Japanese Society: Where Humans and Robots Coexist

Miyako Takagi

***Abstract*—From a global point of view, Japan seems to be the only place where communication robots like Sony's AIBO and Honda's ASIMO are entertained. Why does the communication robot boom not occur outside Japan? This difference may be due to the difference in the sense of robots in Japan and Western countries, and the so-called "robot view." In Japan, the generation who watched "Astro Boy" and "Doraemon" from a young age recognizes that "robot is a friend" and this conception may be passed on to the future. Communication includes the irrational element of human beings that cannot be grasped by technology alone, and it happens that people love an incomplete robot rather than a complete one. In a society where humans and robots coexist, weak robots show that the ability to communicate with humans is more important than the completeness of individual robots. It was pointed out that the receptionist robot developed in Japan promotes gender bias. The robot has no intention of its own, so if there is a gender bias, it reflects the feelings of the person who made it. What about the introduction of robots to nursing care sites? Robots may be considered to assist care workers, and caregivers don't lose their jobs. On a survey on "awareness about care", when asked if they would want to receive physical care from a nursing robot when they are being cared for in the future, 84% of respondents give a positive response.**

***Index Terms*—Communication between older people and robots, gender issues in robots, imperfect communication robot, Japanese view of robots.**

I. Introduction

The 21st century is said to be the age of robots, and companies and research institutes around the world are conducting research on robots. Robots are becoming increasingly familiar, such as when we hear in the news that robots have played an active role in disaster relief and photography using drones.

But what about communication robots like Sony's AIBO, Honda's ASIMO, Softbank's Pepper? From a global point of view, Japan seems to be the only place where these communication robots are entertained. Communication robots are mainly in the Japanese market, and most of the supply companies are Japanese. Why does the communication robot boom not occur outside Japan? This difference may be due to the difference in the sense of robots in Japan and Western countries, and the so-called "robot view."

The term "robot" comes from Robota, which means "forced labor" in Czech, and is a term that classifies farmers who were obligated to perform forced service under the feudal system [1]. In Western countries, this means that robots should be obedient to human beings, sometimes carrying the risk of rebelling against human beings, and the general notion that they are not equal to human beings. The "robot three principles" that a robot should follow, which SF writer Isaac Asimov wrote about in a novel, are defined as "safety to humans, submission to orders, self-defense [2]."

In Japan, attitudes about robots are completely different from Western countries. Since the 1960s, they have become familiar, with Astro Boy [3] and Doraemon [4] manga and television, where robots have independent individuality and become equal as friends. I would like to consider the difference between the robot view in Japan and Western countries, and the influence that they give to a robot.

II. Japan's Unique View of Robots

A. Japanese View of Robots Cultivated by Astro Boy and Doraemon

There is no doubt that the Japanese love robots and they believe that robots help people. In the 1960s, Mr. Osamu Tezuka's Astro Boy was animated for TV, and Japanese children were caught up in a story where robots worked with humans to defeat social evil and grew up watching them weekly. As for Doraemon, which has been loved by the Japanese since the 1970s, it lives in a Japanese family's house and they share morning and evening meals as equal friends. There may be no other country that has drawn a society where humans and robots coexist in harmony like this. The generation who watched "Astro Boy" and "Doraemon" from a young age recognizes that "robot is a friend" and this conception may be passed on to the future.

B. Human–Robot Partnership: AIBO's Funeral

The first AIBO (all upper case) (Sony) is a dog-type robot sold in 1999–2006. The name is an abbreviation of AI (Artificial Intelligence) roBOt. The aibo (all lower case), which has been on sale since 2018, looks like a current digital gadget; it has built-in communication, and the software on the Cloud and the software in aibo cooperate to realize its character and intelligence as a pet.

Although the first AIBO was worth 250,000 yen, it was so popular that 3,000 units are allocated exclusively for sale in Japan sold out in 20 minutes, and a total of approximately 150,000 were shipped. The first AIBO is equipped with AI, and is characterized by movement by one's own intention, and six emotions such as joy and sadness are programmed. There are 15 to 20 driving parts, not only walking but also sitting, stretching, kicking the ball and so on, so it is flexible like a dog. AIBO does not hear what it says in the beginning, but because it is a learning robot, its attitude changes more and more as people get involved. As a result, the owner's love for their robot increases rapidly, and it becomes like a child.

