Care Robots and Humanity: How Can We Cope with The Indeterminacy and Ambiguity of Robot-Human Relationships?

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Abstract
Ageing society, labour shortages in the care sector and increasing social security costs have become serious social problems in many countries. Sweden and Japan are, of course, no exception in this respect. In order to alleviate this situation, both countries have implemented various policies in different social areas, as well as promoting digitalisation and introducing care robots in the healthcare sector. While older people are generally considered to be reluctant to adapt to new technologies, in both Japan and Sweden, the digital integration of older people is higher than in other countries. In the near future, care robots or robotic care would become more common in the care sector in both countries. This study examines how people in both countries perceive robots and autonomous artefacts and how they construct relationships with these artefacts, based on the results of two surveys, one conducted in Japan 2020, and another in Sweden 2019, and elucidates the relationship between humans and robots from an ethical perspective. The research findings show that people's orientation toward the search for the existential meaning and their complex emotions related to ephemerality and transience can affect the relationship between humans and robots. Furthermore, this study is a new attempt to incorporate a 'care' perspective into technology ethics.

Keywords
Care, robots, ethics, existential meanings, ephemerality, horizon

1. Introduction

We are now facing major demographic changes due to a rapidly ageing population. This major change can be seen in many countries, particularly in Europe, the US and East Asia. Sweden and Japan are, of course, no exception in this respect. Life expectancy in both countries is very high - around 83 years in Sweden and 84 years in Japan [1] .1 Demographic ageing and other structural changes resulting from that population ageing are pushing up social expenditure, such as health care costs and public pension expenditure [2]. In Sweden, for example, elderly care is handled based on the Social Services Act and is primarily the responsibility of the municipalities, the counties and the government. This means that the main costs of care for older people are financed by local and central governments. This political mechanism allows older people to receive elderly care services from public and private providers. However, as these services for the elderly are provided under the responsibility of municipalities, the ageing population is putting pressure on municipal resources and requiring municipalities to take responsibility for the health and lives of more and more people.

While approximately 25% of the Swedish population will be aged 65 years or older in 2040, it is expected that most people in this age group will be active and healthy [3] (Swedish Institute, 2021). In Japan, the rapid decline in the population due to falling birthrates and increasing the elderly population is expected to peak in 2040, and this ratio is expected to exceed 35% [4]. This situation is known as the '2040 problem' and is currently drawing public attention in Japan. As is generally known, living a healthy and independent life is essential for older people to maintain an adequate quality of life and to enhance their wellbeing. With the growing ageing population, older people face increasing personal and societal demands to pay more attention to self-care and social participation in order to maintain health, prevent illness and cope with disease.

These changes in people's attitudes to health and societal demands have facilitated the development of healthcare technologies, and society expects advanced technology-enabled care practices. Especially, in the near future, a declining working-age population due to falling birth rates will make it difficult to adequately provide for a much-needed population of care workers. In fact, Sweden has historically had a shortage of labour, and the severe shortage of labour in the care sector has become a social problem [5] [6]. Japan, with an even lower birthrate and an ageing population than Sweden, has an even more acute shortage of care workers, not only in elderly care but also in child care. In both countries, digitalisation in the care sector is seen as one of the key measures to address rising healthcare costs and the shortage of healthcare workers.

In Japan in particular, the development of care robots and advanced healthcare technologies is being promoted at the national level due to the legal difficulties of supplementing the workforce with immigrants from other countries and to control labour costs [7]. This paper examines the ethical implications of robotic care for people, based on our survey of people's attitudes towards robots and AI technologies and critical events in their lives conducted in 2020. In addition, this study does not adopt the perspective of care and technology for sick and bedridden people, but considers so-called 'ordinary' people who lead independent lives and basically take care of their own health. These 'ordinary' people are those who are less likely to be considered for medical ethics, such as those who do not have a diagnosis of being medically ill but use technology-based care for their health. In other words, the ethical aspects of introducing technology into everyday life and self-care are considered. Moreover, it approaches the ethical aspects from the perspective of computer ethics, rather than the conventional medical ethics and bioethics involved in healthcare. This is a new attempt to incorporate a 'care' perspective into computer ethics.

