Love me,
Love my robot?

Horizon Scanning Paper on the use of artificial intelligence and robotics in the care of the older person

BioCentre

Contents

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Introduction

This paper is the primary output of a small research project BioCentre conducted in 2015-16 built around six work packages (see Appendix 1). The purpose of the project was to help build the agenda concerning the key ethical and social issues surrounding the use of artificial intelligence (AI) and robotics in the care of the older person.

The paper is a horizon scanning paper as opposed to a rigorous and detailed research report. A horizon scanning paper strikes a balance between two tensions: first the need to make sense of data and information in order to inform better decision-making. Secondly the need to provoke and disrupt commonly held assumptions, by asking fresh questions with the aim of discovering new insights and gaining better intelligence (Forum for the Future 2014).

The fastest growing population in developed nations is those aged 65 and older. It is estimated that there are currently 10 million over-65s in the United Kingdom - 1.5 million of those are over 85 - and the figures are expected to rise in the coming years (BBC News Online 2012). Globally, over 60 year olds represent 11% of the world population and this figure is expected to double by 2050 (UNFPA and HelpAge International 2012).

In light of this rapid rise in the elderly population, it is increasingly likely that robots and AI assisted appliances will take on part of the role of care providers, including meeting practical care needs, providing round-the-clock support and even providing a form of companionship.

This paper helps to track and make sense of key trends and changes taking place in the field. Based upon the collective intelligence gained through the project's work packages, the short paper sets out the key questions that help to build the agenda on what needs to be addressed as the pace of change and innovative continues.

The paper is divided into the following sections:

A. Background
B. Current landscape
C. Key contexts
D. Setting the agenda

A: Background

By 2051 the numbers of people aged 65 years and over in the UK will increase by 81% (GAD 2003). The support ratio is falling 3.10 in 2011 to 3.09 in 2021, then to 2.53 in 2031, then below 2.2 in the 2050s before levelling off (GAD 2003). To respond to this it is predicted that residential home and nursing home places will need to expand by around 150% over the next 50 years (Wittenberg et al 2004). Many older people wish to continue to live in their own homes for as long as they are able to with appropriate support. The hours of home care is likely to therefore increase by around 140% over the next 50 years to meet the expected demand (Wittenberg et al 2004).

What Innovate UK have referred to as a 'long term care revolution' is expected as fresh approaches are explored and adopted to help develop the range of services and support older people need to meet their personal care needs and assistance with the basic personal tasks of everyday life. Expenditure for this would need to rise by 315% in real terms between now and 2051 to meet demographic demands (Wittenberg et al 2004). The number of older adults in need of care is expected to outstrip the number of family members able to provide informal care for the first time in 2017 (IPPR 2014).

Robotic and AI technology could greatly increase the freedom and independence of the ageing population, allow people to stay in their homes for longer and facilitate their social lives. At the same time the dangers posed to civil and human rights must also be considered.

Innovate UK's Robotics and Autonomous Systems (RAS) strategy stated that RAS can increase the UK's health care productivity and reduce the total expenditure on long term care requirements of the UK's ageing population (Innovate UK 2014). Whilst robots may help to reduce costs, the well being of older persons must be the first priority.

The optimum future is one in which the use of robotics and AIs will help older people live safer, healthier and more fulfilled and more connected lives. But the possible social, psychological and relational consequences of replacing human care with care provided by intelligent machines, particularly machines that are capable of simulating human emotional responses, are unknown.

Within the next 20 years, it is increasingly likely that robots will be used in the care of older adults throughout the developed world. This is a striking technological and social development with widespread but poorly understood implications for the society as a whole. It is critically important that the psychological, philosophical and spiritual implications are considered and debated before robotic care assistants become ubiquitous (Metzler & Barnes 2013).

B: Current landscape

Terminology

Work in the field of artificial intelligence (AI) is concerned with creating a computer 'mind' that thinks like a human. This challenge has been the focus of many scientists and technologists for decades with varying degrees of success. Today, whether it is autopilot on an aeroplane, Apple's Siri app or Google self-driving cars, there are many examples of AI which can be found in our everyday lives.