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Miyako Takagi is with Faculty of Human Welfare, Tokyo Online University, Nishi-Shinjuku, Shinjuku-ku, Tokyo, Japan (e-mail: takagi.miyako@internet.ac.jp).

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Sony set up an AIBO clinic and received repair work, but in 2014 the service was terminated because parts were lost.

In Japan, there is an idea that a tool has a soul, and there is a custom of holding the Buddhist ceremony for a tool that has been used for a long time, such as a needle or a doll [5]. Also, if you ask for sutra, the soul will be removed from the tombstone and it will be just a stone [6]. From such a way of thinking, a temple in Chiba Prefecture decided to provide a Buddhist ceremony to AIBO. In the first round, 17 AIBOs were provided with such a service, and it was taken up in the media, which further increased the number of AIBOs, and a total of four services have been conducted [7].

C. Why did Smart Speakers not Become Popular in Japan?

If a robot is just a substitution for, or expansion of human function, there is no need to be humanoid or have emotions. One of the robots that has recently been attracting attention overseas is the smart speaker "Amazon Echo" and "Google Home." It is a speaker that can be activated by voice, and it has sold 100 million units worldwide, especially in the United States [8]. It is a stationary speaker-type device that lets you play music and control home appliances in the house, by voice input. It is a kind of "life assist robot." These can be said to be "communication robots" in the sense of speech recognition. However, this is developed on the premise that it is useful, and it looks just a speaker.

Are these popular in Japan? According to a survey released by Dentsu Digital in February 2019, the recognition rate of smart speakers in Japan is about 76%, but the penetration rate is only about 6% [9]. There are various reasons why smart speakers do not spread in Japan, but one reason is that Japanese people may not like talking to a speaker which is perceived to be mechanical and inorganic.

III. Imperfect Robot

A. One Might Prefer an Imperfect Communication Robot

Doraemon, a cat-shaped robot, has a "secret tool" that comes out of the "four-dimensional pocket" attached to the tummy, and he sometimes helps Nobita (boy). However, Doraemon often fails because he is an incomplete robot compared to his sister Dorami, who does everything perfectly, but Nobita loves incomplete Doraemon more than perfect Dorami. In a 2017 paper, a similar result was really shown in conjunction with a humanoid robot with a human being. Mirnig and colleagues [10] experimented with the humanoid robot NAO developed in France and investigated what social signals humans would show when NAO made an error. Results showed that people tend to prefer flawed robots over perfect robots.

Communication robots are not yet in a technical state where they operate free from errors. Nevertheless, most research approaches act on the assumption of robots performing faultlessly. Robots in human–robot interaction (HRI) elicit mental models known from human–human interaction (HHI). One aspect we know from HHI is that imperfections make humans more likable and more believable. The psychological phenomenon, the Pratfall Effect [11], states that people's attractiveness increases when they commit a mistake. Superior people may be viewed as superhuman and distant, while a mistake would make them seem more human. Similarly, communication robots are often seen as impeccable, but communication robots that commit errors could then be viewed as more human-like and, in consequence, more likable.

In our daily life, it is thought that opportunities for interaction between robots and people will increase in the future. Communication includes the irrational element of human beings that cannot be grasped by technology alone, and it happens that people love an incomplete Doraemon rather than a complete Dorami. In the future, not only will we aim for robots that are superior in terms of functionality, but various developments will be required. Furthermore, the development of robots that realize communication with people by reducing their functions and giving them "defects" is now being carried out in Japan.

B. Human-Dependent Weak Robots for Creating Symbiotic Relations with Humans

The home cleaning robot "Rumba" was first released in 2002 and has sold over 20 million units to date. Rumba is getting popular because it cleans the room, but we also act to clean up the room so that the rumba can move smoothly. We can say that this is collaborative work between person and a robot. This concept was developed as a "human-dependent Weak Robots" advocated by Professor Michio Okada of Toyohashi University of Technology [12]. Weak robots that cannot complete their functions without assistance from humans are clearly different from AI that aim for "singularity [13]" beyond humans and super robots such as SF. The "Sociable Trash Box" developed by Prof. Okada has the apparent disadvantage of not having the ability to pick up trash on its own. The trash can robot is equipped with a USB camera, infrared sensor, and wheels, but when it moves around the room to find trash, the robot turns its body toward people and bows. The action seems to call people to "please help me pick up the trash." Such robots that need human help are unique.

