensers and 'smart pills' (Chen, Kehtarnavaz & Jafari, 2014). It is unsurprising that the latter has been explored and is being positively endorsed, especially by carers (Alaiad & Zhou, 2014). One particular advantage of robots vis-à-vis other assistive technologies, is that they operate in the physical world with some degree of autonomy. Robots could be designed to track the movement of persons and follow them and may use reminders for the person themselves or alerts to a third party, thereby facilitating the prevention or speedy identification of risky behaviour such as wandering, risky medication practices, low intake of food or drink (Łukasik et al., 2018), leaving kitchen appliances on unsupervised, problematic hygiene, or weather-inappropriate clothing (Beyan, et. al. 2015). Telepresence functionalities of mobile robots, such as the GiraffPlus, may serve such monitoring functions, but may also be used for social functions discussed further below (Jenkins & Draper, 2015; Sorell & Draper, 2014a). One particular challenge with monitoring functions is the invasion of the user's privacy and potential challenges with regard to data uses, which is explored throughout the literature reviewed here (Körtner, 2016; Schafer & Edwards, 2017; Sedenberg, Chuang, & Mulligan, 2016; Sharkey & Sharkey, 2012; Beyan, et. al. 2015; Pirni, 2021).

Robots can also be used to monitor the user's ability to care for others. For instance, robot babies are being used by social services with parents who might be considered at risk to monitor the performance of basic parenting skills as practised with the robot (Søgaard, 2019; Søgaard, Andersen & Christiansen, 2021). The idea underlying this particular use of monitoring robots is that early identification might prevent parenting practices that might put a child at risk.

Increasing well-being

A core characteristic of effective caring is that the needs of the persons receiving care are being met, thereby contributing to their wellbeing (Ienca et al., 2017, Bedaf, Gelderblom, & de Witte, 2015, van Wynsberghe, 2013). Social robots can contribute to wellbeing with regard to a number of different domains, such as physical, cognitive or social wellbeing (Van Wynsberghe, 2013; Tulsulkar, et al, 2021; Klein & Schlömer, 2018). For frail persons, social robots may compensate for physical impairments and provide services such as fetching items or tidying specific items into designated spaces (Casey et. al., 2016). More research and user engagement is needed to inform social robot design so it genuinely meets user needs (Ienca et al., 2016). It also needs to be explored whether robot use carries social stigma and how this might be addressed (Blackman, 2013, Søgaard, Andersen & Christiansen, 2021).

Areas frequently discussed in the literature include the opportunities and pitfalls consequential to the use of robots for social functions, including advanced social functions such as elements of psychiatric counselling (Bickmore & Gruber, 2010). A fundamental concern has been that robots may replace relationships with real human beings, but that sociality involving a robot is not genuine sociality (Sharkey & Sharkey, 2012; Sparrow & Sparrow, 2006). It is debated whether the affective bond with a robot could be an element of a flourishing life (de Graaf, 2016), or whether it is a potentially significant liability if attachment develops (Huber et al., 2016). On the other hand, robots may also serve social connectedness, especially in domestic settings, by means of telepresence functions through directly connecting a robot user with family members who may not otherwise be present in their lives, or with professional carers (Isabet, et al, 2021; Draper & Sorell, 2017a; Casey, et. al. , 2016; Jenkins & Draper, 2015; Beyan, et. al. 2015). Entertainment and cognitive functionalities may also have a social function. Robots that deliver information or provide enjoyable activities for non-mobile persons may support participation in the outside world for those users. Mobile telepresence robots that can be used by persons with mobility issues to participate remotely in cultural offerings, as used by some museums, fulfil such a function. Robots that provide reminiscence functions provide users with stimuli that may help to reconnect them with the trajectory of their lives or communities.

With regard to social functionalities, it has also been discussed whether the design of actively noncompliant robots might be a good idea (Billard, 2017); whether it would be ethically appropriate to design robots in a way that incentivises users to be polite (Jenkins & Draper 2014); and whether robots should be developed to nudge their users into becoming more empathetic (Borenstein & Arkin, 2016, 2017).

