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Preparing for a Robot Future? Social Professions, Social Robotics and the Challenges Ahead

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Cover Page Footnote

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Abstract

There have been significant developments in social robotics in the care sector: in particular, in the fields of elder care and in the care and education of children and young people, especially those with specific disabling conditions such as autism. Within the context of an increased interest in the social and ethical impact of automation and robotics, this paper, based on an overview of relevant literature, addresses some pertinent issues in the field of social robotics, social care and the social professions. It opens by pointing to the increasing application of information technologies in the care field, in areas such as Assistive Technology (AT) and Assistive Learning Technology (ALT). It defines social robotics and provides examples of relevant initiatives, prototypes and products in the care field, including and up to 'third generation' social robots. It outlines some of the challenges, in terms of ethics, human-robot relationships, acceptance and user-centred design, social impacts and issues of autonomy and control, and points to concerns about the professional identity of care providers. It identifies the need to respond in terms of educational/CPD supports and regulatory standards, for example in relation to the Irish regulators QQI and Coru. Finally, it suggests some pedagogical approaches to these issues that may be of assistance to educators, CPD practitioners and students within the social professions.

Key words: Social robotics, social professions, technology, care.

Introduction

> *We shouldn't just let these technologies fold into our lives unexamined, we ought to care about how we think about these things and develop an understanding of the meaning and consequences of the objects we build. Every time we say there's something we should or should not do, it comes with a sense of morality. We see evidence. We might not take a position on it, but we are invited to question it. This is a future in which ethics are at stake, and as authors of our own destiny, we are advised to take a more active role in the creation of our everyday lived realities* (Case 2017)

The rise of the robots? The robots are coming! Race against the machine. Humans need not apply. Recent book titles reflect growing popular interest in the development of robotics and concern about where it might be taking us. From the US to Ireland to Singapore, media figures and academics, researchers and policy-makers are debating the potential of the 'robot revolution'. They acknowledge that robots are having and will have major impacts in transport and logistics; in manufacturing; in international relations and conflict; and, importantly, in human services areas such as health care and the law.

What about the caring and social professions? Is this field 'immune' to the development of robotics? Should it be? Will the care of vulnerable people continue to demand skilled, empathetic and professional practitioners? Should educators, students, practitioners and policy-makers in areas such as social care practice, early years' education, social work or elder care be seriously thinking about what the future might bring?

Film and TV fictions such as *Robot and Frank, Her* and *Humans* introduce us to robots as carers and companions - even as conspirators. Meanwhile, in the 'real world', researchers and companies are actively working on sociable robots and making remarkable progress, as well as confronting seemingly insurmountable barriers. A typical image of such research depicts robot, robot 'creator' and service user in a positive light, helping to solve some human need. Often absent, or perhaps somewhere in the background or to the side of the picture, is the existing human carer, social professional, teacher or nurse. Usually unexplored is *their* future role. How, if at all, will the development of care-focused robots affect their work and livelihood? Will they be made redundant, be deskilled or reskilled or, as promoters of automation often assure us, gain rewarding new tasks and careers that do not yet exist?

This paper asks what these developments may mean for social professional practice and regulation and - of particular interest to us - what they may require of the education and training of the social professionals of the future. It opens by pointing to the increasing application of information technologies in the care field. It defines social robotics and provides examples of relevant initiatives, prototypes and products. It identifies some of the challenges, in terms of ethics, human-robot relationships, social impacts and issues of autonomy and control, and outlines concerns about user acceptance and the professional identity of care providers. It argues that we need to respond in terms of educational/CPD supports and regulatory standards. Finally, it suggests some pedagogical approaches to these issues.

The Rise of the Robot

Many have predicted the roboticisation of society since Czech dramatist Carel Capek introduced the world to the word and concept 'robot' in his influential 1921 play *RUR – Rossum's Universal Robot* (O'Connell 2017, pp. 104-107). There have since been many advances in real-world robot design and application. These have been most prevalent in fields that require routine task fulfilment, such as agriculture and manufacturing, as in the car-making industry; in retailing and distribution, as in warehouses and self-service cashiers; in the military, as in drone technology; and in the mundane but significant world of "back office automation" (Willcocks and Lacity 2016). Having moved from the world of science fiction to that of socio-economic fact, the application of robotics technology is leading to a discernible societal impact, for example on employment and incomes. Many analysts, commentators and artists have foregrounded the related social, political and ethical issues (Amos and Page 2014; Dyer-Witheford 2015; Susskind and Susskind 2015; Avent 2016; Carr 2016; Eurofound 2016; Willcocks and Lacity 2016; Bell, 2017; Cameron 2017; Case 2017; Kiggins 2018).

