THE FRIENDLY FACE OF ROBOTICS IN JAPANESE CULTURE

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Robotics both not only reflects but also influences Japanese culture. Interwoven in the fabric of the society, robots and automatons appear in a wide range of roles and are often cast in a positive, neutral, or ambivalent light. From Sony's Aibo robotic dog and Astro Boy to robotic workers and automated assembly lines, robotics have been seen as embraceable and accessible. This is sometimes in stark contrast to negative portrayal of the West portrayal of violent robots, androids, and automatons. Union workers feared in the 1960s they’d be replaced by robots and in the 1979 science fiction/horror film Alien, Ash the android took over a starship to protect corporate interests and not the human crew. The Japanese view robots as friends and distinct beings, while the western idea of robots sometimes implies soulless machines that would dispassionately wipe out human, given the chance. While both views have more optimistic and cynical scenarios, the Japanese appear are far more amenable to robots. The West tends to build faceless machines inspired by insects and other arthropods, in contrast to the Japanese, who build humanoid- and animal-based robots to act as partners. Possible reasons for this difference are a long history of real-world applications for robots, the frequent use of robots as heroic protagonists in Japanese popular culture, the view of robots as a source of entertainment and companionship, and differences between Eastern and Western spiritual philosophies.

The Japanese have a long history of working with robots, starting with their original forays into clock-making after mechanical clocks and firearms were introduced from the West by Jesuit missionaries during the 16th and 17th centuries, according to Timothy Hornyak's Loving the Machine. However, in 1639, the Tokugawa shogunate cut off contact with the West with the exception of the trade port of Nagasaki. This resulted in the domestic clockmaking industry producing elaborate clocks designed to deal with the traditional Japanese timekeeping methods, and while this technology was only available to the rich, it did lay the groundwork for the development of the first karakuri automata. (Hornyak, 21) Karakuri means “trick,” “mechanism,” or “gadget” in Japanese, according to Hornyak. (17) These devices ranged from larger automata and bunraku-style puppets “butai karakuri” on ceremonial floats to smaller room dolls “zashiki karakuri”, such as the famous tea-serving
The designers of these karakuri, such as Yorinao Hosokawa, a Kyoto-dwelling inventor from the late 17th Century, and the 19th-Century Hisashige Tanaka, the “Gadget Wizard” who would go on to found a technology firm that would later develop into the giant electronics corporation named Toshiba. Compared to European designs such as the contemporary Jaquet-Droz automata, they were more of an attempt to produce art for its own sake instead of an attempt to replicate human behaviors. These small tea-serving “social robots” laid the groundwork for the Japanese cultural perception of robots over the next couple centuries, according to Hornyak.

“They shaped the way Japanese view robots,” says Toyota National College of Technology Dean Yoshikazu Suematsu, a mechanical engineer and karakuri enthusiast whose collection includes a chahakobi doll made by Tamaya. “To put it simply the difference between Mighty Atom and the Terminator shows the differences between how Japanese and Westerners view robots. Westerners tend to have this sense of alarm or wariness. Japanese are unique in the world for their strong love and affinity for robots.” (Hornyak, 25.)

The term jinzo ningen, or “artificial man” reached Japan in 1924, along with the famous 1921 Czech play about a robot uprising, “Rossum's Universal Robots.” Jinzo ningen was soon replaced by the loanword "robotto." Among the first modern Japanese robots was the Buddha-like Gakutensoku built by Makoto Nishimura for a fair in Kyoto in 1928, and reinforced the Japanese concept of building
elaborate machines for fun instead of mechanized labor. (Hornyak, 35-37.) During the 1930's, there was a boom in the number of stories and manga featuring robot protagonists, but this came to a swift end with the start of World War II. (Hornyak, 38-39)

Another factor in the positive portrayal of robots was the often techno-euphoric nature of popular culture during the post World War II era, which was buttressed by various manga and anime series during the following decade and has had a lasting effect on their view of robots up until the present day (Krebs, 67.)