Originating from the work of a science fiction writer in 1920, the word *robot* comes from *robota*, a Czech term for servitude (Carr 2015:225). A robot is a machine that is capable of carrying out a series of actions automatically, often work that was previously undertaken by a human. Combining

developments in the field of AI with robotics makes for one of the most exciting areas of robotics as attempts are made to build 'intelligent machines'. This has led to the emergence of the term 'autonomous systems', defined as "machines and systems that are capable of performing a series of operations where the sequence is determined by the outcome of the previous operation or by reference to external circumstances that are monitored and measured within the system itself" (Royal Academy of Engineering 2015).

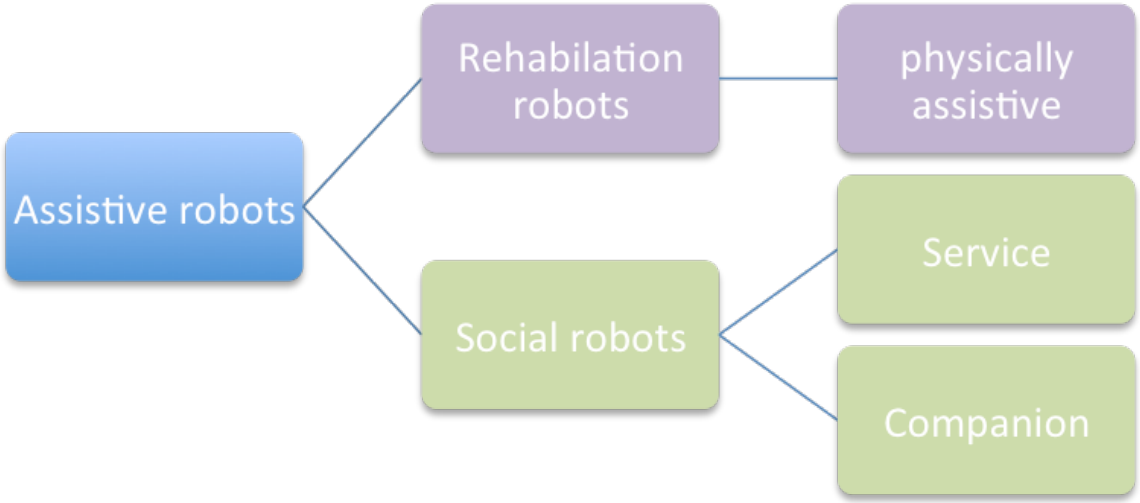
Whilst there are many examples of how robotics can assist us, such as in assembly line production, there is no consensus on the level of intelligence a robot could ever attain. Androids or humanoids are particular robots that have an appearance or character resembling that of a human often with the task of caring or supporting humans, from cleaning the house or assisting with mobility. The Japanese have been at the forefront of developing humanoids with the ASIMO humanoid robot being one popular example.

Care of the older person

Initially the use of AI and robotics to care for the older person may seem like something out of a science fiction novel, yet over recent decades significant advances have taken place which have led to AI and robotic based applications becoming a reality in care planning.

In the context of care of the older person, advances mostly focus on assistive robotics which fall into two broad categories (see Figure 1). First, those designed to help with rehabilitation and secondly those designed to assist with social interaction and companionship.

Figure 1



Rehabilitation robots

Robots in this category are primarily physically assistive technologies and are not designed to perform any form of communicative function, nor be perceived as a social entity (Broekens et al 2009). Examples include:

- **RIBA** (Robot for Interactive Body Assistance) is a robot developed by the RIKEN-TRI Collaboration Center for Human-Interactive Robot Research (RTC), established as a joint collaboration project by RIKEN and Tokai Rubber Industries. The robot can carry a person to a bed, a wheelchair or a bath, using its very strong human-like arms and by novel tactile guidance methods using high-accuracy tactile sensors (Riken 2015).
- **Resyone,** built by the electronic company Panasonic, is a form of 'smart' wheelchair which automatically transforms from a bed into a robot wheelchair on command.
- **My Spoon robot** from Secom assists with the practical task of eating by lifting food and putting it in to a person's mouth.
- Cyberdyne's **HAL 5 (Hybrid Assistive Limb) exoskeleton** suit reads neural signals from the thighs and walks without you having to think about it. The devices are currently being leased to old people's homes in Japan (Matsuyama 2014).

Social robots

Within this category there are two sub categories: service robots and those that offer a form of companionship.

