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Robots of the Rising Sun

Jennifer Robertson

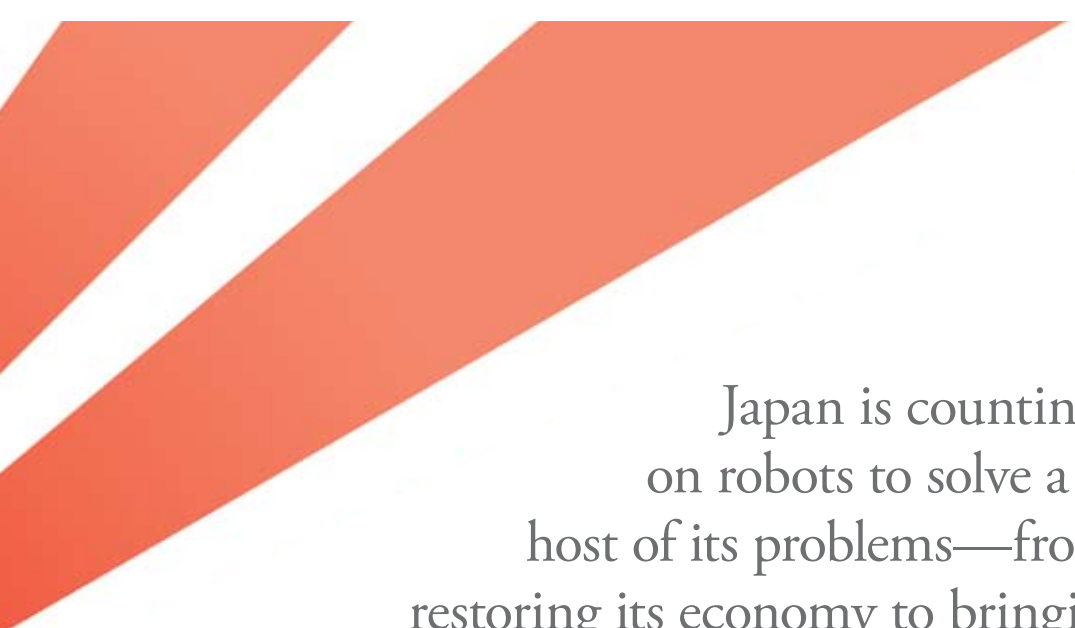


In the 1980s, when automotive trade friction between the United States and Japan sparked ugly riots and deadly violence in Detroit, the Japanese people—salaried men in particular—were stereotyped in the American media as automatons or robots who slaved 24/7 for the glory of Japan, Inc. These disparaging characterizations seem to have faded along with the Japanese economy, but robots—albeit the unsalaried kind—are still very much in the picture.

Jennifer Robertson is professor of anthropology at the University of Michigan.

Today, Japan is banking its economic revival on robots. Its Ministry of Economy, Trade and Industry (METI) forecasts that its robot industry and spin-offs will dominate this century's global marketplace, just as its automotive industry did forty years ago. *Robots Will Rescue Japan!* shouts the title of a 2009 best-selling book by Shin Nakayama. Shigeki Sugano, who chairs the Department of Modern Mechanical Engineering at Tokyo's prestigious Waseda University, claims,

If the robot is commercialized the investment will be nothing compared to the money that will be made if it is mass produced. Compan-



Japan is counting on robots to solve a host of its problems—from restoring its economy to bringing peace in the war between the sexes.

ion robots are going to be the next big industrial thing after the car and the computer. It is not just Japan but the whole developed world that is moving towards an aging society.¹

Already Japan is home to over half of the global share of the one million industrial robots, 295 for every 10,000 manufacturing workers; Singapore is second with 169 industrial robots per 10,000.² Japan also leads in the creation—and most importantly, acceptance—of humanoid household robots developed to care for children and the growing numbers of senior citizens, to provide entertainment and companionship, and to perform domestic tasks. In 2016, by which time each Japanese household is likely to own at least one robot, the size of Japan's household robot market is expected to top 18.6 million units.³

Demographics and Gender

There is no secret about what is driving Japanese enthusiasm for robots, at least at a social structural level: demographics. Ja-