2. Digital Healthcare Technology, Care Robots and Older People

When we get sick, we can go to hospital, receive medical treatment from doctors and nurses, and get medicines from pharmacies. However, many people take time off from school or work before going to hospital, often choosing to be cared for by themselves or by others, such as family members. Even after receiving medical treatment, people still need to recover at home and care is essential for our health, regardless of age [8]. Also, in fact, the number of people taking care of their health to avoid illness has been increasing year by year [9]. In particular, the use of digital tools for care is growing as they are very convenient for individuals who want to prevent illness.

The most typical examples of such digital tools are the various digital applications available with a smartphone. For instance, digital applications that measure and record vital information such as blood pressure and pulse, self-tracking applications to record exercise, eating and drinking or smoking, and applications to maintain mental health. People are now increasingly using digital tools that can be used for a variety of everyday activities. Previous research has shown that self-care has three dimensions: health promotion and treatment adherence (self-care maintenance), body listening and symptom recognition (self-care monitoring), and taking action to manage signs and symptoms (self-care management) [10]. Digital applications have made it possible for non-medical professionals and experts, i.e. even 'ordinary' people, to care for their health in an autonomous way. Recently, in academic research, new keywords such as eHealth and mHealth have emerged, particularly in the fields of medical engineering and computer science, and research on digital technology and healthcare is very active.

Despite the rapid development of healthcare technologies and people's growing interest in healthcare, elderly people are particularly reluctant to adopt digital health technologies such as mobile health tools [11] Although media provide abundant information about what is good for health, ironically, too much information disturbs their ability to make a decision properly. Under the information overload situation, they don't have enough and proper knowledge to determine what is good to do for health by themselves. Furthermore, one of the main reasons to diminish digital adoption by elderly people is 'perceived risks of digital health tool use', such as privacy risk, performance risk, legal concern, and trust [11]. However, several international comparative studies on care robots for the elderly report that Japanese users are more positive about the use of care robots than European users [12][13]. Users of care robots as a digital healthcare tool include older people and care workers [13].

Unlike digital healthcare applications that appear on the interface of digital devices such as smartphones and tablets, robotic care appears in front of users as a material existence - a robot. Needless to say, robots do not only appear as humanoid robots, but sometimes in animal form, sometimes in very mechanical forms such as robot arms, and sometimes in new forms that are futuristic and unlike anything else in existence. Care robots that materially appear in front of users have much in common with traditional digital health technologies in terms of the digital applications they carry, but their impact on users can also be more visible or greater in that they are visible, touchable and sometimes communicable to users.

In addition, unlike the aforementioned studies and the general perceptions that older people are reluctant to use digital health tools, Japanese people have high expectations of care robots as they get older, indicating a positive attitude among older people towards robotic care [14]. According to the research by the Ministry of Internal Affairs and Communications in Japan, when people themselves become the generation that has to care for their families, or are taken care of by their families, they have to realistically confront the problems of care that Japanese society is facing today. Generations for whom care is a practical issue then tend to think more seriously about care, including the need for care and the convenience of care, which raises their expectations about the usefulness of care robots and makes them more positive about the use of care robots [14]. On the other hand, the younger generations, who are in the midst of raising their children, tend to avoid the use of care robots for parenting and educating of their children [14]. This implies that people control their use of technology in accordance with the target group they are 'caring' for. In particular, the use of social robots for children raises ethical concerns about the impact on children's emotional development, communication skills and intellectual development, as well as privacy and security issues of concern to older people [15]. Based on these previous studies and the results of our survey, in the next section, we compare the correlation between the Japanese view of robots and important events in their lives and the correlation between the Swedish view of robots and social problems and important events in their lives, and discusses the attitudes people have towards robots.

3. Japanese Views on Robots and Their Perceptions of Life Events

In our previous studies, we have pointed out that we are trying to understand the meaning that robots and advanced technologies have for our world and life, under the significant influence of the cultural and social contexts [16][17]. Moreover, one's view of life itself is not always fixed, and the very encounter with robots, AI and artifacts can trigger a renewal of one's awareness and view of life.