In a society where humans and robots coexist, weak robots show that the ability to communicate with humans is more important than the completeness of individual robots. Robots can be broadly classified into "things that are useful and improve productivity" and "things that enrich human life." [14] In the latter category, there are trash can robots and communication robots, which are expected to become increasingly important in relation to people.

IV. Gender Issues in Robots

A. Does a Beautiful Young Receptionist Robot Promote Gender Bias?

In Japan, humanoid robots equipped with AI are beginning to play an active role in shopping mall information and hotel reception. Market research companies predict that by 2030, the number of domestic robots will reach 9 million. Many receptionist robots tend to be equipped with advanced technologies such as multilingual functions, and there are great expectations for dealing with the labor shortage and labor cost reduction.

However, the idea of the receptionist robot is not always positive. Prof. Noriko Arai, of the National Institute of Informatics, has received a great deal of attention in the critique of "Gender's perspective on the receptionist robot" published in the Asahi Newspaper [15]. The content of the critique is that she is told by three overseas experts that many of the reception robots are stereotypes in the form of a young woman, who seems to be obedient and beautiful, which is a sexual prejudice that is unacceptable in the West. In other words, it was pointed out that the receptionist robot developed in Japan promotes gender bias.

In December 2018, the World Economic Forum published The Global Gender Gap Report 2018 [16], in which the Gender Gap Index (GGI), which measures gender disparities in each country, was announced. This index is created from data in four fields: economy, education, health, and politics. '0' means complete inequality and '1' means complete equality. Japan's overall score in 2018 was 0.662, ranking 110th out of 149 countries. The robot has no intention of its own, so if there is a gender bias, it reflects the feelings of the person who made it. Did the idea of a receptionist robot come out because Japan has a GGI of 110th in the world?

Even in the real world, it is unlikely that there will be a strong man at the reception and a delicate woman as a security guard. As a reflection of the real world, is there a problem with receptionist robots that give a welcoming atmosphere? Or will the gender problem be solved by stopping the humanoid robot itself and making it a smart speaker robot?

B. UNESCO Claims that Female Voice Assistants Will Increase Gender Bias

In May 2019, UNESCO released a report claiming that the default voice assistant as female would increase gender bias [17]. In the report, for Apple Siri, Amazon Alexa, google Assistant, and Microsoft Cortana, it was pointed out that the default female voice strengthened the gender bias that women played the role of support.

Currently, AI assistants for male voices are increasing, but the male version is also subject to gender issues. Apple Siri defaults to male voices in the UK, but several scholars have interpreted it as an extension of the British male servant culture [18]. The number of assistants who can change their voice after setup is increasing, but it may be necessary to select the gender of assistant during the initial setup before using it.

AI robots that could be pointed out as "discrimination," whether masculine or feminine. Voice assistants and gender issues were not much considered at the time of their appearance, but it seems that it is time to think seriously as they become more widespread. From now on, the distance between humans and robots will be dramatically reduced.

So that a robot coexists with a human being, the culture and values that have been built by society must be incorporated into the functions and design of robots.

V. Robots Do Not Replace Care Workers

September 16 is celebrated as Respect for the Aged Day in Japan. According to the data released by the Ministry of Internal Affairs and Communications on September 16, 2019, the number of Japan's elderly population aged 65 or older stood at 35.88 million, accounting for 28.4% of its total population [19]. In addition to the record increase in the aging population, the acute shortage of eldercare staff has become prevalent in Japan. According to the Ministry of Health, Labor and Welfare's "Estimation of Supply and Demand for Long-Term Care Human Resources," there will be a shortage of approximately 380,000 workers by 2025 [20].