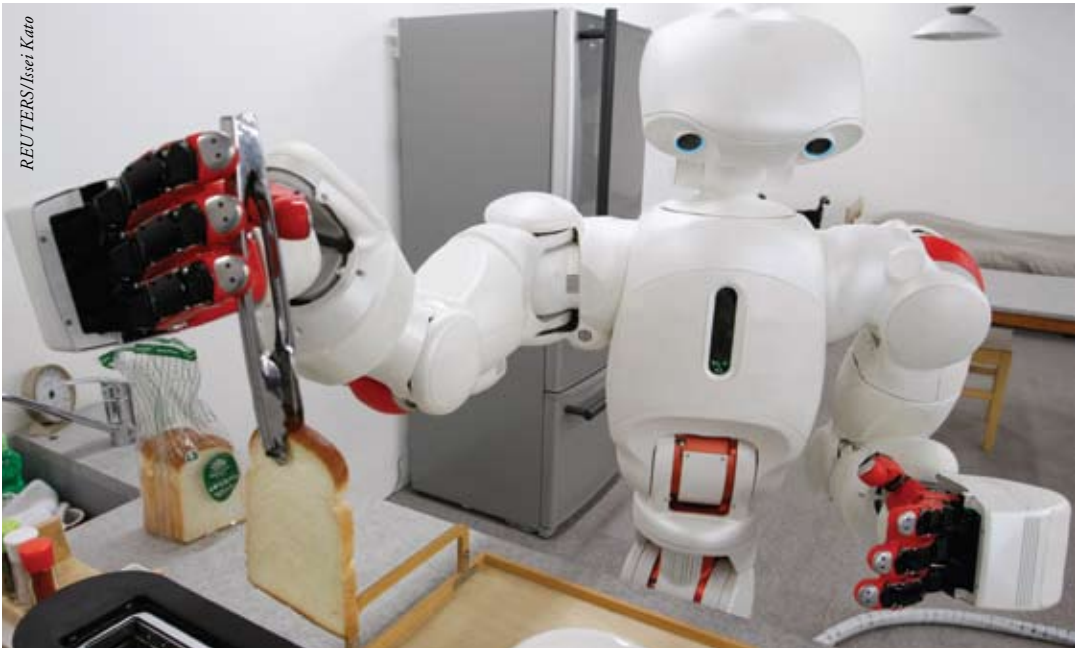
pan's birthrate presently stands at about 1.3 children per married woman, and over 21 percent of the population of nearly 127.7 million people is over 65 years of age. By 2050 that ratio is expected to surpass 40 percent. The Ministry of Health now projects that Japan's population will shrink to fewer than 111 million by 2035 and to fewer than 90 million by 2055.

Demographic estimates from 1995 indicated that more than 600,000 immigrants a year for fifty years would be needed to keep the labor force at its 1995 level of 87.2 million persons. That forecast has obviously not made much of a dent on reality, for Japan's politicians have discouraged immigration as a solution to the demographic challenge; they prefer humanoid robots made in Japan

¹“The Future of Robotics” (Rex Features, 2009).

² Eric Guizzo, “The Rise of the Machines”, *IEEE Spectrum* (December 2008).

³“Update on the Partner Robot Market and Analysis of Key Technologies and Parts”, Seed Planning Inc., June 20, 2006.



Twendy-One, a robot designed to help elderly and disabled people around the house

to workers from outside of Japan. METI's survey data indicates that, after their own children, elderly Japanese preferred robot caretakers to foreign ones.⁴ In a recent interview, Shigeki Sugano—the creator of Twendy-One, a dexterous humanoid caretaker robot unveiled in 2007—explained that free trade agreements by Japan enacted between 2002 and 2006 provoked tenacious opposition because of their proposals to “import” foreign labor. As I see it, limiting the number of foreigners in Japan reinforces the tenacious (if mythical) ideology of Japan's ethnic homogeneity.⁵

My research corroborates the power of this view. Throughout the past several years of fieldwork in Japan, I have conversed with roboticists, government ministry bureaucrats, corporate officials, academics and consumers, visited robotics laboratories and critically perused METI data and ever ballooning scientific and popular literature in Japanese and English on humanoid household (or partner) robots. All these sources lead to one conclusion: Many Japanese, especially the elderly and conservative politicians, prefer humanoid robots to foreign laborers because unlike migrant and minority workers, robots have neither cultural

differences nor, in the case of East Asians, smoldering wartime memories.

In one sense, the robotics surge in Japan is nothing new; it is consistent with the postwar precedents of pursuing automation over replacement migration to keep the economy going. There has always been a third option, however: Japan's political class and opinion leaders could stop disregarding women as a talented and vital labor force. The latest analysis of the employment of women in the labor market shows that “in marked contrast to many

⁴See “Better Than People; Japan's Humanoid Robots”, *Economist*, December 24, 2005; Matsumoto Seiji, ed. *Hyumanoido robotto kaitai shinsho* (Demystifying humanoid robots), (Kasuga Shuppan, 2008), p. 111; and Shujiro Urata, “Japan's FTA strategy and a Free Trade Area of the Asia-Pacific”, in Charles Morrison and Eduardo Pedrosa, eds., *An APEC Trade Agenda? The Political Economy of a Free Trade Area of the Asia-Pacific* (Institute of Southeast Asian Studies, 2007), pp. 81–3.