Service

Service type robots function by supporting independent living by providing some level of functionality in basic activities such as:

- Eating, bathing, toileting and getting dressed
- Mobility (including navigation around the home
- Attending to household maintenance
- Monitoring of those who need continuous attention and maintaining safety

The social functioning of these service type robots are primarily concerned with facilitating interaction between it and the human around a particular task.
Examples of these robots are:

- **'Nursebot' Pearl.** This intelligent 'nursebot' uses sonars and an internal map to detect and follow her patients. She knows exactly where they are and what they should be doing at certain times of the day.
- **Kompaï.** This robot consists of a touch-screen display on an easel and a bowling ball–size white head with a "face" designed to give emotional comfort. It is expected that future versions will light up and show expressions (Horowitz 2010). The idea behind Kompaï is to facilitate online contact with family and friends. Whenever a friend or family member Skypes Kompaï, it uses ultrasonic sensors to detect the location of the person being called and navigate to that person, who answers the Skype videoconference call via Kompaï's multitouch tablet PC and Webcam. The robot also has the capability to store a person's daily schedule and shopping lists, and access online calendars or weather.

STRANDS Project
The STRANDS project (Spatio-Temporal Representations and Activities for Cognitive Control in Long-term Scenarios) based at the University of Birmingham has received 8m euros (£6.69m) in funding from the European Commission to carry out research into robots and intelligent behavior in human environments with the aim of developing robotic assistants which are truly useful in a wide range of domains (Hudson 2013).

The team have found that one of the biggest complaints of care home staff members is that they do not spend enough time doing the human interaction and the caring part of their jobs. Developing intelligent assistants who can assist with the practical tasks of care to allow human carers to have

more interaction time with patients would be invaluable. The Strands robot began trials with an Austrian care provider in May 2014, starting with simple things such as checking fire doors remain unblocked and defibrillators are always present and in the right place.

GIRFAFF+ Project
The GIRAFF+ project is testing 14 robots in three European countries to see how a network of sensors in cooperation with a robot can help older people live safer, more independent lives and enjoy social life from their home (European Commission 2014).

GIRAFF is a telepresence robot which moves around the person's home and enables them to interact with family, friends and healthcare professionals via videoconference. Sensors and wearable devices also form part of the GIRAFF+ system which are designed to detect activities like cooking, sleeping and medical data such as blood pressure and body temperature. They allow the person's carers to remotely monitor their wellbeing and to check for falls.

In the UK NHS Western Isles and NHS Shetland have been trialling the use of the system in patients' homes, particularly those living with dementia (McKenzie 2016). The NHS is keen to emphasise the need to tailor any application of assistive technology devices to the patient and not adopt a generic approach.

Companionship

Companion robots are intended to interact with people for social and therapeutic purposes. Examples of companion robots developed in recent years include:

- **Yumel** is a robot developed by Japan toymaker Tomy. Equipped with six sensors and a chip the robot was designed to keep track of and record your sleeping time.
- **Artificial Intelligence Robot (Aibo)** were a series of robotic pets developed by Sony, primarily marketed as entertainment robotics for domestic use. However they were also used for educational purposes to further understanding into human-robotic interaction. In 2006 Sony announced that it would be discontinuing the Aibo range of products.
- Softbank's **Pepper robot** was designed to not only chat, but also to alter its reactions and speech by sensing and 'feeling' the emotion of its users.

Initially these types of robots were regarded as novel and expensive toys without much real use. As technology and innovation has developed the robots have become incorporated into a new and emerging field often referred to as 'robotherapy'. This involves studying how robots can be used effectively to treat patients with different special needs including those living with dementia.

Paro
To explore the effectiveness of companion robots with dementia patients, Japanese manufacturing giant AIST developed an advanced interactive robot known as 'Paro'. Designed to resemble a baby harp seal, the robot is equipped with touch sensors over its body and whiskers as well as sensors to respond to vision, hearing, and temperature. This helps the Paro robot in proactive and reactive behaviour routines, helping it to respond in a similar way to a baby and to develop an emotional bond with patients. Paro responds to being stroked, at the sound of its name being called and can also develop new routines.