The nursing care industry has a high turnover rate with the highest in first and third years of working. According to a survey conducted by the Nursing Care Labor Center, of the 19,246 people who quit their nursing care jobs between October 1, 2013 and September 30, 2014, 73.9% were found to have left their jobs within three years [21].

In 2008, the government began accepting nursing care workers from Indonesia, Philippines, and Vietnam under the Economic Partnership Agreement (EPA) to secure care workers [22]. In the first 10 years of this agreement, 3,492 care workers were secured, which was not enough; hence, in November 2017, care workers were added to the foreign technology internship system to attract more foreign workers [23].

The Japan Care Worker Association is opposed to this government policy. They believe that the government regards care workers as simple labor and accepts semi-skilled foreign care workers with no Japanese language or specific care proficiency, which may lead to a decline in the quality of care services. Furthermore, the entry of cheap foreign labor into the workforce will drive down current wages of caregivers resulting in the shortage of Japanese caregivers [24].

On the contrary, what about the introduction of robots to nursing care sites? Is the use of robots a threat to care workers? Recent advances in AI have made it theoretically possible to automate several tasks that formerly could only be achieved by humans. However, modern jobs are becoming increasingly complex, and few jobs need only one thing to be done. Almost all occupations have work that can be automated, but currently less than 5% of jobs can be fully automated using AI and robotics. Nihon Keizai Newspaper and Financial Times have jointly developed a tool that easily identifies which occupations and tasks can be replaced by robots. The answer here is simply to determine whether a job can be automated using the technology currently available [25]. According to this tool, the probability of a robot replacing a caregiver is 19.4%. Thus, even if a robot is introduced at a nursing care site, the caregiver cannot lose his/her job. Robots may be considered to assist care workers and reduce their workload but rather contribute to reducing the number of employees quitting their jobs.

VI. Discussion and Conclusion

In September 2017, the government set up the "conference to think about the era of 100 years of life" in order to examine economic and social systems on the era of 100 years of life, and an interim report was compiled in December 2017. The term "the era of 100 years of life" is a concept proposed by Ms. Linda Gratton, a professor of London Business School in the UK, in a book "The 100-year life" that describes how to live in the longevity period [26]. Ms. Gratton believes that it is necessary to take further action if your lifespan is over 100

years old. One overseas study estimated that half of the children born in Japan in 2007 will live to be more than 107 years old [27]., and Japan is a fully-fledged longevity society. Japan is attracting worldwide attention as to how it will approach such a longevity society.

Recently, lifestyles for the prevention of dementia have attracted attention. The Japanese Society for Dementia Prevention lists "intellectual activity," "exercise" and "communication" as three pillars of dementia prevention [28]. Humans use the "Broca's area [29]" below the frontal lobe to express what they want to convey, and the "Wernicke area [30]" above the temporal lobe to understand the words heard. Therefore, communication is an important tool for dementia prevention.

According to the 2017 White Paper on Aging Society, the increase in the number of single older people aged 65 and over is remarkable. In 2015, single older people numbered about 1.92 million men, and about 4 million women. Under these circumstances, communication seems simple but difficult, and if you live alone, you may not talk to anyone during the day or week [31]. Now is the time to deliberately create opportunities to talk to people. In November 2018, ORIX Living released a survey on "awareness about care." The survey was conducted on the Internet, and responses were received from 1238 men and women over the age of 40 [32]. When asked if they would want to receive physical care from a nursing robot when they are being cared for in the future, 84% of respondents give a positive response.

This is a strength of Japan in the future aging society. It is expected that communication between older people and robots will show their supportive power, in ways such as enhancing human motivation and helping people improve their abilities.

Conflict of Interest

The author declares no conflict of interest.

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Miyako Takagi is a professor in Faculty of Human Welfare of Tokyo Online University. Interest in her research is various ethical issues in medical science and robotics. She is a member of the Gene Therapy Review Committee in the Institute of Medical Science, University of Tokyo and she was a former president in Asian Bioethics Association. She received her Docteur d'Université ès Sciences, Université PARIS VII. One of her research, with the title of "Ethical issues in medical and health care innovation" was published on Eubios Journal of Asian & Int'l Bioethics, vol.15 no. 4 pp.125-126, Nov. 2016.