Robots entail always instability and indeterminacy, not only in their technical aspects, including their appearance and function, but also in their existence itself. For example, in the process of trying to make a humanoid robot resemble a perfectly human appearance, people perceive it as creepy and fall into the uncanny valley [18]. On the other hand, when a pet robot they have used for years breaks down and they realise it will never work again, they show great attachment to it, even holding a funeral service for it. This section explores how people perceive these robots and artefacts in their world and lives, based on the results of our 2020 survey.

In 2020 a survey conducted in Japan with 400 people (men and women aged 25-44 living in Fukushima, Miyagi and Iwate prefectures) to measure people's attitudes towards technology, AI, robots and the important meaning of life [16]. And, it was designed as a quota sampling, with gender and age percentages based on the Japanese government's official statistical reports on Internet users. The

Japanese concept *mono no aware* has been used as an important parameter in the survey. It refers to people's complex emotions in certain contexts. In other words, when we see or hear something ephemeral and short-lived, such as fireworks, the glow of fireflies in summer or the sound of cicadas, we are touched by their transience, with a slight sadness. The Japanese describe such emotional responses as mono no aware. In order to analyse the "views on robots and related matters" of the Japanese people, the following items were used as a life event in the questionnaire:

- Care robots: To leave older persons or the handicapped to robots for their care would be seemingly good but might worsen isolation of them from societies.
- Education by robots: To use robots for child education at school would be good to improve educational effectiveness.
- Requiem and memorial service for broken robots: To hold a memorial service for broken robots and computers.
- Naming a robot: To name a robot and kindly treat it would make its user kind and caring at the same time.
- Life-or-death dependence on an autonomous vehicle: To use autonomous driving cars with AI would be convenient, but depending on them to make a life-or-death decision would be problematic.
- The ending of Astro-boy: To know Astro-boy sacrificed him to save the earth in the final episode moves me.
- Smartphone/SNS as important tools for a life: To know social situations by a smartphone or social networking services (Facebook, Twitter etc.) is important for one's life.

The way the Japanese view their lives (views on life) was also set up in the survey as follows:

- Lonely death: If I read stories about lonely death in newspapers, I would feel that this is a very important and serious matter for me, even if it happens outside my community.
- Helping others in a disaster: If there are old people in my community who need to be evacuated in the event of a disaster, I would help them.
- Places for memories: There are many places in my community where I would remember precious memories.
- Mono no aware: Fireworks and/or the glow of fireflies in summer would make me feel beautiful because of their transience or ephemerality.

In our 2020 survey result, each item of views on robots and related matters shows a strong correlation with all items of views on life, except for the item "Smartphone/SNS as important tools for a life". This means that Japanese people clearly recognise the different roles of robots and smartphones/social media in their lives, and have emotionally attached to robots. When people answered affirmatively to the items of the two views, they showed empathy, compassion and sensitivity for surroundings or phenomenon around them, regardless of physicality and materiality. On the other hand, using a smartphone or social networking services doesn't show correlation to the views of life. What are the differences between perspectives on events related to robots and automated vehicles and those related to smartphones and social networking?

As we have already known, smartphones and SNS have become part of our daily lives and the use of smartphones and SNS is taken for granted by different generations as commodities. They also differ significantly from autonomous vehicles and robots in that they are not supposed to move autonomously, but only under the control of the user. In other words, contact with artefacts that, as a result of technological development, are able to function to some extent autonomously, could allow us to establish relationships with them that remind us of 'life' or 'humanity'. More to the point, in this world, people explore the meaning of their life-world in different ways. The orientation towards the search for 'existential meanings' determines the manner of understanding and interpreting the meanings of encounters with robots and autonomous vehicles. What the survey results have shown is that the orientation and the manner in which people acquire in their search for meaning of life have a significant impact on the relationship between people and artefacts when interacting with autonomous vehicles and robots. *Mono no aware* that the Japanese feel towards fragility, perseverance and selflessness is an affirming sentiment and projects certain social values in Japan.