⁵Contrary to popular belief in and outside of Japan, the archipelago is home to an ethnically diverse population, from Ainu and Okinawans, to resident Koreans, Chinese and many other self-identified ethnic groups.

other industrialized societies, the overall level of female labor force participation in Japan has shown no sharp or consistent rise in recent decades. In 1965, it stood at 55 percent, and in 2006, it was slightly lower, at 49 percent.” Moreover, since 2000, the proportion of currently married women below age fifty working full time has declined and the proportion working part-time has gone up.⁶ Most Japanese pundits, however, choose not to question this deep-seated discrimination but instead blame women alone for Japan’s low birthrate. Many now see robots as a way to reverse the demographic trend without redressing sexism and changing women’s status in society.

It is, of course, not even remotely fair to blame Japanese women alone for the country’s demographic woes. The New Japan Women’s Association has identified the nexus of factors responsible for Japan’s low birthrate: shrinking family budgets because of the high cost of educating children, a dearth of public childcare facilities and after-school programs, excessively long working hours and unpaid overtime work, and the increasing replacement of regular employees with “just-in-time workers.” Others have speculated about a kind of East Asian Lysistrata complex: that Japanese women’s tendency to marry “very late” (defined as in their late twenties or early thirties), if they marry at all, and their reluctance to have children constitute a form of protest against a social system that continues to regard women as second-class citizens.⁷

Whether that is so or not, there is no doubt that economic pressures lead many Japanese women to live with their parents while working instead of marrying. Masahiro Yamada, who coined the phrase “parasite single” (*parasaito shinguru*) in a rather disparaging reference to these women (and some men), nonetheless acknowledges that women’s standard of living falls dramatically once they marry. Not only do they have to do all the housework, but they are likely to lose two thirds of their disposable income when they leave their parents’ home.⁸ How all this is their fault is a little hard to credit.

How can robots relieve this pressure and help turn Japan’s demographic decline around? Enter *Innovation 25*, the central government’s visionary blueprint for revitalizing Japanese society—and especially the household—by 2025. Introduced in February 2007 by former Prime Minister Shinzō Abe (who is attempting a comeback) and supported by former Prime Minister Yukio Hatoyama, *Innovation 25* promotes a robot-dependent way of life that is safe (*anzen*), comfortably secure (*anshin*) and convenient (*benri*). Subtitled “Making the Future; Toward the Challenge of Limitless Possibilities”, *Innovation 25* promotes a “robotic lifestyle” and earmarks \$26 billion for distribution over the next ten years to promote robot technology. That industry is supposed to “rescue” Japan from an ongoing recession and help stabilize socio-cultural institutions such as Japan’s traditional extended family.⁹

It may sound strange to American ears that cutting-edge technology can save

⁶Statistics Bureau, *Annual report on the labour force survey* (Japan Statistical Association, 2007); Robert Retherford and Naohiro Ogawa, “Japan’s Baby Bust: Causes, Implications, and Policy Responses”, in Fred Harris, ed., *The Baby Bust: Who Will Do the Work? Who Will Pay the Taxes?* (Rowman & Littlefield, 2006); Robert L. Clark, Naohiro Ogawa, Makoto Kondo and Rikiya Matsukura, “Population Decline, Labor Force Stability, and the Future of the Japanese Economy”, *European Journal of Population* (May 2010).

⁷Chikako Usui, “Japan’s frozen future: Why are women withholding their investment in work and family?”, in Amy McCreedy Thernstrom, ed., *Japanese Women: Lineage and Legacies* (Woodrow Wilson International Center for Scholars, 2005), p. 58.

⁸Masahiro Yamada, *Parasaito shinguru no jidai* [The age of parasite singles] (Chikuma Shobo, 2009).

⁹For a more extensive analysis of *Innovation 25*, and for an introduction to the Japanese family of the near future, see Jennifer Robertson, “*Robo sapiens japonicus*: Humanoid Robots and the Posthuman Family”, *Critical Asian Studies* (September 2007). See also Shin Nakayama, *Robotto ga nihon o sukuu* [Robots will rescue Japan] (Tōyōkeizai Shinpōsha, 2006).

traditional social structures, but it is supposed to work like this. Tomotaka Takahashi, a leading robot designer and founder of Robo Garage, predicts that well more than half of all future humanoid robots will be female. The Japanese government predicts that their presence in the home will free up human females to become pregnant and thereby raise the declining birthrate. Household robots will be “mothers’ little helpers” that not only monitor young children and elderly in-laws alike, but also function as household productivity boosters *par excellence*. Women will have time to be mothers without also facing the drudgery of full-spectrum homemaking.