The use of robotic animals or dolls, such as Paro or other robotic animals, has been extensively researched, with varying user responses (Moyle et al., 2015, 2017). Robotic animals can be seen to fulfil proto-social functions by increasing comfort and engagement in basic or even more complex forms of social responses. This shows calming effects, and may help persons with dementia to engage better with other human beings around their robot use (Chiberska, 2018). As indicated above, it has been argued that such use of robotic animals may constitute deception or infantilisation for those who do not have the capacity to understand the nature of robotic animals (Sharkey & Sharkey, 2012a; Sharkey & Sharkey, 2012b). The particular ethical status of the affective responses in relationships to robotic pets has been explored (Rodogno, 2016). Technology, such as Smart Homes, might be employed to facilitate the keeping of real pets as an option (Preuß & Legal, 2017). With regard to the Paro robot, Misselhorn et al. (2013) argue that a careful contextdependent analysis of such uses of robot animals is needed, rather than sweeping generalisations.

Some authors highlight the risk that robots may undermine social caring relationships (Parks, 2010) or allow carers to escape uncomfortable realities of care, including the uncomfortable realisation of human life as beset by vulnerability, dependency and ultimately decline, thereby disincentivising humans from taking on the caring role and ultimately stunting moral development, with potentially wider social consequences (O'Brolcháin, 2017; Vallor, 2011).

Enhancement of independence

In the literature on care robots, especially robots for older persons, their role in supporting independence is a prominent theme. For some persons with more severe impairments, autonomy, transparency and independence may not be appropriate goals for the use of care robotics (Coeckelbergh, 2016; Pirni, et al, 2021). Many care robots are being designed for persons with less limiting impairments, especially for domestic settings, with the explicit purpose of allowing frail persons or those with mild dementia to live independently in their homes for longer (Huschilt & Clune, 2012; Tobis et al., 2017; Suwa, et al, 2020). The previously discussed functions of harm prevention and wellbeing improvement are meant to facilitate such independence, as they aim to reduce risks that might otherwise lead to the initiation of institutional care and allow persons a healthier everyday life, with an increased ability to manage their lives. Parks (2015) argues that robots that facilitate persons to stay in their homes for longer should be seen as extending

people's capacities or capabilities in ethically valuable ways by allowing them to preserve their identities (Share & Pender, 2021).

The aspect of facilitating, but also partly limiting, the user's autonomy and control is prominently discussed (Borenstein & Pearson, 2010; Draper & Sorell, 2017b; Sharkey & Sharkey, 2012a; Sorell & Draper, 2017; Sorell & Draper, 2014b). One concern is that in the service of independence, it might appear desirable to design paternalistic functions in robots, to allow persons to stay safe, and keep up their health or skills. Jenkins & Draper (2015) and Sorell & Draper (2014b) argue whether it is appropriate to have paternalistic robot functions in order to maintain the skills and bodily condition needed to remain independent, or whether users should be allowed the freedom to engage in risky behaviour.

Robots for learning, skills development and rehabilitation

Ethical issues in the use of robots for educational purposes arise both in the context of mainstream classrooms (Fridin, 2014; Serholt et al., 2017; Tanaka, 2014; Tanaka & Kimura, 2010; Tolksdorf, et al, 2021) and in the context of learning for children and adults with impairments, such as in the area of rehabilitation (Iosa, Morone, Cherubini, & Paolucci, 2016; Voelker, 2005, Prescott & Robillard, 2021). With regard to social care contexts, the use of social robotics with children most prominently discussed in the literature is educational work with children with disabilities, especially autism (Adams et al., 2018; Coeckelbergh et al., 2016; Pearson & Borenstein, 2013; Peca , et. al. 2016; Richardson et al., 2018; Tsun et al., 2015, Harris & Anthis, 2021). This comprises subject matter teaching (such as teaching colours, letters, or body parts), play (dancing, imitation, reacting to musical stimuli), facilitating the expansion of manipulation of objects for physically disabled children (Adams et al., 2018) or social skills learning (reading expressions, practising verbal exchanges). For such highly vulnerable groups, similar ethical challenges arise in the educational setting as were identified with regard to the care setting, concerning deception, marginalisation and replacement of human care by robots. Coeckelberg et al. (2016) studied empirically, with a large international sample of various stakeholders, the ethical acceptability of robot-assisted interventions for children with ASD. In their analysis, they emphasised that while respondents were in favour of robots as assistants, they did not support replacement of human therapists (Peca et al., 2016). As in discussions with regard to the care sector, participants highlighted the importance of ensuring trustworthiness of robot assisted interventions by ensuring human supervision at all times and limiting the degree of autonomous operation of the robot in direct contact with the child. In order to assess these concerns, more empirical studies are needed regarding how such robots are being perceived, especially in relation to longer term uses.