The recent explosion of interest in robotics has taken a number of forms. There has been much public and media interest in research and development initiatives undertaken by *Google* and other private and public entities on 'driverless' cars. Some forward-thinking governments (e.g. China, Singapore) have indicated an intention to invest heavily in artificial intelligence [AI] and robotics research. Significantly, major consumer goods firms such as Toyota (Japan), Bosch (Germany) and Midea (China) have made substantial investments in the field of robotics for personal and community use (Bosch Global 2017; Christopherson 2017; Vincent 2017).

All these indicators suggest that production of affordable robots for application in everyday private and public settings is only likely to increase (Fortunati 2017).

New developments in robotics and AI, and possible linked futures (utopian and dystopian), are regularly reported in fiction (Amos and Page 2014) and non-fiction sources. Print and social media articles reflect the diverse (potential or real) impacts of robots: in novel applications of the technology (Knight 2015; Mollman 2015); in speculation about human-robot interaction (Jozuka 2015; Kageyama 2015); and in expression of fears of the societal impact of robotics technology (Cellan-Jones 2015; Kelion 2015). These attest to the increasing current and potential use and public awareness of robots, while also pointing to some of the fears and concerns.

'Europe' is also taking note. The EU Commission has recognised the significance of robotics to the EU's future prosperity and has funded a Public Private Partnership [PPP] contract with euRobotics (ASIBL) to the value of €700m. Titled SPARC, the initiative involves over 195 organisations and businesses affiliated to euRobotics who have invested an additional €2.1bn in the project. Speaking at the launch of the partnership, EU Commissioner for the Digital Agenda, Neelie Kroes, asserted:

> this is a great opportunity for Europe. These PPPs will maintain our global lead in robotics … Combined with a comprehensive industrial strategy, the PPPs will ensure vigorous European leadership and a better future for all (Kroes 2013, p.1).

The EU Commission hosts and sponsors an annual Robotics Week (https://eu-robotics.net/robotics_week). In 2017, there were over 1000 events in 36 countries, though only three in Ireland, reflecting the relatively low level of development of the robotics industry in the country.

The Future of Care: Technological, Artificially Intelligent and Roboticised?

There is now the potential to provide a mix of human and technological applications to social care delivery and the technologisation of care is on the agenda for policy and practice. Technologies used in the administration, management and delivery of care may include Assistive Technologies (ATs) such as mobile technologies/apps or screen readers (Wynne et al 2016); and more sophisticated Assisted Living Technologies (ALTs) such as telecare and telehealth; smart homes; or social robots (Wigfield *et al*, 2013; Centre for Policy on Ageing 2014; Dunn *et al*, 2014). Dunn *et al* (2014) indicate that 95% of UK social care providers use at least one digital technology in their organisation, most usually for staff communication needs (now, likely to be smartphones). The use of AT is thus normal and routine, but reflection on its implications or potential is only beginning to emerge (Hansen et al 2016).

ALT encompasses caring technologies labelled 'telecare' or 'telehealth'; and 'digital participation services' designed to enrich the lives of people in need of social support living at home, through education, entertainment or communication (see, for example, Konnektis.com). It also includes "wellness services" that aim to encourage people to adopt and maintain a healthy lifestyle, to prevent or delay the need for additional health or social care support (Lewin et al 2010). Such developments increasingly involve technology-based self-monitoring, leading to the emergence of what has been termed "the quantified self" (Lupton 2016), part of the broader adoption of "metrics" in contemporary society (Beer 2016).

Dunn *et al* (2014) argue that ALT use in the care sector is underdeveloped. They recommend that frontline care staff need coherent ALT training. The UK Skills for Care and Development

partnership (SfCandD 2014) makes a similar argument. Its workforce learning strategy aims to embed 'electronic assistive technology' (eAT) in social care through: support of eAT practices; provision of high quality learning opportunities on eAT care delivery from short courses to Masters; and implementation across the UK of an eAT National Occupational Standards framework for the social care workforce. Similarly, an *EU Skills Panorama* with a focus on skills for social care identifies as a key emergent competence "technological expertise - especially related to the growth of health technologies" (EU 2014, p. 2).

In Ireland, as in other countries, there has been an increasing level of research into ways to address issues of care, disability and ageing through digital and other technologies. In the areas of intellectual disability and autism, the Irish-based international DOCTRID initiative (www.doctrid.ie) has a strong focus on the development of AT/ALT, bringing together clinicians, psychologists, engineers, occupational therapists, computer scientists, educators, and speech and language therapists. It conducts research in areas such as app development, smart homes and virtual reality applications. In the area of ageing, the Dundalk Institute of Technology-based body Netwell/CASALA (www.netwellcasala.org) similarly addresses technological and digital solutions, such as smart homes, digital apps and data analytics.