For the fertility reason above all others, Japan has viewed the accelerated convergence of humans and machines more favorably than any other post-industrial society. This in turn explains the growing market for intelligent, autonomous humanoid robots that can push or carry heavy loads (Hitachi’s Emiew); patrol premises and extinguish fires (Alsok’s Guard Robot D); replace human service sector employees (Kokoro’s Actroid, tmsuk’s receptionist/guide robot); babysit and tutor children (NEC’s PaPeRo); house-sit (ZMP’s Nuvo, tmsuk’s Roboior); nurse the infirm and elderly (Waseda University’s Twendy-One and Murata Machinery’s robotic nurse); provide companionship and entertainment (Business Design and Futaba Industries’ ifbot, Flower Robotics’ Posy and Pino); and perform as a fashion model (AIST’s HRP 4C). Several of these functions, which are encoded in effect as artificial intelligence software, can be performed by a single robot.

The Japanese are optimistic about the social impact of robotics largely because they believe robots can do things most Americans still cannot begin to credit—and they are not completely off-base in that belief. Japanese household or partner robots today are already fitted with algorithmic software that enable them to learn from their immediate environment, and to quickly memorize the names and routines of family members or office staff. Future developments, covered generously by the Japanese media, are truly remarkable, giving rise to what can only be

called robot fetishism. Other innovations, however, are also coming down the pike.

Eugenic Cybernetics

Japanese society in the 21st century offers a case study in posthumanism, or the reconciliation—even integration—of humans and machines, which one can literally see with the increasing ubiquity of lifelike humanoid robots and wearable robot suits. But that’s just the beginning. “Posthuman society” presupposes not only that human beings live symbiotically with humanoid and other types of robots, but also that human bodies may themselves be biotechnologically enhanced. This is best called “eugenic cybernetics”, defined as the application of robot technologies to enhance the physical and cognitive abilities of humans.

Such technology can be used, for example, to counteract the effects of aging, or to compensate for a variety of disabilities. Together, robotics advances and eugenic cybernetics are steadily dissolving the boundaries between the organic and inorganic. Americans already have gotten used to hip replacement operations, lasik eye surgery and a variety of mechanical implants in recent years; the Japanese are prepared for far more invasive and creative interventions than these in the years to come. Indeed, the posthuman condition is a staple of Japanese popular culture and is quickly becoming a corporeal reality. The pursuit of eugenic cybernetics as a mode of managed social engineering is bound to further aestheticize (and even eroticize) the erosion of the boundary between humans and machines.

Consider HRP-4C, a new-generation gynoid—the female version of a human-looking android—unveiled in the spring of 2009 as a body double (and replacement?) for the human female. Her “name” is an acronym for Humanoid Robotics Project-4th Cyborg. She sports shoulder-length black hair in a pageboy cut, and her silicone face was fashioned from a composite photograph of five female employees at the Advanced Institute of Science and Technology (AIST), where she was created. HRP-4C’s dimensions are based on average values for

young Japanese females recorded in the Japanese Body Dimension Database (1997–98): She is 158 centimeters (five feet, two inches) tall and weighs 43 kilograms (95 pounds) including the battery. HRP-4C's height is average but she is about ten kilograms lighter than the average Japanese woman. Like her face, the humanoid's hands are also covered in a silicone skin. The rest of her anthropometrically exact body consists of silver and black plastic molded



The HRP-4C gynoid

to resemble a Barbarella-like costume, which accentuates her ample bosom and naturalistic buttocks.

The fembot's movements follow part of an algorithm developed by capturing the motions of human females and then mimicking them. Similarly, the robo-Barbarella's interactions with humans have been enabled through speech and gesture recognition.¹⁰ HRP-4C debuted in March 2009 at a fashion show held during the 8th Japan Fashion Week in Tokyo. As explained somewhat tautologically on the AIST website, "HRP-4C is expected to pave the way for the early practical application of humanoid robots by utilizing the key characteristic of humanoid robots, namely a human appearance."

HRP-4C marks the beginning of the "cyborgization" not of humans but of robots; that is, her robot body has been enhanced by the integration of anthropometric features. Although the usual understanding of cyborgs positions a human as the altered agent, it makes just as much sense in a posthuman world to view a robot as the altered agent. A cyborg is an "equal opportunity" hybrid form, at once human and robot, and capable of being altered in one direction or another.¹¹

¹⁰HRP-4C was developed as part of the User Centered Robot Open Architecture (UCROA), one of the projects under the Industrial Transformation Research Initiative, a three-year industry-academia joint project implemented by AIST in 2006 with intended applications in the entertainment industry.