The use of social robots for skills development and rehabilitation is not restricted to uses involving children with autism or developmental disability. They can be used in mainstream educational settings, to foster social skills and play (Fridin, 2014; Tolksdorf, 2021). Socially assistive robots for persons with dementia have been designed to include the elicitation of cognitive and physical activity. Social robots may also present or support physical exercise regimes for persons with physical disabilities or after stroke; however, robots with these functionalities were not frequently mentioned in the ethical literature surveyed (Tsun et al, 2015). A potential application of social robots for substance abuse rehabilitation, drawing on functionalities for social robots for older persons (such as reminders and safety warnings) was also mentioned in the literature surveyed, albeit only in a hypothetical manner (Filimon, 2018); other mental health applications were also discussed (Riek, 2016). A further application specific to the social care field is the use of a robot baby to increase the knowledge of care requirements for babies, support the development of baby care skills among at-risk prospective parents, but also to monitor and quantify their performance (Søgaard, 2019). This particular application includes a mix of knowledge and skills development and monitoring/surveillance. A substantive ethical difference to the other applications in this section is that its potential use by government agencies tasked with child protection decisions introduces a potentially punitive element that is currently absent in the other applications.

According to the literature reviewed here, the primary ethical concerns for these applications of social robots are very similar to those in the category of robots for care. They consist in:

1. ensuring that sufficient benefits accrue from the use of robots, with a particular focus on expanding capabilities that correspond to the educational and skills aspect of this application domain
2. the risk of inappropriate replacement of human intervention by robots, with the resulting risk of marginalisation of vulnerable persons.

More empirical studies conducted with a view to assessing benefit in light of the overall spectrum of ethical risks is however needed.

Robots that fulfill sexual functions

The importance of sexuality as part of human experience raises challenges for the area of social care, especially regarding persons with limited capacities. According to the capabilities approach (Nussbaum 2003), sexuality is included among the first essential human capabilities meriting attention. Within psychology such a perspective is widely contested pertaining to a collection of basic needs, and whether such a collection includes or excludes sexuality. Regardless, it is ethically relevant that persons with

disabilities or those living in residential care institutions are often excluded from sexual experience (Bianchi, 2021). Tepper (2000) highlights this as an issue in what he calls the 'missing discourse of pleasure' in the area of disability. It has been pointed out that sex robots might be able to fill such a gap. Within the literature reviewed, the subject is explored to a larger extent from 2019 to 2021, than any prior years (Bianchi, 2021; Galizia & Rossi, 2020; Fiske et al, 2019). Before then, brief mentions were included for instance in Wolbring & Yumakulov (2014), Bendel (2015) and Döring (2017). De Nucci (2016) engages more in depth with the question of the use of sex robots in healthcare settings. Empirical studies on public attitudes or potential user perspectives on the use of sex robots are limited so far (Scheutz & Arnold, 2016).

A further area of concern that has been controversially discussed is the use of sex robots as a therapeutic tool for persons with paraphilia, such a pedophilia (Behrendt, M., 2017; Galizia & Rossi, 2020). It has been argued that the use of sex robots could potentially be therapeutic by allowing affected persons to realize their sexual desires without causing harm to others. However, this position is widely rejected, and there have been calls for criminalising child-like sex robots.

A concern that is repeated regularly throughout the ethical literature on social robots is the fear that increased robot use might lead to a reduction in opportunities for human contact, specifically as human interactions are replaced by interactions with robots (Coeckelbergh, 2015; Sharkey & Sharkey 2012). As van Wynsberghe (2013, 2016) has argued, the application of care-centred value sensitive design might be a solution to this problem. She proposes to include care-related values as essential in the design of technologies to ensure that robotic technology will be employed in a manner that does not stand in the way of ethically valuable care delivery but might contribute to its realisation. In a similar vein, Draper & Sorell (2017a) propose the inclusion of ethical values in the development of robot technologies.