When these findings are viewed in the context of 'care', we can see why people in Japan have a more positive attitude towards care robots than they do in Western countries. Care robots that follow

human orders, work selflessly only for human care, and can break down or be removed at any time make people feel *mono no aware*. The instability and indeterminacy of robots also evoke the search for existential meanings in humans, which leads to situating the existence of the robot in relation to human life. In this context, it is not surprising that people anthropomorphise robots by giving them names and holding funerals for 'dead' robots. In Japan, such an orientation and shared social values towards robots will promote the active implementation of robots in care and various social fields.

In other words, it can be said that technology emerges meaningfully in people's lives when it is combined with the concept and interest of "care". Care robots also have a general meaning, but because they are care robots, they come into direct contact with individual health conditions, concerns and interests.

4. Swedish Views on Robots and Their Perceptions of Life Events

What, then, are people's perceptions of robots in relation to care or life in Sweden, where people, including older people, have a higher affinity for technology and higher skills and literacy in using it, compared to other European countries? Swedish people have a reputation for being innovative and technology-savvy, which has led to increased interest in the use of robots in various fields. As a result, the recognition of robots among the Swedish population is generally high, and many people shows strong interests with digitalization of their daily lives [16]. In fact, these Swedish social trends can also be seen in the Digital Economy and Society Index (DESI) 2022, published annually by the European Commission [19]. This index indicates European Union (EU) member States' digital progress based on the monitoring results by European Commission since 2014, and focuses on five key areas (connectivity, human capital, use of internet services, integration of digital technology and digital public services) in its analysis. In the 2022 DECI, Sweden ranks 4th out of the 27 EU Member States and has made steady progress in digitalisation in recent years. Each index of the five key areas is appeared above the overall EU average [19].

In recent years, robots have been increasingly used in healthcare, transportation, manufacturing, and other industries in Sweden. This trend has been facilitated by the country's favorable regulatory environment, investment in research and development, and collaboration between academia and industry. For example, Sveriges Kommuner och Regioner (SKR), which is called the Swedish Association for Local Authorities and Regions (SALAR) in English, has been promoting robotic process automation (RPA) or software robots in the public and social service sectors in municipalities and counties [20][21]. In fact, since 2019, SKR has started to introduce software robots to assist social workers with repetitive tasks, such as checking documents and data, which used to be done manually [22].

The use of robots in the care sector will promote more and more under the social trend of digitalisation. Additionally, in terms of digital inclusion, the level of individual digital skills in the older generation (64 years and older) is higher than other European countries, which ranks 8th in EU member States in 2022 [23]. Swedes generally view digital technologies and robots as tools that can help improve efficiency, safety, and quality of life.

In light of these social trends in Sweden, we conducted another survey in 2019 to explore Swedish people's attitudes towards technology, AI, robots and the important meaning of life. Although the number of responses to the survey (the 2019 survey) was smaller than the 2020 survey conducted in Japan, a total of 109 people who were/are students at Uppsala University completed the questionnaire. As with the survey in Japan, the 'views on robots and related matters' for our 2019 survey in Sweden were set as described below：
- Care robots: To leave older persons or the handicapped to robots for their care would be seemingly good but might worsen isolation of them from societies.
- Preventing the mistreatment of robots by giving them emotions: To give robots the ability to express emotions is good for preventing cruel treatment of robots.
- Life-or-death dependence on an autonomous vehicle: To use autonomous driving cars with AI would be convenient, but depending on them to make a life-or-death decision would be problematic.

- Losses in the choice of education and health care services: To have free education from primary school to university and inexpensive health and medical care is good, but it could lead to a loss of choice in these social services.
- Interest in the environment: To have a strong interest in global environmental issues is important.

The way the Swedish view their lives (views on life) was also set up in the survey as follows:

- Requiem service for broken robots: To hold a memorial service for broken robots and computers.
- The ending of Astro-boy: To know Astro-boy sacrificed him to save the earth in the final episode moves me.
- Flowers for the victims: To see flowers in memory of the victims at the scene of the incident makes me aware of the transience of this world and makes me consider my life deeply.
- Naming a robot: To name a robot and kindly treat it would make its user kind and caring at the same time.
- The ending of Astro-boy: To know Astro-boy sacrificed him to save the earth in the final episode moves me.
- *Mono no aware*: Fireworks and/or the glow of fireflies in summer would make me feel beautiful because of their transience or ephemerality.