Despite such developments in research, the training and education, regulatory, and policy fields arguably lag behind. There has been some AT/ALT training for caregivers affiliated to social care providers and representative organisations such as Enable Ireland, Daughters of Charity and the Alzheimer Society. The National Council for Special Education has surveyed and assessed the utility and acceptance of the varieties of AT (in particular, software packages) supported and funded by the state (Wynne et al 2016). Otherwise, there is little evidence that most Irish campaigning organisations, representative bodies or key education, social care and health policy framers have engaged intensively with future AT/ALT needs in the care sector. Consideration of social robotics is even less developed.

What is Social Robotics?

While perhaps less visible than breakthroughs in driverless cars and drone technology, there is real progress in the development of *service* and *social robots* – robots designed to work alongside, and/or interact on a "social" level with, humans (Breazeal et al 2016). Within the span of "service robots" is the more specific category of "social robots" being developed for educational, health care, social care and domestic use. For Breazeal et al (2016, p. 1349) social (or "sociable") robots are engaged in particular types of tasks:

> *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.*

Moodley (2017) goes further and identifies that social robots should be able to demonstrate a range of human-like capacities:

> *a social robot should show emotions, have capabilities to converse on an advanced level, understand the mental models of their social partners, form social relationships, make use of natural communication cues, show personality and learn social capabilities.*

As can be imagined, the development of effective social robots represents a particularly exciting and challenging frontier in robot research and deployment. Consequently, claim

Breazeal et al (2016, p. 1351), "many social robots are among the most sophisticated, articulate, behaviorally rich, and intelligent robots today".

International Federation of Robotics figures indicate the sale of over 24,000 'professional service robots' in 2014 and 4.7m robots for personal or private use (cited in Karreman 2016, p. 3). These include robots intended as toys, such as Lego Mindstorms and Furbies, as well as automated autonomous devices such as robot vacuum cleaners (e.g. the Roomba) and robots to aid those with disabilities (Dyer-Rutherford 2015, p. 171). More radical propositions, such as the deployment of driverless vehicles (SPARC 2016a; Ted.com nd) and 'sex robots' (Levy 2008; Sullins 2012; Reisz 2017), are predicted for the near future.

SPARC (2016b) has identified aged care as a likely space for the development of social robotics, in response to demographic pressures in Europe that will increase the number of older people, coupled with a decline in those available (or willing) to act as caregivers. SPARC draws attention to the 'repetitive nature' of caregiving and its physical demands as a rationale for the introduction of assistive robots: "It's like you're part of a machine. You've got to be here at this time and you've got to finish at this time … It's all down to minutes." – Peter, a care worker, cited in SPARC 2016b). Similarly, Huijnen et al (2017, p.2) note that social robotics can be a valuable tool in addressing the needs of children with autism:

> *interacting with robots can be particularly empowering for children with ASD, because it may overcome various barriers experienced in face-to-face interaction with humans. Moreover, robot assisted interventions can be tailored to the needs of the specific child and can be used in an identical manner as often as needed.*

There have indeed been significant developments in social robotics in the care sector: in particular, in elder care and the care of people with dementia; in the care and education of children and young people, especially those with specific disabling conditions such as autism; but also in an expanding range of other areas (Conti et al 2016).

Related, and important to note, but beyond the scope of this paper, is the increased use in care provision of automated systems such as decision support systems (Gillingham 2013) and artificial intelligence (AI), stimulated by adoption of evidence-based practice (EBP) and implementation science and practice (ISP) approaches to service design and delivery (Ghate 2016). Systematisation of tacit and practice knowledge, as seen in such approaches, is a vital precursor to automation and robotics (Willcocks and Lacity 2016; Lomas 2017).

Social Robotics: Prototypes and Products

International robot trade shows such as Innoboro (France), the Consumer Electronics Show (CES) (USA) and Innoecho (China) now attract hundreds of exhibitors and many thousands of visitors. One of the most popular robots at Innoboro 2015 was *Pepper* (Fig. 1). The BBC (2015) reported that it "does not undertake any practical tasks, but is designed to engage with you on an emotional level". Advances in sensors allow *Pepper* to process facial expressions, verbal intonations and body movements of humans and so provide responsive companionship. In Japan, in June 2015, 1000 *Peppers* were sold within minutes of coming on sale (Bogle 2015).