¹¹Orient Industry Co. of Japan already makes sophisticated female sex dolls. The doll-maker sells at least fifty

Embodied Intelligence

What should be clear by now is that in Japan the accelerating dynamics of eugenic cybernetics are not cause for many furrowed brows or bioethics committees. Most Japanese seem to have no qualms about the onrushing posthuman future. Clearly, that is not the case in the Euro-American world. Why is this?

Let us repair to basics. What exactly is a robot? The word was coined by the Czech playwright Karel Čapek from the word *robota* or forced labor. His play *R.U.R., Rossum's Universal Robots*, which premiered in Prague in 1922, was about a factory in the then-near future where synthetic slaves, or robots, were mass produced for export all over the world. Performed in Tokyo in 1924 under the title “Artificial Human” (*Jinzō ningen*), *R.U.R.* sparked a “robot boom” in Japanese popular culture that has continued to this day.

Its origins in the arts notwithstanding, a robot can be defined empirically as an autonomous or semiautonomous device that performs its tasks either according to direct human control, partial control with human supervision, or completely autonomously.¹² A robot is an aggregation of different technologies—sensors, software, telecommunications tools, motors and batteries—that make it capable of interacting with its environment. What that environment looks like and what interactions are desired shape the robot.

Thus, industrial robots look like pieces of machinery, meant to fit into an industrial manufacturing environment. A humanoid, on the other hand, has to act like a human in environments designed for the capabilities of the human body, such as an office, hospital or house. It must therefore have a body that resembles a human (head, arms, torso, legs). There are basically two categories of humanoid robots with respect to their gendered embodiment: those designed to “pass” as human, and those whose overall shape merely bears some resemblance to human morphology.

Industrial robots do not raise many moral qualms in the United States. Americans see them as just better machines. Humanoids

do raise qualms, however. Osaka University roboticist Hiroshi Ishiguro, who specializes in building androids, has long defended—in contrast to many of his American counterparts—the “good reasons” to build “human-like robots”:

Functionally . . . human-robot communication will presumably be optimized in many contexts if the robot conforms to human-like appearance and behavior, rather than asking humans to conform to a computational system. . . . It is also possible that psychological benefits could accrue if humans kept ‘company’ with robotic others.

If you want to understand how people interact with a mechanical-looking robot, you use a mechanical-looking robot. If you want to understand how people interact with each other, a mechanical-looking robot is not enough. Since we want to understand human beings, we build androids.¹³

So in July 2006 Ishiguro’s lab built a robot twin of Ishiguro himself named Geminoid HI-1—“H” and “I” being the roboticist’s initials. The android was purposively created as Ishiguro’s doppelgänger through which to distribute his unique personhood via telepresence. Briefly, “distributed personhood”

silicone companions per month, costing up to \$7,000 each. See Tom Hornyak, “Programmed for Combat or Pleasure”, *Japan Times*, May 25, 2009.

¹²Autonomous (or semiautonomous) robots did not become possible until the invention of transistors and integrated circuits. Compact, reliable electronics and a growing computer industry were also critical. In the computing world, having more transistors on a chip means more speed and possibly more functions. Moreover, as the component density of chips radically increases, the chips themselves become smaller and thinner, enabling developments in humanoid robotics in the area of artificial intelligence.

¹³Karl F. MacDornan and Hiroshi Ishiguro, “Opening Pandora’s Box: Reply to Commentaries on ‘The Uncanny Advantage of Using Androids in Social and Cognitive Science Research’”, *Interactions Studies*, vol. 7, no. 3 (2006).

refers to the ability of human actors to intentionally relocate some of their agency into things beyond the body-boundary. Ishiguro believes that androids and gynoids offer an improvement over teleconferencing because they enable the physical presences of *particular* humans to interact, not just their video images and voices. He is among those engineers who rationalize that the creation of what he calls “soft-bodied systems” will facilitate human-machine communication and interaction, and will stimulate the development of new, marketable biocompatible materials, including artificial muscles, tendons, tissues, as well as biosensors.¹⁴

Japan is a cyber-Olduvai Gorge where the newest forms of human(oid)s, *Robo sapiens japonicus*, are emerging.

What distinguished Japanese robotics early on—and now almost all roboticists have followed suit—is the concept of embodied intelligence or embodied cognition. Roboticists point out that intelligence cannot exist in the form of an abstract algorithm, but requires a material body. The emphasis on embodiment recognizes that the body (whether human or robotic) is actively and continually in touch with its surroundings. Moreover, cognitive processes originate in an organism’s sensory-motor experience. Only dynamic interaction between a robot and its environment can generate emergent autonomous behavior; behavior initiated by some external control system cannot. Advances in artificial life, including nanotechnology and self-evolving genetic algorithms, have led to the development of new sensory, actuation and locomotion components for robots that, in turn, have enabled the actualization of artificial embodied cognition.