The 2019 survey results show that 'preventing the mistreatment of robots by giving them emotions' in 'the views on robots and related matters' correlates with all of the views on life. Why did these correlations only appear for this item? The possible implication here is that, unlike the robots and machines in the other items, in this item the robot is given the essential human element of giving emotions. What's more, it indicates that care robots and self-driving cars, which are even involved in human life and death, are seen merely as technological tools, without recognising life or humanity in these machines themselves.

In the Japanese view, there is a tendency to find 'life' and 'human qualities' in autonomous objects, whereas in Sweden this tendency is less pronounced. These differences can significantly affect how people interact with robots and autonomous objects. These differences in perceptions of robots can also make a significant gap in the degree of adoption and utilisation of robots in the healthcare sector. In fact, the robots currently introduced in the Swedish healthcare sector are software robots, which do not think or feel anything autonomously on their own, but only perform the functions they have been programmed to do under the navigation of healthcare experts and social workers.

According to the 2019 survey results, when the use of robots that can think and act autonomously on their own increases, it will likely change people's views of robots and their interaction with robots will take place in the context of 'life'. That means, depending on the type of robots we introduce into the healthcare sector in the future, the orientation in human perception will change, which in turn will change the relationship and trust between humans and robots in Sweden.

The survey result shows that neither ethics nor technology creates a closed area of meaning or evaluation. It is associated with different perspectives on life. It can be said that one's view on life also changes its content when it encounters problems related to technology and the relationship between technology and ethics. Here, we can see an "open horizon" as Husserl and Merleau-Ponty called it [24]. It can be said that the various ways of looking at things contained in that "open horizon" are interconnected and transform their meaning as long as they appear within this horizon. As a result, a new statistical correlation was found between the f3-2 factor, consisting of the "Mono no aware view" and "sympathy for sacrifice," and "interest in the environment". It can be seen that the Swedish people's "Mono no aware" and their empathy for "sacrifice", which make up this f3-2 factor, create a new interest in and empathy for the environment.

5. Conclusion

Through the findings in this investigation, we can find a kind of emergent connection between people and robots and their technology. According to Kimura, a Japanese psychiatrist, 'these links of meaning that are opened up by relationships between matters that have certain intrinsic meanings as things' are

called 'Koto' [25]. The Japanese term 'Koto' is translated directly into 'matter' in English. However, this 'matter' has its own "spontaneity" rather than being created by human hands. 'Matter' is inherently passive, but it has a certain 'quality'. At the level of this "quality", matter itself creates interconnections. We can find a kind of "passive synthesis" here. Whether it is technology or the ethics of technology, it is difficult to fully understand the meaning of these findings if we only understand the 'active synthesis' aspect. Our empirical study here provides 'scientific' evidence of the emergent phenomena between robots and humans, not through imagination or fantasy, but through empirical analysis. In other words, it allows us to interpret human-robot interaction from an existential perspective. In conventional discussions on 'technology and ethics', our findings tend to be excluded. The reason is that technology ethics tends to be treated as two different practices - 'technology' and 'ethics'. What we have attempted to elucidate in this study is the link between robots/technology and ethics, focusing on "care" as a phenomenon. In other words, it is to attempt to see how we can find a kind of 'horizon' described above in the relationship between them.

In Japan and in Sweden, ageing society, labour shortages in the care sector and increasing social security costs have become serious social problems. In order to alleviate this situation, both countries have implemented various policies in different social areas, as well as promoting digitalisation and introducing care robots in the healthcare sector. While older people are generally considered to be reluctant to adapt to new technologies, in both Japan and Sweden, the digital integration of older people is higher than in other countries, and the implementation of robots into the care sector has been encouraged by national and local governments. Robotic care is expected to become increasingly common in the future.