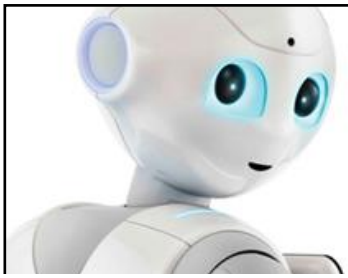


Figure 1: 'Pepper'

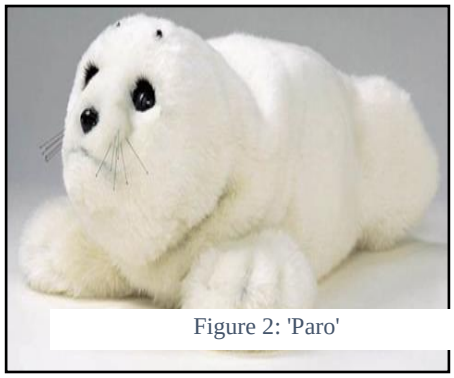


Figure 2: 'Paro'

The robotic baby seal *Paro* (Fig. 2) is a therapeutic companion with basic AI, developed at Japan's National Institute of Advanced Industrial Science and Technology. It has proven to be effective in the care of people with dementia and children with autism (IEEE 2009). Britain's NHS has conducted a trial with *Paro* in Sheffield on its impact on the behaviour of people with dementia. Researcher Claire Jepson asserts: "It is a robot companion. It is about empowerment … It allows people to still feel a sense of achievement, a sense of identity. They become the carer instead of the cared for" (Jepson 2014).

Japanese car manufacturer Toyota is producing a suite of care robots. These include a mechanistic *Human Support Robot* that lifts and fetches objects and can provide remote monitoring and control; a *Walk Assist Robot* that assists people with mobility issues (Christopherson 2017); and a *Care Assist Robot* (Fig. 3) aimed to benefit carers who suffer back pain due to lifting immobile clients. The latter is "equipped not only to assist lifting the patient to and from bed, but to help transport the patient to and from the toilet or other indoor destinations" (Toyota Global 2015). A more anthropomorphic robot, Robina, can "think (*sic*) and move for itself, carry and use objects, and even converse with people" and, suggest the developers, will "become a trusted partner, assisting doctors and nurses and looking after patients and the elderly wherever medical and nursing care are provided" (Toyota Global 2015).


Figure 3: Toyota Care Assist Robot


Figure 4: Care-o-bot 4

Fraunhofer (Germany) manufactures products it claims 'forge the future'. It has led the way in the EU in the production of *Care-o-bot* robots (Fig. 4). There have been four iterations of *Care-o-bot*. Fraunhofer has not yet brought *Care-o-bot 4* – or any of its preceding prototypes – to the market. It reports that:

> put to the test in nursing homes, this robot demonstrated its appeal time and time again – not only for transportation services but also helping ensure the residents drank enough water throughout the day. But with material costs alone approaching a quarter of a million euros, Care-O-bot 3 proved too expensive for series manufacture (Fraunhofer 2015).

Chu et al (2017) refer to "3rd generation robots" that facilitate social engagement between the robot and the person being cared for. Such robots include the aforementioned *Pepper* and others such as *NAO*, *Kabochan*, *Brian 2.1* and *Nexi*. Chu et al (2017) report on 'baby-faced robots' *Sophie* and *Jack*, developed in conjunction with Japanese corporation NEC: part of a broader range of socially interactive robots also involved in processes such as recruitment interviewing (Nickless 2013).

Challenges

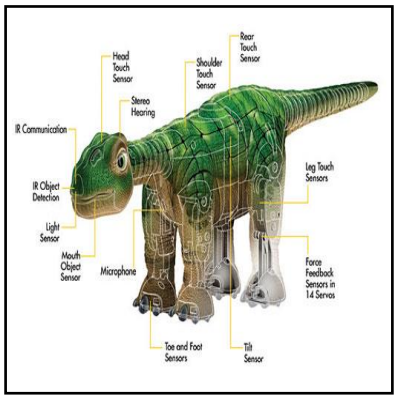
Widespread development and sale of effective social robots remains some way off. Joe Jones, an inventor who has helped to develop the Roomba robot vacuum cleaner and Tertill weeding robot, argues that creation of consumer robots that work and are affordable is very challenging.

It means reconceptualising human tasks: "robots have different strengths and weaknesses compared to people. What that means is that any application you want to roboticise must be re-imagined from the ground up" (cited in Ackerman 2017). There are major technical challenges: not least, how to design a robot that can navigate a set of stairs (*Guardian* 2017b) but also, in how robots gather and process information.

There are philosophical and ethical challenges too: for Sparrow and Sparrow (2006) "for the foreseeable future ... using robots to provide emotional care and companionship to people will be unethical" (p.156). Sharkey and Sharkey (2012) identify key issues at stake in robot-assisted care of older people. These include a potential reduction in human contact; an increase in feelings of objectification and loss of control; loss of privacy and personal liberty; tendencies towards deception and infantilisation of older people; and debates about when elderly people should be allowed to control robots. These analyses reflect a discourse that opposes the technologisation of caring relationships. Philosophically, Parks (2010) draws on a range of theoretical frameworks: feminist, cultural relativist, social justice, capabilities approach and Habermassian public discourse theories, to argue against the case for the substitution of human by robotic care. At the very least, the development of social robotics will lead us to reflect on the nature of care and to identify its distinctively 'human' dimensions.