Since 2003, Paro has been used in nursing homes in Japan and Europe and has been the focus of research examining its effectiveness with nursing home residents in Denmark, Germany and the United Kingdom (Vitelli 2013). Some of the findings from these studies (Klein, Lone and Cook 2013) include:

- Direct interaction with Parao can help to relieve stress and boost oxytocin levels in the bloodstream.
- Paro can be used as part of treatment programming to increase social stimulation.
- Patients with advanced dementia are able to interact with companion robots and can find the novel experience stimulating. Since Paro provides sensory feedback to the patient's interaction, this can shape how patients respond.
- From interaction with Paro, aggressive behavior in patients can be reduced and patients discouraged from "wandering off".

In Denmark, the Danish Technological Institute (DTI) has introduced a one-day certification course for caregivers to ensure that the use of Paro is used effectively and appropriately (IFA 2015).

As the technology develops there is a growing interest in these types of companion devices. Early studies and reviews have been conducted to begin to review the effectiveness of these assistive social robotic devices in caring for the older person resulting in some qualitative evidence as well as limited quantitative evidence of the positive effects (Broekens 2009). The general perception from among those working in the field is there is need for more robust studies to be conducted, paying particularly attention to research methodology and method, in order to achieve successful robust, large-scale studies on the effectiveness of these devices.

C: Key contexts

The significant advances in AI and robotics, particularly in the field of care of the older person, need to be considered and understood within two distinct contexts: technology and need.

Technology

The key reason why these advances are beginning to be discussed and posing profound questions about the future, is the speed of exponential change driven by Moore's law. In many respects technology has an agenda all of its own. Driven with great dynamism, its influence drives decisions, conversations and tends to drives outcomes unless it is engaged with effectively.

Of particular relevance to the AI and robotics conversation is the Internet of things (IoT). It is estimated that there will be nearly 20.8 billion devices on the IoT by 2020 (Garner 2015). This network of interconnected devices that will collect and exchange data will help to drive forward the idea of the 'smart home'. It will therefore become the most natural thing in the world to have robotic assisted devices as part of this panoply of interconnectedness.

Need

Japan's social crisis provides a pertinent example of how AI and robotics could meet real need. With the highest life expectancy in the world, nearly 30% of Japan's population is over the age of 65, and with only about 1.2 births per woman, there are not nearly enough people entering the work force to make up for it. The challenges the Japanese are faced in terms of health and social care and the resultant impact on the economy, are likely to play out on a large scale in many developed countries.

Traditionally Japan has relied on importing semi-skilled labour as a way of dealing with the problem of cost and availability (Bremner 2015). It is therefore not difficult to understand the apparent benefits afforded by robotic assisted solutions.

Technological imperative versus the human imperative

However the imperative to pursue technology at whatever cost should not trump the human imperative. As members of homo sapiens, we are still relatively young in terms of biology. Talk of the "post-human" and "transhumanism," therefore seems rather premature and should be regarded as a distraction to the more serious questions at stake.

As we consider the continuing evolution of homo sapiens there is a place for realistic optimism as to what new advances in technology can afford us. At one end of the spectrum there is naïve optimism and the belief that technology will solve all our problems; what could be termed the technological imperative. At the other end, we have what we may call doomsday futurism, in all its varieties, with a focus on the likely impact of existential threats.

These are very real challenges that face us, yet at the same time we need to ensure we are not simply naïve about a context driven by need; need to contain cost and need to provide care. Rather than naively think technology alone has the solution, we need to appreciate the role of humanity with technology.

The greater focus must be on striving for the optimism on the far side of the raft of challenges and risks we soberly see ahead. Realistic optimism should become an essential methodological principle if we are to engage effectively in discussions concerning the future, not least those pertaining to AI and robotics.

This sober realism recognizes the fact that technology can bring with it great transformation and improvement to the ordering of human affairs. Yet at the same time it has not solved all our problems: the struggle for human rights, freedom, and humanitarianism continues.

We are a young species, with new tools and as such we begin to cut straight to a core question which underpins our anthropology: what does it mean to be human? We need to remember that we are not only Homo sapiens or 'wise man' but also Homo faber - 'working man'. The whole idea of technology, from the most primitive axe to the latest silicon chip, is the story of us making things that enable us to do more than we could do without them.

It is perhaps no surprise to find us in a place where robots and AI powered machines are being made to copy what we do it and do it more efficiently. Nevertheless, we need to identify and distinguish ways to clearly state that our intention in using AI robotics devices is to enhance the human experience.