As we have seen, the use of robots and technology to take care of ourselves seems to be a natural progression in the current ageing society with a declining birthrate. While we use technology to stay healthy, we are also creating an ironic situation where our health is defined by technology and the analysis of data collected through it [8]. In practice, we pay little attention to the ambiguity of this natural consequence. This is because we face the risk of falling into aporia by questioning the obvious. When we do not know what we should know, it is clearly a problem. If we know that we don't know, then it is possible to find a solution. However, when we do not even know what we do not know, we cannot even recognise the problem, and the problems that are not even recognised and made invisible just pile up. The concept of 'horizon' explored in this study and some philosophical insights about human-robot interaction based on our survey in Japan and Sweden make it possible to question the obvious from a fundamental level. In particular, 'care' has an aspect of a phenomenological event arising from the interrelationship between the person in need of care and the person or thing providing care. People are cared for from the time they are born in their mother's womb, and as they grow up they sometimes care for others and are cared for by others throughout their lives. Even if we only look at it in this way, we live in a multitude of different ways, and the ways of being that we are aware of may only be a part of the totality [26].

While care robots are gaining a great public attention, nowadays, there is also a growing awareness of the potential social and ethical implications of the widespread use of robots, particularly in relation to privacy and personal data. Many studies have been conducted on these issues from technological and political perspectives. However, these issues are only the problems which we can easily recognize as the obvious. This study focused more on the individual and examined people's orientation towards robots, which is invisible but has a significant impact on the implementation of robots. In other words, this study examined how people in both countries perceive robots and autonomous artefacts and how they construct relationships with these artefacts, based on the results of two surveys (the 2020 survey in Japan, and the 2019 survey in Sweden), and elucidated the relationship between humans and robots from an ethical perspective.

Japanese views of the world, the meaning of the lifeworld and human interaction with technical objects, which have sometimes been criticised as a 'strange dualism' of existence and logos or as animism, could be seen in a different light. Karatani describes that Today's Japanese views of modern society reflect the divided views held in Japan's historical, existential, and cultural situations. People live continuously in the world of historical and cultural existence [27]. Within these views, people share a traditional and existential view called *mono no aware*, i.e. a sensitivity to the emergence of the momentary harmony of beauty and an awareness of its fragility [17] [27].

On the other hand, there is also a realm of institutionalised and rationalised views. In this realm, propositions such as logos and science are believed to determine the meaning of life. In the process of modernisation in Japan, a large distance was created between the logos and the existence of life [17][27]. This large distance between the logos and the existence of life could cause the instability and the indeterminacy. However, such a state of uncertainties encourages us to see the world with a newer awareness. In fact, this view is not unique to Japan. This is clearly illustrated by the results of the Swedish survey results and its insights. That is, if the things are in the intermediate state of appearance and hiddenness, as Heidegger states, then they need a newer human awareness each time [28]. Rather, everything in this world needs a newer awareness [17].

The Japanese orientation towards robots allows the relationship between humans and robots to transcend a reductionist framework and to be constructed in search of its existential meaning. The robot is then not just a tool, a convenient artefact, but is recognised in a context beyond the human. In simple terms, the relationship breaks away from human-centrism. Furthermore, in Japanese, the relationship between subjectivity and objectivity is often inverted, reflecting the structure of Japanese language and historical and cultural experience. In other words, things are defined in the form of oneness or undifferentiatedness [16][17].

Mono no aware, which is people's complex emotions related to ephemerality and transience, affects the relationship between humans and robots in Japan. As it can be seen in our survey in Sweden, in Sweden, the results show that non-technological views of life, like mono no aware play an important role for their attitudes towards robots. That is, similar results could be seen in Sweden, although not to the same extent as in Japan, in the relationship between emotional robots and humans. Judging from this comparison between the Japanese and Swedish surveys, we can conclude that people's ways of thinking and feeling about the meanings of life in informatised environments are influenced, or at least correlated, by their orientations toward the search after existential meanings and also understandings of the fragility, change and fading of life.

In particular, highly sophisticated, autonomous and independent-thinking robots would question people about the existential meaning and also challenge people with fundamental but still novel ethical questions about what humanity is, how to position subjects and objects, and how to deal with the increasingly ambiguous boundaries between humans - artefacts - the environment/nature.

6. Acknowledgements

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