Central to the emphasis in robotics on embodied intelligence are qualitative studies in the field of child development.¹⁵ Data from studies of infants are also used dialectically,

and Japanese scientists have taken the lead in both. In June 2007, the Japanese Science and Technology Agency unveiled the Child Robot with Biomimetic Body, or CB2, that will teach researchers about sensory-motor development in human children. The androgynous CB2 moves like a human child between the ages of one and three, although it is disproportionately large and heavy at 1.2 meters tall and 33 kilograms. Its 56 actuators take the place of muscles, and it has 197 sensors for touch, small cameras working as eyes, and an audio sensor. CB2 can also speak through a set of artificial vocal chords. With this robot, researchers hope to “study human recognition development” such as language acquisition and communication skills. Roboticists involved with CB2 are keen on the eventual creation of a new intelligent “robo species.”

Clearly, the idea that humans and machines might meld into a new, superior species is most actively pursued in Japan. The bones of ancestors of *Homo sapiens* were discovered in Tanzania’s Olduvai Gorge; Japan is a cyber-Olduvai Gorge where the newest forms of human(oid)s, *Robo sapiens japonicus*, are emerging. As made clear in the visionary *Innovation 25*, Japanese scientists and engineers, with public acceptance if not active support, seek a posthuman society in which citizens—including robots, for

¹⁴See Hara Fumio and Rolf Pfeifer, eds., *Morpho-functional Machines: The New Species: Designing Embodied Intelligence* (Springer, 2003).

¹⁵For more recent studies linking robotics with child development studies, see Luc Berthouze and Christopher Prince, eds., “Special Issue: Developmental Robotics: Can Experiments with Machines Inform Theory in Infant Development?,” *Infant and Child Development* (January/February 2008). See also Jessica Lindblom and Tom Ziemke, “The social body in motion: cognitive development in infants and androids,” *Connection Science* (October 2006).

some have proposed granting humanoids citizenship—can play their roles within a planned environment characterized by security and convenience.

Roots of Robot-Friendly Culture

While demographic pressures, economic incentives and certain attitudes about the social role of women explain some of Japan's attitudes toward robots—and thus how robots have suffused Japanese popular culture—that isn't the whole story. Beneath all this are cultural factors that influence the dominant Japanese perception of robots as benign, benevolent *living* entities.

Foremost among these factors is Shinto, the native animistic beliefs about life and death. Unlike the three major Abrahamic monotheisms or Indian Brahmic religions, which have never enjoyed large followings in Japan, Shinto lacks complex metaphysical and theological expressions. Shinto is primarily concerned with notions of purity and pollution. Vital energies or forces, called *kami*, are present in all aspects of the world and universe; some *kami* are cosmic and others infuse trees, streams, rocks, insects, animals and humans, as well as human creations such as dolls, cars and robots. In contemporary Euro-American culture what is living is distinguished sharply from what is not. What is living has spirit or soul or, in more modern terms, self; what is not living does not. Such distinctions are not so clearly made in the Japanese way of thinking.

Closely related are Shinto understandings of life and living in which fertility and fecundity are especially celebrated. *Inochi* is the Japanese word for life, but the concept behind it is different from those behind the English word. It encompasses three basic, seemingly contradictory but inter-articulated meanings: a power that infuses sentient beings from generation to generation, a period between birth and death, and the most essential quality of something, whether a living being or a manmade object such as a puppet.¹⁶ This last definition is key for our purposes: Robots, humanoid and otherwise, are living things

within the Shinto universe and in that sense are part of a “natural” world.

Not surprisingly, therefore, public interest in automatons, or self-operating machines, has a long history in Japan. The *karakuri* (mechanical) tea-carrying doll of the early 17th century is often invoked as evidence of the historical interest of the Japanese in mechanical gadgets. Historians of robotics tend to emphasize that *karakuri* were not intrinsically related to the pursuit of scientific knowledge and systematic experimentation; rather, the dolls were entertaining gadgets created as a craft. Nevertheless, *karakuri* should be seen in a broader context as part of an early interface of human and autonomous machines in the realm of entertainment. Bunraku, the Japanese puppet theater, which dates to the late 17th century, can also be productively understood as constituting a cybernetic relationship between human and machine. Each of the principal dolls is operated by three manipulators who serve as “engines” and who, with their accompanists, work in perfect machine-like unison. The manipulators carry the dolls onto the stage and are visible throughout the play; their exquisitely coordinated performance is an equally important part of the play.