D: Setting the agenda

Key themes and questions with far-reaching implications emerge from advances in AI and robotics. They require our attention and careful consideration. Based upon the collective intelligence gained through the project's various activities, each of the following 10 key questions help to shape the long-term global conversation on this important issue:

1. How to uphold and protect human dignity?

Whilst a difficult term to define and subject to much debate, dignity is an important concept to consider in this discussion and is often quite easy to intuitively appreciate and recognize (Sharkey and Sharkey 2010). Broadly understood, it relates to the value of human welfare. Advances in both AI and robotics could both promote as well as diminish human dignity.

Dependency is a key issue in care of the older person. Assistive technologies controlled by the older person could help to empower and increase their independence at a time in their lives where they feel increasingly more reliant and dependent on others. Increasing life span brings with it increasing levels of dependency. It is erroneous to suggest that living longer creates dependency, for humans are always dependent on each other. It is a feature of all our lives as we live interdependent, not independent lives. What is at stake is the need to think through and explore further what aspects of dependency are at stake as people live longer.

Increasing levels of dependency also prompt an increase in levels of intimacy both physically and psychologically. In the life of the older person boundaries of intimacy are being shifted, prompting fundamental questions to arise: what can I control? What can I no longer keep private? What do I need to allow others to help me with? In responding to the questions comes the possibility of abuse and objectification as well as the benefits of safety and care.

2. How to preserve personalised care?

In exploring ways in which AI and robotics can be employed in caring for the older person, the person needs to remain the focus and not be displaced by the technology. Who controls the robots? What is the motivation for introducing them into the lives of the older person - is it to actually help the older person, or to cut costs and reduce the workload of their carers?

The focus could subtly shift from attempting to improve the lives of the older person themselves, to improve the lives of the caregivers. The danger is that older people become objects that are merely moved, lifted and processed from one place to another, causing some people to feel that they have even less control over their lives than when they are dependent on human nursing care (Sharkey & Sharkey 2010).

3. How to champion autonomy, control and accountability?

Autonomy, control and accountability are all valuable concepts to protect and champion in later life, but is there a limit to how far this should go? How much control, or autonomy, should an elderly person be allowed to exercise through the use of assistive technologies?

Of crucial importance here is getting the right balance between care and empowerment. Caring enough for the older person to protect them from danger and yet empowering them to maintain independence and mobility.

Initially the idea of an intelligent smart home environment which allows someone living with dementia to remain in their home appears to be extremely empowering. Nevertheless, how far should this be pursued before the same person becomes a prisoner in their own home? Should an older person request a robot to throw them off a balcony, what mechanisms should be in place (if at all) to prohibit and override this command? (Sharkey & Sharkey 2010). These are particularly complex questions to try and answer, not least because they involve careful consideration of the person's cognitive, as well as physical, abilities. It cannot be assumed that these will remain consistent in someone who is older. Whilst not inevitable, it is more likely that an older person could become increasingly confused and disorientated.

Related to this is the issue of accountability. If an assistive device were to drop an older person when trying to lift them out of bed, who should be held accountable?

4. What does the practice of care look like in the 21st century?

The practice of care can be seen to be based on a functional relationship. Philosopher and psychologist, Bubeck writes that this kind of relationship involves "the meeting of needs of one person by another where face-to-face interaction between care and cared for is a crucial element of overall activity, and where the need is of such a nature that it cannot possibly be met by the person in need herself" (IEP 2016).

In considering and assessing how robotics and AI assisted devices can benefit the older person, a functional relationship model needs to be adopted which requires looking at both sides of the coin: what does it do to the person being cared for and on the other: what does it mean for the one providing the care?

Care relationships also need to be considered in a wider social context in terms of what society will allow, what needs to be provided (social support, organization, technology and administration) and what values should direct this.

Within this lexicon, robots and AI devices hold the promise of being able to help facilitate relationships of care as instruments and tools within the overall sphere of care. Technology can assist with the *tasks* of care and we must ensure that it is not exploited for the *practice* of care. In Denmark, robot cleaners are a key part of the 'welfare modernization strategy', helping to free up human carers to focus on the practice of care. The aim is to use technology to cut 12bn kroner (£1.3bn) from the government's welfare budget by 2020 (Orange 2014).

Increasing longevity and living with long term conditions should not be at the expense of everything it means to be human. An existing institutional model of long term care provision that has been in existence in the UK since the early 19th century needs to be disrupted - and not merely reformed - by developing alternative models, ways and approaches that are dignified, desirable and affordable alternatives to the status quo.