Regulation, legislation, guidance and policy

The use of robots in social settings raises potential concerns regarding the identification of and compliance with legal and regulatory requirements. This has particular urgency in cases with heightened vulnerability levels of social care clients. Despite an understanding of the need for guidance and various European initiatives to progress specifically the area of robot law (Pagallo, 2018), as of yet, there is no comprehensive and fully developed legal or regulatory approach for dealing with robots in social care settings in the European context, although suggestions have been made towards a comprehensive adaptive approach that allows for the application of an evolving framework in the context of rapid technical development (FoschVillaronga & Heldeweg 2018; Fosch-Villaronga & Golia, 2019). At the same time some legal and regulatory instruments and industry standards are available, that have relevance to the use of robots in

social professions, including the data protection regulation, health and safety legislation, the machine directive, the medical device directive, ISO Standards for healthcare and personal care robots, and even an industry standard on robot ethics by the British Standards authority (Fosch-Villaronga & Golia, 2019). Accordingly, when the introduction of robots is considered in an institutional or domestic setting, care needs to be taken that legal and regulatory perspectives are being considered. Training regarding potential Health and Safety impacts of robot use and the management of client, professional and bystander privacy from the point of view of data protection requirements are particularly relevant (Schafer & Edwards, 2017).

In some contributions to the question of governance of robotics, ethical concepts and approaches are explicitly linked to concepts of governance (Cath, 2018; O'Sullivan et al., 2018; Pagallo, 2018; Yueh-Hsuan Weng, 2010; Tan, et al, 2021; Fosch-Villaronga, Lutz & Tamò-Larrieux, 2020). Governance and legislation regarding social robots are often based on various guidelines and policy papers developed either specifically for the field of robotics, or with close relevance to the field of robotics, such as guidance on AI (EPSRC 2010, EGE 2018, IEEE 2018, HLEG 2019). These groups are working from different backgrounds and with different goals: the EPSRC is a national body for research in engineering with strong industry representation; the IEEE represents international voices of engineers involved in the development of information technologies, equally with strong industry orientation; the EGE is an independent, multidisciplinary body appointed by the European Commission from across Europe to advise on general emerging ethical concerns of relevance for Europe; and the HLEG consists largely of established European academics and was specifically appointed for the purpose of developing guidance on emerging challenges in AI. The EPSRC proposes five principles to guide the development of robots in society. The IEEE provides guidance on ethically aligned design. The EGE outlines general challenges, mostly with regard to AI but also including autonomous systems and robotics. The HLEG opinion is centred on conditions for the achievement of trustworthiness in AI.

The EPSRC's principles of robotics, as an example of such documents, represent a somewhat interdisciplinary take on robot- and techno-ethics driven by the industry sector. The aim of the EPSRC was to create principles pertaining to those who design, sell and use robots (Bolden, 2011). According to the council, *'The five ethical rules for robotics are intended as a living document. They are not intended as hardand-fast laws, but rather to inform debate and for future reference'* (Bolden, 2011). These principles have received critical scrutiny, with several articles identified in the scoping review aiming to improve, criticise or transcend the principles, including their underpinning anthropological assumptions and ethnocentricity (Boddington, 2017; Gning, Davis, Cheng, & Robinson, 2017; Szollosy, 2017; Voiculescu, 2017). Regarding ethnocentricity, several authors point to cultural differences in the perception of the relation of persons and robots (H. R. Lee, J. Sung, S. Šabanović, & J. Han, 2012; Metzler & Lewis, 2008;

Szollosy, 2017). In contrast to the high-level guidance documents, in academic documents the point of departure is not the consensus within a group of expert practitioners, but the analysis of challenges of the field through engagement with specific ethical paradigms, from classical perspectives to postmodern or other contemporary perspectives, with self-applied labels such as roboethics, cyberethics, or technoethics (Jason
Borenstein, 2012; Espingardeiro, 2014b; Hin-Yan & Zawieska, 2017; Howard & Borenstein, 2018; Vanderelst & Winfield, 2017; Winfield, 2011). This then points to a need for mediation between the more practiceoriented research on ethics within the field, and the more normative creation of policies and guidelines for both production and usage of technologies within such a field.