Today, as Japanese engineers of anthropomorphic robots study neuropsychology and child development in their quest to create companions and caretakers for humans, Japanese citizens cheer them on. While there are some malevolent robots in Japanese popular culture, Japanese roboticists claim legitimacy and inspiration in their pursuits from the great preponderance of friendly, cute and emotional humanoids such as the late Tezuka Osamu's Atomu (Astro Boy). Euro-American popular culture, by contrast, often lacks such warm feelings. Robots and other automatons have been represented as a competing new species or even a demonic force. They are regularly portrayed in popular culture as amoral or evil, from the oppressive machines of the

¹⁶Adapted from Masahiro Morioka, “The concept of *inochi*: A philosophical perspective on the study of life”, *Japan Review* (1991).



A Japanese girl shows off her new Tamagotchi in Tokyo in 2006.

Matrix trilogy or the *Terminator* series to the demonic puppet Chucky of the *Child's Play* movies.

In Japan, the presumption is that humanoid robots can work and play together with human partners in the same home and work environment, and can experience the same kinds of thinking and behavior patterns as a human being. Some visionaries believe that the more humans interact playfully and harmoniously with humanoids the more cyborgian they—and the robots—will become. They will learn about and become more like each other.

To all appearances, this process has already begun. A few years before Japanese companies began marketing humanoid robots other companies were busy supplying the Japanese public with human/machine interface toys that seemed to test the future market for humanoid robots. Serving as a kind of proving ground for an emergent cyborgian society was the Bandai Company's virtual pet, Tamagotchi. As many will recall, the Tamagotchi is a chicken egg-sized LCD video game that comes attached to a key chain, bracelet or necklace. The object of the game is to perform certain "parental" responsibilities

to keep it alive, such as feeding, playing with, medicating and grooming it. In 1996, when Tamagotchi debuted, 3 percent of all Japanese—more than three million females and males of all ages—owned one.¹⁷ Bandai still markets the "lovable egg" as a "living creature" whose lifespan depends on how well it is cared for. The average lifespan of a Tamagotchi is ten days—the oldest on record lived 26 days. Its portability allows for continuity; more specifically, it requires continuous empathy and altruism. Like a human child, it cannot be turned off, so the "parent" is expected

to remain more or less in constant contact, or to arrange for surrogate care.

I believe that Bandai purposefully created a mutually constitutive cybernetic pairing of human and machine for purposes of anticipatory "affective blackmail." The digital eggs certainly provide a spectacular example of how entertainment can be mobilized as a specialized form of "soft power"—the ability to get what you want, and to get others to want the outcomes that you want, through attraction rather than coercion or bribery. To wit, if a child will obey the digitally expressed needs of an electronic egg as millions have, then that child as an adult will be a good deal more likely to think nothing of taking instructions from humanoid robots in the home or office.

¹⁷As of 2009, there have been 44 Tamagotchi versions since their creation in 1996. The most recent are the *Tamagotchi Music Star*, in which the player raises a single Tamagotchi that eventually forms a band after making friends; and the *Tamagotchi Plus Color*, a Japan-exclusive virtual pet with a large full-color screen with enhanced graphics and gameplay.

Catwalk in Khaki

Well beyond the marketing of toys like the Tamagotchi, consumers provide Japanese roboticists with important data on human-robot interactions. For example, at Expo 2005 in Aichi Prefecture, roboticists closely observed tens of thousands of visitors participating in informal “robot-human interaction experiments”, gathering real world, real time data. Based on my interviews with staff and visitors, the same was true of the October 2008 Robo Japan Expo in Yokohama, which I attended. Robot engineers in Japan regularly use the sites of humanoid robot-based services and entertainment—from exhibitions halls to the home—as giant laboratories and proving grounds for robot research and development. Contrast this with the situation in the United States, where it is mainly the military, particularly the Defense Advanced Research Projects Agency (DARPA), that invests in robotic technology. The consumer public is not tapped (for better or worse) as a didactic resource.

That is not to say that the Japanese do not also seek military uses of robotic technology. Data from entertainment and household robot experiments and expos are clearly being used by Japan’s new Ministry of Defense (until 2007, the Defense Agency), whose annual White Papers for the past decade have included a section on robotics and robot warfare on earth and in outer space. But these reports are not exactly on the bestseller list. No wonder a cabinet-level official I interviewed in autumn 2008 was taken aback when I mentioned to him that the theme of the amateur robotics competition at the 2008 Robo Japan Expo was “robots that can fight in outer space.” He had been under the impression that military applications of robots was not (yet) public knowledge in Japan.

Note, too, that Japanese spin-offs of high technology move mainly from the civilian to the military sector, not the other way around as was so long the case in the United States. Front-line Japanese trading companies such as Mitsubishi Heavy Industries contain embedded defense companies. Because the postwar constitution still limits the purchase of foreign

military equipment to the United States alone, most of these large Japanese companies also manufacture arms strictly for use by the Japan Self-Defense Forces.