5. How can the patient-healthcare professional relationship be strengthened and developed?

The perception of training and education of health and social care professionals is that it is conducted in a very traditional fashion with little regard paid to the speed of innovation, what benefits new and emerging technologies can bring and how best to build capacity for future advances. Very often these more conventional systems of training focus on new medical devices that the professional uses on the patient, reinforcing a patriarchal approach to health and social care.

Technology has helped to redefine the way in which we shop, bank and socially interact. In a similar way care also needs to be redefined so that we move away from an approach that views a healthcare professional as only caring for someone if they are practically doing something for them.

Change needs to take place so that people take more responsibility for their health and become much more part of a joint-decision making process. In the face of corresponding demographic, economical and social changes, if the aim is to use AI and assistive robotic devices to help give the older person greater autonomy and the best possible care experience available in later life, then this change needs to happen.

Technology should certainly not end up replacing the GP but a new form of relationship needs to be established based around the clinician and patient partnering together. With more information at their fingertips, the patient is becoming more proactive as opposed to passive, entering into a dialogue with

the clinician as opposed to just acting upon the advice given. As an expert, the clinician has a key role to help bring understanding and educate the patient as to what the information and data really means for them.

This represents a significant change in the way medicine is practiced and will inevitably be seen as a challenge by some clinicians. It will involve a shift in culture requiring new levels of trust to be established between both patients and healthcare professionals as together they work at ensuring the older person is supported in managing their health, able to make informed choices, manage their conditions and avoid complications.

6. How to develop and articulate a new language of ageing?

Discussion around how technology can be used to assist and empower the older person prompts the question: who is old? What do we mean by the term 'ageing'? To some extent we are all ageing so to whom are we specifically referring to when we use the term 'older person'?

Part of the problem lies in the fact that these are 'soft' humanistic issues which are more difficult to define, in contrast to the harder economic and business issues. Very often there is the tendency to demean and talk down to older people. A new narrative therefore needs to be told using new language which champions and places values on the older adult, who cannot be reduced to a single stereotype but represents a section of the population that spans different cultures and socio-economic backgrounds.

7. How does technology exacerbate or resolve health inequalities?

Older people will increasingly face the challenge of having to pay for their care in the years to come. Degrees of access to technology in wealthy and impoverished nations could in turn impact upon existing social inequalities and exploitation such as healthcare provision. Once again, rather than pursuing the technological imperative at the expense of the human, new models of care and the terms upon which they are built and paid for need to be carefully negotiated and discussed.

Older people need to be involved and be able to choose how they pay for their care and that they are happy with what they receive. If handled responsibly, technological solutions could be a real game changer in this area, helping to reduce inequality, improve quality of care and champion independent living.

8. What can faith traditions bring to the conversation concerning advances in AI and robotics?

As our focus is increasingly drawn to consider the interaction between what is human and artificial, we begin to cut straight to a core anthropological question: what does it mean to be human? This is a question which tenets of various faith traditions speak to and which demand a response in the face of technological advances that could transform human life.

There is emerging interest in how best to evaluate these advances and this needs to be encouraged further if the centre of gravity of ethical discussion is to reflect a greater range of diverse faith-based and religious views, particularly in the UK, where there is a propensity for the ethical conversation to be dominated by utilitarian perspectives.

The faith leaders roundtable consultation was particularly designed to respond to this challenge, seeking to catalyse how different faith traditions and beliefs speak to advances in AI and human identity. The following key questions emerge from the roundtable as those which call for further engagement and consideration:

- To what extent can a machine be conscious?
- If metaconsciousness is understood to be non-reducible and unable to be fully explained, can humane care be given without metaconsciousness?
- Is a metaconscious machine possible?
- Can 'smart' devices act as a substitute for compassion or are they a tool in the hands of compassionate carers?
- How do questions of consciousness sharpen or blur distinctions between man and machine?
- Can human value really be derived from an understanding of human uniqueness?
- What does it mean to be neighbour to fellow humans?
- If we could replace humans with a conscious machine, in principle at least, could we replace God with a machine?