McNally and Inayatullah (1988) raised the novel issue of the 'rights of robots'; this debate has been taken up seriously by ethicists and policy-makers. Khan (2011) argues that a new ontological entity between 'object' and 'agent' must be devised to accommodate robots, as research consistently indicates that humans identify with and ascribe anthropomorphic characteristics to social robots (Chanseau 2016; Karreman 2016). The concept of rights links closely to that of the 'autonomy' of robots (Rini 2017). As robots are increasingly enabled to 'make their own decisions', how will humans best be able to (or should they) seek to influence those decisions?

For Calo (2015) there is a need to advance legal rights of robots, in the same way that legislators created a major body of new law to regulate the Internet. In 2016 the legal affairs committee of the European Parliament adopted a report on the rights of robots. It urged the drafting of a set of regulations to govern the use and creation of robots and artificial intelligence (European Parliament 2016). Report author, Mady Delvaux MEP, argued that "a growing number of areas of our daily lives are increasingly affected by robotics … in order to address this reality and to ensure that robots are and will remain in the service of humans, we urgently need to create a robust European legal framework" (Guardian 2017a).



Dautenhahn (2007) calls our attention to the potentially two-sided nature of human-robot interaction (HRI). Robots can be caregivers of humans; but humans can also be the caregivers of robots. The former is reasonably well understood, at least conceptually; the latter less so (Lipp 2016). Cho and Shin (2011) examined how children with autism who cared for *PLEO,* a toy robotic dinosaur (Fig. 5), experienced rewarding attachments, spiritual satisfaction, companionship and fulfilment. This expands on the 'Tamagotchi effect' (Holzinger and Maurer 1999) whereby humans can become attached to, and 'care' quite deeply for, technological devices. Levy (2008), in his discussion of what are popularly termed 'sex robots', explores this phenomenon in the highly controversial

context of the human use of robots not only for sexual gratification, but for companionship and love.

User Acceptance

We have seen that social robotics researchers and companies alike are actively developing both prototypes and finished products. Discussion of such socially interactive robots presupposes that people will - and will want to - interact with non-human technologies: i.e. machines. As Katz et al (2015, p. 25) note:

> *it is important to explore how people experience, communicate with, and conceive of robots in their social and physical environments. Also important to consider is how people see the various roles for robots and how their comfort levels may vary depending on robotic functions and experiences.*

Taipale et al (2015) remark that "people who are expected to accept [social robots] are not used to having industrial-looking robotics devices in their homes (the majority do not have them in their workplaces either)". Thus, a challenge for robot designers is to allow for - or encourage - the 'domestication' of robots in a way similar to that for other widely adopted technologies, for example the telephone and the television (Silverstone et al 1992).

As increasing numbers of social robots are developed, tested and deployed, attention is shifting towards issues of user experience [UX] – including how robots are 'accepted' by users (de Graff et al 2016). This has become both a practical and an ethical issue. On the one hand, people are probably more likely to make use of, or live with, robots if they feel comfortable with, or even like, them. On the other hand, there are important ethical issues in relation to autonomy, choice and power when it comes to introducing robots to workplaces, care settings or domestic spaces. The socially or physically vulnerable, for example, should not be coerced into interacting with robots in the place of humans.

'Acceptance' of robots can be measured at the level of the 'general public'; amongst specific sets of service users or other people directly exposed to social robots; and amongst practitioners who make use of social robots. Space prohibits any more than an overview of some key issues, but we can see that the 'success' of robots as a widely used technology will, as for any other technological innovation, hinge on user acceptance (Venkatesh et al 2003). We address an aspect of the issue of practitioner acceptance in the next section, in the context of professional identity. Here we point to some issues of acceptance amongst the public and amongst users.

An EU Commission Eurobarometer report on attitudes towards technological innovations reflects some of the key issues and concerns. While survey participants saw widespread use of robots to undertake household chores as likely by 2030, they worried about loss of privacy and self-determination; impersonal presence of a robot in the home; fear of robots; lack of exercise; and loneliness (Eurobarometer 2015). Fortunati (2017), drawing on a more recent survey of high school students in the North East of Italy, reports that they see the "sectors that most deserve the introduction of robots are the care of the elderly, children, and disabled people, and then education". She notes that younger people are more likely to locate robots in the social domain, while older respondents associate robots more with areas such as space travel and military applications (Fortunati 2017, p. 9).

A policy alert report from the European Commission's iKnow initiative reports concerns that:

> *elderly people will get their care predominantly from robots or machines and not from human carers. Humans will become technicians overseeing the operation of numerous robots and*

> *machines. It will be extremely important to overcome the mental barriers of elderly people against new technologies and to combine their physical and psychological care appropriately* (Popper and Butler 2011, p. 92).