Moreover, despite a universally observed self-imposed ban on (but not law against) exporting weapons since 1976, end users have long adapted Japanese civilian technology exports for military purposes. As Gavan Gray points out, “Japanese chips and cameras have become components in missile guidance systems and armored vehicles, while military troops around the world can be seen riding Toyota, Suzuki and Mitsubishi vehicles.”¹⁸ Arms production, a lucrative business, can also serve as a cushion against recession. Already in the late 1980s, the Japanese defense industry earned profits 50 percent higher than the Japanese automobile industry, so it comes as no surprise to learn that Japan is “re-joining” the global arms industry, using its robotics technology as a wedge. According to a Japanese government minister, “The greatest significance [to the economy] would be the *conversion* of Japan’s robotics industry from civilian to military use as the world’s defense spending is directed to remote-control hardware, such as drone aircraft.”¹⁹

I became alerted to this conversion on the occasion of a visit last fall to Waseda University’s Wabot (short for Waseda robot) House, located in a remote part of Gifu Prefecture close to a military airbase. I was intrigued to find a newcomer robot on the premises. Waseda’s robot division is famous for its Wendy, Wamoeba and Twendy-One humanoids, but there in the special laboratory for human-robot coexistence was Wakamaru, the banana-colored humanoid unveiled in 2006 by Mitsubishi Heavy Industries. Initially advertised as a butler-babysitter for Japanese yuppies, the meter tall robot on wheels has been rented out to businesses as a receptionist since 2007. At Wabot House, however, Wakamaru was

¹⁸Gray, “Japan’s Weapons Industry: The potential consequences of Japan’s resumption of arms exports”, *Global Research* (2009).

¹⁹My italics; Leo Lewis, “Japan’s big guns prepare to rejoin global arms industry”, *The Times* (London), May 25, 2009.

taking part in GPS-based positioning exercises. Equally intriguing to me, the taxi driver who took me from the train station to the laboratory had mentioned that he had seen humanoid robots rolling about on the tarmac of the airbase. Wendy and Wakamaru, perhaps, with their GPS devices switched on? When I mentioned this to the Wabot House staff they appeared uncomfortable. Unlike their American counterparts, public universities in Japan and their professors are not allowed to negotiate defense contracts. Waseda is a private university but, even so, the specter of the academy colluding with the military might elicit significant dismay on and off campus, and a concomitant loss of social capital.

Or, these days, it might not. I doubt that an HRP-4C or a geminoid on the catwalk modeling the latest fashions in khaki and camouflage would provoke a negative reaction. Japan's nuclear and military allergies are receding with the passage of time. Sabine Frühstück, a professor of Japanese cultural studies at the University of California, Santa Barbara, has written insightfully on the Japanese military's savvy exploitation of popular media in attempting to win the hearts and minds of a Japanese public still beholden to the post-war "peace" constitution.²⁰ War games are the substance of Japanese video games and

animé, so in real life humanoids—even those in uniform—will likely remain friendly and familiar faces.

To help ensure this likelihood, Waseda University roboticists collectively published seven volumes of *The Book of Wabot* ("Wabot to no hon") between 2002 and 2007. The series constitutes a cartoon "bible" that promotes the desirability of living symbiotically with sapient humanoid robots, epitomized by the cute mascot, Wabot. No military uniforms are present in *The Book of Wabot*. But if humans and robots are equally subject to cyborgization, then analogously, or perhaps allegorically, Japanese civilian and military needs can be equally served by the robotics industry. We will watch and see where the money goes. The year 2025 is only 15 years away, and the ultimate shape of *Innovation 25* has yet to be determined. It could well include a far larger robo-military dimension than we suppose. 🌐

²⁰See Sabine Frühstück, "'To Protect Japan's Peace We Need Guns and Rockets': The Military Uses of Popular Culture in Current-day Japan", *The Asia-Pacific Journal* (August 2009); and *Uneasy Warriors: Gender, Memory, and Popular Culture in the Japanese Army* (University of California Press, 2007).

Japan's insular mentality is . . . the ultimate source of most of its difficulties with other countries. . . . [W]e need urgently to comprehend that Japan does not plan to become more open or cosmopolitan in the way Americans and others suppose when they hear Japanese spokesmen say that their country is determined to "internationalize". . . . Japan's promised "internationalization", known as *kokusaika*, is indeed more a device for continued anxious self-protection than for a fresh outward engagement with the rest of the world. . . . Fearing contamination of their own social structures by live foreign participation, the Japanese continue to promote "internationalization"—as they did *kaikoku* or "opening the country" in the Meiji era—as a matter of things as opposed to people, a prodigious effort to admit foreign civilization at the material, institutional, and intellectual levels, but never foreign people.

—Ivan P. Hall, *Cartels of the Mind* (1998), pp. 173-4