9. How should humans relate to robots?

The development of social, companion robots offer many positive benefits however the extent to which they are perceived as just 'pets' or human is a significant one. Turkle et al writes: "the fact that our parents, grandparents and our children might say 'I love you' to a robot who will say 'I love you' in return, does not feel completely comfortable; it raises questions about the kind of authenticity we require of our technology" (2006: 360).

In general, humans are very quick to anthropomorphise machines, and other objects, and to imagine that they are capable of more than is actually the case. The psychoanalyst Zizek describes the way in which people can chose to act as though something were not real, "I know very well that this is just an inanimate object, but none the less I act as if I believe that this is a living being"(2002).

In an attempt to aid companionship in later life, does the development of social robots help to set up a situation where those who are losing their mental and cognitive functioning are going to increasingly regard these devices anthromorphically? Could we begin to lose our capacity to distinguish between human and machine? This is perhaps the most fundamental question of the 21st century. Steven Spielberg in his film *A.I.* (2001) helped us consider this question through the interplay between the highly advanced, intelligent silicon-based 'mecha' and the natural, human 'orga'.

It could well be the case that the older person feels a sense of pleasure, companionship and fulfillment through engaging with a robot which appears to understand and response to them, at the same time as being mindful and aware of its mechanical nature (Sharkey and Sharkey 2010). Further research particularly in terms of the psychological implications is necessary in order to form a clearer perspective as to the perceptions and beliefs that the older person holds towards robotic and AI devices.

The ethical nature of robot companions has been challenged by some who question whether their effectiveness depends on deceiving the older person (Sparrow 2002; Sparrow & Sparrow 2006). It is acknowledged that a robot companion can also help with problems of loneliness, especially when equipped with individual features, but the ethical issues arising from a potential emotional attachment to a machine requires more detailed examination and evaluation (Lehmann et al 2013).
What is clear is that the extent to which we choose to distinguish between human and machines will be shaped significantly by a population which is needy and perhaps unprepared to tackle this.

10. How do we integrate technology in the life of the older person?

Some of the key challenges to living longer are loneliness and social isolation. Those engaged with supporting those in later life are quick to point out that the two are not the same thing. Social isolation concerns separation from social or familial contact, whilst loneliness can be understood as "an individual's personal, subjective sense of lacking these things to the extent that they are wanted or needed" (Age UK 2010: 7). To effectively combat loneliness, combating isolation is usually necessary but not sufficient.

Technology could help address this challenge by allowing older people to stay connected and engaged, empowering them to build relationships with other people. The extent to which technology will play a role in this will depend on a person-by-person basis and take note of both the human and the technological imperative. For example, a man living on his own in a sheltered housing complex, wore a personal alarm pendant around his neck. Should he fall or have an accident, pressing the button on the pendant put him in direct contact with an emergency response centre where support staff could action appropriate help for him. Staff at the centre became concerned when the man began to use the pendant on a regular basis when he was not in any apparent danger or predicament. They soon discovered he did not have any one to talk to other than those he knew would be there if he pulled the pendant. On the one hand the man had the technology to support him in an emergency, but he was subverting its intended use to meet his real need: human interaction. Rather than pursue the technological imperative, the human imperative needs to be pursued, focusing on how technology can be integrated into the lives of older people so that it empowers and compliments practical human support.

Robotics and AI devices will not be the panacea for an ageing population but they could well be part of the answer. This has prompted some to call for a values-sensitive design process, whereby values and ethical considerations run as common themes through the process and connect back to the device's primary use and function. There is a need to integrate the view of the user throughout the process so that at every stage of the design there is input from those who will be using the end product. Caring and reflective practice must be part of the design and innovative process. If it is not, then it is more likely that what takes place is a mechanical exchange based solely upon what is technically possible.

Appendices

Appendix 1 – Project work packages

The aim of the project was to initiate and host a conversation that explores the key ethical and social issues surrounding the use of artificial intelligence and robotics in the care of the older person and how this potentially impacts upon the 'specialness' of human life and human identity. To this end, a plan was developed for the project built around six work packages:

WP1 – Opening symposium

The opening symposium was held on 25th March 2015 in committee room 3 of the House of Lords, Palace of Westminster chaired by Matt James, Director of BioCentre. The event was kindly hosted by Professor The Lord McColl of Dulwich CBE who attended the event and made the opening address, drawing upon his distinguished career in medicine as a professor of surgery.