We have seen that the care of older people, especially those with dementia, is one of the fields that has attracted both social robotics developers and policy-makers. Casey et al (2016), from the perspective of the use of social robotics in the care of people with dementia (PWD), note that there is little in the literature on what PWD (and their care providers) want from 'companion robots'.

Casey et al (2016) (of the EU-funded MARIO project: www.mario-project.eu) stress that robots, at the least, must be useful. In a purely functional sense, robots may be 'acceptable' in a therapeutic context for reasons of health and safety (compared with live animals, for example, that can spread infection in hospital environments). Carers are positive about robots that foster 'communication, activity and fun'. Unsurprisingly, Casey et al (2016, p. 3) conclude, based on a review of a number of existing studies, that "in order to succeed, social robots need to be perceived by users as useful and relevant to their current unmet needs". Nevertheless, PWD and their carers may have differing perceptions of utility and relevance.

Casey et al (2016) point to a number of ethical concerns in relation to the use of social/companion robots with PWD. These echo those voiced above by Sharkey and Sharkey (2012) and impact in concrete ways on initiatives such as the MARIO care robot. They include: the impact on the understanding of 'care'; paternalistic or coercive actions by the robot, for example in relation to decision-making by PWD; potential loss of dignity through deception or infantilisation of users; concerns about emotional or cognitive attachment to or dependency on the robot; physical risk and safety; privacy and data protection; and informed consent. This is a formidable list, albeit reflective of the ethical concerns that can exist in relation to many technologies.

In order to address these issues Casey et al (2016) conducted focus group discussions with PWD and nurses in residential care settings. This exercise was part of a user-centred approach to design (Care Centred Value-Sensitive Design) that sought to ensure that robots would not "endanger and where possible enhance the realisation of ethically valuable forms of care" (p. 3). Through the focus group, users and carers identified many desirable features for the MARIO companion robot, summed up in the following sentence:

> *acceptance is influenced by … the ability of [the robot] to have a friendly face, for him (sic) to know them as a person, knowing their likes and dislikes, be useful, able to play favourite music and movies, connect them to their families and friends* (p. 5-6).

Similarly, Katz et al (2015, p. 26), citing a number of research studies on human robot interaction, point to evidence that "anthropomorphic qualities of robots lead human partners to treat humanoid social robots as real persons"; conversely Karreman (2016) reports situations where less-humanoid robots can be more effective. Taipale et al (2015, p. 5) seek to move beyond the engineering focus on the design of 'human-mimicking' machines that can (to a degree) look, move and sound like people. They suggest that the social context of interaction between machine and human is more significant: "immaterial responses and communicative actions to a user's behaviour from a robot device … are equally and sometimes even more important than physical actions that robots can perform".

User Experience (UX)

In tandem with advancements in socially interactive robots, an emerging field of research on user experience (UX) of robots has emerged. Alenljung et al (2017) provide a comprehensive review of this terrain. UX is defined as: "people's feelings, as caused and shaped by the use of technology in a particular context" (Alenljung et al 2017, p.1). Social robot developers are increasingly concerned about positive user experiences, the key components of which relate to: the quality of the human-robot interaction; usability; learnability; safety; trust; and credibility. Referencing Bartneck et al (2009), Alenljung and colleagues posit that: "currently, robot developers sometimes create their own evaluation methods without sufficient knowledge of appropriate methodologies, resulting in questionable validity and reliability of those so-called "quick and dirty" methods" (2017, p. 2). They point to a pressing need for socially interactive robot manufacturers to develop 'research-based guidance' on the most effective ways to conduct user experience design. In particular, there is a paucity of work that includes direct interaction with users of social robots in extended, real-world situations.

Bearing these insights and warnings in mind, we can consider the work of Chu et al (2017). They undertook an observational longitudinal study (2010-2014) of the level of user engagement PWD experienced when exposed to two social robots operating in an Australian residential care facility. The research set out to explore if and how social robots: "improve[d] diversion therapy service value to PWD through sensory enrichment, positive enjoyment and entertainment" (2017, p.2). They identified four key measures: approaching social robots; experiencing pleasure with the robots; interacting with the robots; and interacting with others. They used two third generation social robots (the aforementioned 'Sophie' and 'Jack') designed to provide diversion therapy services such as face recognition, singing, dancing, gestures and changed emotions. They observed that over the course of their observational research, there was significantly improved social engagement of PWD during 2013 and 2014 compared to the earlier years. This followed alterations to the social functionality of the robots; improved ability to perform voice and face recognition; and an increased capacity to speedily respond to users' interactions. These changes led to "an increase in the pleasure of being with the robots while playing bingo or dancing" (p.16). The authors conclude: "overall, the findings provide evidence that our robots have shown a significant improvement from 2010 to 2014 in care quality" (p.16). This example, one of the few cases of longitudinal, real-world research on user-robot interaction, reveals the power of user-centred approaches to social robot design.