Conclusion

In this review, we have presented an outline of ethical issues with regard to the use of social robots as pertaining to the social professions. Methodologically, a wide range of ethical approaches and conceptualisations were evident in the literature, including principle-based, virtue ethical, phenomenological, post-phenomenological, relational, and feminist approaches. This methodological richness allowed us to capture a variety of different ethical concerns. While the aim of this review was to remain largely theoretically neutral in reviewing the ethical debate within the field, the value of the sensibilities arising from different theoretical frameworks is evident in the richness of concerns identified.

Social robots operate within human-robot relationships, and the ethical characteristics and significance of such relationships were prominently discussed in the literature reviewed. The ethical significance of morphological and affective factors and their impact on the human-robot relationship were explored in depth from a range of philosophical perspectives.

Evident in the literature was that social robots are being developed or could be developed for a wide range of practical contexts in the social professions. There were significant differences with regard to the extent of ethical literature addressing each of these domains. The most prominent domain represented in the ethical literature was the performance of care and companionship functions, especially for vulnerable groups, such as older persons, persons with dementia, children, or persons with disabilities. All other groups were significantly less represented, although educational/therapeutic robots for autism and childcare also received substantial attention. Educational, social robots, albeit a highly researched area, appeared to give rise to somewhat less ethical debate. The area of sex robotics for therapeutic purposes was one where production of research was significantly rising in later years, most likely with regard to an existing, societal debate on sex robotics.

Ethical themes identified included: critical reflections on the nature of the relationship between humans and robots; the issue of replacement or supplementation of human care by robots; the ethical use of robotic companions and robotic pets for certain user groups; the question of which circumstances would mandate the deception of the user becoming an ethical issue; and the potential tensions between privacy and independence vs harm prevention, improvement of well-being and autonomy. The potential role of robots to contribute to or impair the achievement of a good life was also discussed in several contributions, both with regard to primary users and carers or family members.

While many empirical studies involving users, other stakeholders or the general public were included in the review, a number of contributions highlighted that more research was needed. It was highlighted by many that ethical considerations had to be supported by relevant evidence, and that insights gained should be deeply integrated into the design process. One repeated observation was that the research paradigms used for such research needed to show more awareness of the complexity of social phenomena and more adjustment to real life application contexts. In particular, what was evident from the literature was a comparatively narrow focus on the end-user and considerably less focus on other stakeholders in the care systems whose role will nevertheless be fundamentally affected once robots enter their field of practice. Specifically, consequences to the professional identity of carers or other social professionals receive very little focus within the literature.

The review of legal and regulatory concerns showed an emerging body of literature where there is a need for greater clarity and calls for a more coherent and less fragmented approach to regulation and guidance abound. Robotics and AI have received increasing attention by lawmakers, which may lead to the achievement of some greater clarity. Nevertheless, currently available guidance documents tend to be general and vague and, while they address important ethical concerns, do not provide sufficient guidance to professionals.

In conclusion, we have presented an outline of ethical issues with regard to the use of social robots as pertaining to the social professions, highlighting core themes as well as gaps in the debate. The relational role of robots is a core ethical theme underlying much of the debate and it continues to attract deserved attention. In general, more research involving stakeholders and real-life settings is required, and the role of the professionals vis-à-vis robots needs to be explored more. Further ethical research on specific topics is needed especially with regard to marginalised groups other than persons with dementia or autism, for example at-risk parents, or persons with disabilities. From the perspective of the social professions, the complexity of ethical issues when using robots in their practice domains is substantial. Therefore, the potential impact of social robotics on the professional roles and identities of practitioners of the social

professions needs to be explicitly reflected upon and practitioners need to have access to training that allows them to increase their understanding and skills with regard to ethical challenges and potential management of these challenges in situ. This complexity is further emphasised by the EGE, as the hyperconnectedness of our society increases, and technologies are put in place to solve more and more complex issues, uncertainty and unforeseen consequences might rise as a result (European Commission, 2021). Health and care professionals must be equipped to handle such complexities, wicked problems and the multitude of potential consequences.

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