WP2 – Private consultation

The purpose of this private consultation was to bring together key stakeholders with a focus on knowledge exchange, horizon scanning and agenda setting. The consultation took place over dinner immediately following the symposium on 25th March 2015 and involved the speakers from the symposium. Other associates of BioCentre, engaged in these issues from the disciplines of gerontology and medical anthropology, also attended.

WP3 – Roundtable consultation

Convened at The Royal Society of Arts in central London on 9th July 2015, the roundtable consultation brought together representatives from different faith traditions to dialogue together, identify key areas of common interest and coalesce on future forms of engagement between faith groups on the evolving field of AI and robotics. Participants did not need any specific expertise in the area to participate.

WP4 – Literature review

A short, rapid evidence review of the literature on current advances in the field of AI and care of the elderly, the ethical and social consideration of these advances and perspectives of key thought leaders and specialists.

WP5 – Closing symposium

The closing symposium brought together some of the strands of discussion which emerged from the opening symposium and consultations. Starting from a place that acknowledges the advances of this kind of technology and the potential utility of it, the symposium looked to the future and asked the question what should the future of care of the older person look like? The symposium was held on 15th September 2015 in the Council Room, One Great George Street, Westminster.

WP6 – Horizon scanning paper

Based upon the collective intelligence gained through the project's work packages, the short paper sets out the key questions that help to build the agenda on what needs to be addressed as the pace of change and innovative continues.

Appendix 2 – Event participants

Public symposium: 25th March 2015

Committee Room 3, House of Lords, Palace of Westminster

Kindly hosted by Professor The Lord McColl of Dulwich CBE.

Chaired by **Matt James,** Director of BioCentre.

Speakers:

Name	Position	Affiliation
Professor Nigel Cameron	Fulbright Visiting Research Professor in Science and Society	University of Ottawa, Canada
Dr. Heike Felzmann	Lecturer in Philosophy/Ethics in the discipline of Philosophy	School of Humanities, NUI Galway, Ireland
Professor Noel Sharkey	Emeritus Professor of AI and Robotics & Public Engagement	University of Sheffield

Roundtable consultation: 9th July 2015

Romney Room, The Royal Society of Arts

Chaired by **Prof Nigel Cameron,** Executive Chairman of BioCentre

Name	Position	Affiliation
Ian Berle	PhD candidate	St Mary's University, Twickenham
Dr. Elisabetta Canetta	Lecturer in applied physics	St Mary's University, Twickenham
Professor Geoff Hunt	Buddhist chaplin; philosopher	University of Surrey
Dr. Chamu Kuppuswamy	Senior lecturer in Law	University of Hertfordshire
Dr. Brendan McCarthy	Policy advisor	Church of England
Professor Neil Messer	Professor of Theology, Humanities and Social Sciences	University of Winchester
Dr. Sibtain Panjwani	Teacher of Islamic Ethics	Islamic College, London
Dr. Agneta Sutton	Associate Lecturer	University College Chichester
Rev Justin Tomkins	Curate	St Mary's Longfleet, Poole

Public symposium: 15th September 2015

Council Room, One Great George Street, Westminster, London

Chaired by **Prof Nigel Cameron,** Executive Chairman of BioCentre

Speakers:

Name	Position	Affiliation
Caroline Abraham	Charity Director	Age UK
Professor Arlene Astell	Professor of Health Services Research in the Centre for Assistive Technology and Connected Healthcare (CATCH)	University of Sheffield
Jackie Marshall-Balloch	Lead Specialist on the Assisted Living Innovation Platform	Innovate UK
Dr. Kathleen Richardson	Senior Research Fellow in the Ethics of Robotics	De Montfort University, Leicester

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BioCentre is an independent think tank concerned with the ethical, social and political implications presented by new emerging technologies.

Its **vision** is to capacity build for a **'hyper–human future'**; a future which embraces and celebrates future technologies at the same time as embracing what it means to be human.

To realise this vision, BioCentre's **mission** is to be recognised as the place which is **'hosting the conversation'** concerning the major implications posed by emerging technologies as they impact upon the future of humanity.

In so doing by **fostering a cross–disciplinary knowledge network** BioCentre seeks to clarify and frame the key questions, providing informed opinion and advice on these advances.

BioCentre

BioCentre UK
PO Box 65112, London, SW1P 9PU
Tel: 0207 227 4706
E: info@bioethics.ac.uk

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