Social Robotics and Professional Identity

What of the humans who currently provide human-to-human social care? What of their future professional training and identity needs in a world of care provision delivered by or, at the very least, augmented by AI and robots? Exploring the future of the professions in general, Susskind and Susskind (2015) chart the demise of the historic 'grand bargain' that ceded certain specialisation and expertise to well-rewarded professionals. They argue that rapid technological change, especially automation of knowledge-based tasks, will have a radical impact on the abilities of most professions to monopolise and disseminate their 'unique' knowhow. Avent (2016) outlines a similarly bleak future for many forms of human employment, due to the twin forces of digitisation and globalisation, while Dyer-Witheford (2015) links automation with an overall crisis of capitalism. Manning (SPARC 2016c) reflects a more optimistic view:

> *the impact of new technology on jobs is zero. Meaning that the net percentage of people employed will stay the same overall … It is clear that there will be occupations where opportunities will fall because of robots. Other opportunities will also be created due to an increase in spending power. These will not necessarily be new jobs, just more old jobs as consumers spend the extra spending money that comes from the falling prices caused by new technology.*

We often see this upbeat perspective amongst those who argue for the greater application of AI and robotics (Willcocks and Lacity 2016, pp. 275-299).

How will the future world of the social care professional evolve in this context? What will the 'acceptance' of social robots be amongst social professionals? Not surprisingly, viewpoints vary. Cahill *et al* (2007), in a review of AT usage among Irish dementia caregivers, highlighted that available technology had been successfully integrated into the care plans of clients, but caregivers perceived it to be prohibitively expensive. Wolbring and Yumakulov (2014) reveal that staff in a Canadian disability organisation are content to work with social robots as long as they perform repetitive tasks that: "did not require mimicking human interaction and touch" (p. 465).

Conti *et al* (2016) provide insights into the acceptance of robots in the education and care of children in Italy, uncovering that established practitioners are largely skeptical of such innovations, while less experienced degree students in psychology and education demonstrate a "significantly higher willingness to use" robots. Pragmatically, they find that "intention to use" a (hypothetical) robot is "mainly predicted by the perception that it will enhance and facilitate the educational process" (Conte et al 2016, s.5). Moreover, they report, "practitioners have a clearer view than students of the educational and therapeutic tools available and their effectiveness. They can easily identify the current technology difficulties and limitations" (including cost). In other words, is the robot potentially useful in their work and can it be accommodated within current practices and approaches? Students are perhaps more open to the technology and more likely to be impressed with its symbolic value in terms of their self-identity. Many of them saw "use of the robot as enhancing their self-image or social status in the opinion of significant others, which, in turn, could have consequences for [their] acceptance of that innovation" (Conti et al 2016, s.5).

Working with, alongside or even for robots will have significant implications for social professional practice and identity. Practitioners may benefit from the opportunity to engage with and, if deemed appropriate, develop the skills required to work in collaboration with social robots. Those involved in the education and formation of the social professionals of the future have an obligation to stimulate and facilitate debate that may, as a parallel outcome, lead to debates about the broader philosophical, ethical, social and practical nature of 'care' itself.

Education and Training

Few social professional HEI learning and training programmes (in social care practice, social work or elder care) offer students the opportunity to explore and integrate awareness of the technologies currently and in the future deployable in employment settings. They do not provide students with sufficient opportunities to develop critical awareness of and proficiency in AT/ALT or HRI. In Ireland, the educational awards standards of Coru (the professional regulator) and QQI (the educational regulator) remain silent on the impact of such technologies. There are few CPD (continuous professional development) opportunities for social professionals in this area.

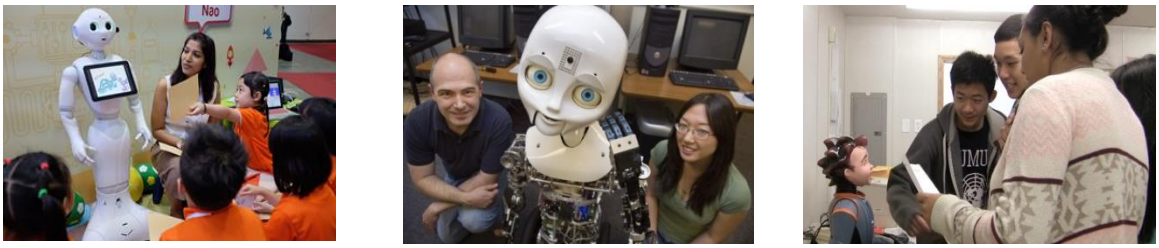


Figure 6: Teaching and learning about social robotics

What might an appropriate and effective pedagogical approach to facilitate and encourage current and future social professionals to learn about the challenges of professional work in a world that may include social robots look like (Fig. 6)? Drawing on the discussion earlier in this paper, we suggest that it might involve:

- engaging with the key philosophical, political and ethical issues
- developing strategies to work alongside social robots
- enquiring into the impact that social robotics may have on (vulnerable) service users
- addressing professional, industrial relations and management issues in the care field
- developing the practical skills to work with robots, including development and programming
- becoming familiar with and able to use the appropriate technical language to work in multi-disciplinary teams
- developing the skills to engage in relevant research activity
- becoming familiar with key sources of information and data; professional networks and support services in relation to social robotics
- exploring our ideas and feelings about social robotics
- learning how to speak to non-professionals about social robotics

Such questions, as well as exploring issues related to social robotics, also have the capacity to interrogate concepts and practices of care itself.

Conclusion: Towards a Pedagogy of Social Robotics

This paper has sought to address some salient issues in the field of social robotics, social care and the future of the social professions. We identified the trend towards increasing application of information technologies to the care field, in line with the growing economic and social importance of robotics more generally. We outlined how assistive and assistive living technologies (AT/ALT) are becoming more widely adopted in the field, along with related processes such as decision-support systems and artificial intelligence (AI). We presented some definitions of social robotics and provided examples of social robotics initiatives, prototypes and products in the care field. We identified some of the challenges, for example in terms of

ethics, human-robot relationships, user experience, social impacts and issues of autonomy and control, and alluded to developing concerns about the professional identity of the social professions.

As educators in the social professions, we argue that both current social professionals, and those entering the professions in the future (including current students), need to be exposed to, and facilitated to process, the types of developments we a have discussed in this paper. Practitioners need to develop an informed and critical orientation towards emergent technologies, so that they can be part of the social shaping of technology (MacKenzie and Wajcman 1985) rather than being socially determined by it.

What pedagogical tactics could educators use to achieve these ends? There is scant literature or documented body of practice that can address these issues. Baxter et al (2015) address the challenges of teaching with robots in the primary school setting. They identify some salient issues: *pedagogic* practices – how do teachers work with robots? *Methodological* issues – how can we accurately gauge the impact of robots in the classroom? *Ethical* issues – how do learners interact with robots? While these issues relate to the use of robots in primary school settings, they also point to the types of questions that might arise in the teaching/learning about social robotics in a Higher Education or Continuous Professional Development [CPD] setting.

Drawing on current practices in social professional education, we suggest a number of activities that might stimulate learning about social robotics (Table 1). Currently we (learners, teachers) may lack some or all of the tools, knowledge or skills to engage in these practices. We also lack information on what is effective in helping students to learn about social robotics. There may be considerable scope to learn from those involved in robotics-related education in other fields, such as engineering, IT, design or healthcare.

Table 1: How might we teach/learn about social robotics? Potential pedagogical tactics

1. Reading and discussing academic articles and research reports about robots
2. Reading and discussing popular articles and news items about robots
3. Reading and discussing science fiction books and short stories about robots
4. Watching science fiction films that feature robots
5. Watching videos about 'real' robots
6. Interacting with real robots in the classroom, in a ‘real’ or ‘wizard of Oz’ (simulated) situation
7. Role-playing as robots and interacting
8. Debating ethical issues related to robots
9. Using ‘Lego Serious Play’ to think about robots
10. Programming virtual or real robots
11. Studying and breaking down caring behaviours with a view to programming robots

12. Auditing caring behaviour with a view to identifying what could (not) be conducted by a robot
13. Studying jobs/professions where automation/social robotics have already come into play
14. Interviewing service users about actual and potential interaction with robots
15. Interviewing professionals about actual and potential interaction with robots
16. Interviewing policy-makers and legislators about actual and potential interaction with robots
17. Writing fictional Human Robot Interaction [HRI] scenarios (Nourbakhsh 2013)
18. Designing and producing learning materials about robots
19. Designing and producing informational materials for the public about robots
20. Designing and building robots at varying levels of technological sophistication
21. Conducting scoping reviews and systematic reviews on the use of social robots
22. Debating the advantages of anthropomorphic vs non-anthropomorphic robot designs
23. Examining cultural diversity and differences in general and to relate these to documented cultural differences in responses to robots – e.g. in terms of how close people are happy to be with a robot (proxemics)

Faced with the developments in the social robotics field, and the fundamental questions that they raise, we have identified a need to develop responses in relation to the establishment of educational and CPD supports and amendments to regulatory standards. Finally, we have suggested some potential pedagogical approaches to these issues. We hope that we have succeeded in raising some of the issues and concerns, as well opportunities, in the field of social robotics and social professional work and education. We do not doubt that this field of enquiry will become of more importance and of broader interest for all those involved in the social professions in the years to come.

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