Satoshi Amagai, president of Sony subsidiary Entertainment Robot Co. explains the great success of his products, the dog robot, Aibo and the humanoid robot, Qrio, also with a reference to pop culture; “We are lucky in Japan that we have always had—through manga and animation—a positive image about robots.” (Krebs, 65.)

More than anything else, this has contributed to the long-running acceptance of robots by the Japanese, and the most famous depiction of a heroic robot involves a little pointy-haired robot boy named Atom.

As Japan rebuilt itself into a major economic power after the war, a medical student by the name of Osamu Tezuka created a manga series that ran from 1951 to 1968 about a doe-eyed, 100,000-horsepower robot boy by the name of Mighty Atom, known to Americans as Astro Boy. (Krebs, 66) This story was originally set in the far-off future of 2003, and was moved forward into the 2030's by the 1980's anime adaptation. Tezuka, while holding strong anti-war views, was a strong advocate of
science and modernization who wondered if humans could be redeemed by their own technology. While he portrayed technology as a value-neutral tool, he pointed out that a lack of planning or misuse of technology could result in disaster (Hornyak, 47-49.) Stefan Krebs, in the article “Tetsuwan Atomu and the Difficult Cohabitation of Humans and Robots,” wrote, “The author's explicit goal is to build a bridge between the two cultures—human and machine” (66.)

According to Tezuka In English, a fan website that hosts analyses and plot summaries of Tezuka's various manga and anime series, Atom was built by Dr. Tenma, the head of the Japanese Ministry of Science, to replace his son, Tobio, who died in an automobile accident. Tenma all but sacrificed his position to build Astro. However, when the doctor's replacement son fails to age and develop like a human child, he disowns Astro and sells the boy to a robot circus before losing his job due to abusing the power of his position at the Ministry. However, Astro is rescued from slavery and rebuilt by Dr. Ochanomizu, the new head of the Ministry of Science and a strong proponent of robot civil rights. Ochanomizu later built a sister for Astro, the tomboyish Uran, and robotic parents. In Astro Boy, many of the ethical conflicts were things humans had to deal with, and are still relevant in the real world and the present day, even being mentioned with regards to NASA's autonomous robot program. (Krebs, 67.) In the words of Tachibana Takashi, “Thanks to Astro Boy, Japan has become one of the most robot-friendly nations in the world.” (Krebs, 65.) Astro Boy and his co-stars are cited
as an inspiration for humanoid robotics programs, and even advertise production robots, such as the Mitsubishi Heavy Industries Wakamaru household robot (Hornyak, 97.)

Another famous series that started in the late 1960's and ran until the mid 1990's was Doraemon, a manga series involving the adventures of the titular time-traveling robot cat and a flawed, unlucky schoolboy, Nobita Nobi. While it possessed a positive view of technology, it was critical of the overuse of superfluous technology to solve problems. Its robotic protagonist is an element of kawaii culture, something cute, endearing, or desirable. (Krebs, 65.)

Warrior robot series, featuring either the fantastic “super robots” or the more utilitarian, yet noble “real robots” are also generally a positive portrayal of robots, although many real robot series are of a darker nature that fits their war story genre. Instead of being autonomous machines, these robots, also known as mecha, are usually piloted by a human. The term “super robot” was first coined by the 1970's series Mazinger Z, created by Go Nagai, although its history stretches back to the remote-controlled Tetsujin 28-go, or “Iron Man #28” of the 1960's (Hornyak, 58-60.) Super Robots are usually unique, towering machines crewed by young or adolescent pilots, and tend to use melee weapons and more fantastic energy weapons in battle against their equally mammoth foes, be they other super robots or various daikaiju, or “giant strange beasts.” This had several effects and contained some unusual elements relating to how Japan felt about itself in the decades after World War II.

Nagai's most important contribution to the genre was the idea of the robot as a dynamic entity that could join with other machines and exist in symbiosis with a human: by working together as pilot and vehicle they were an unstoppable force. Battling evil invaders every week may have also had a deeper social resonance. “Practically all of the mecha anime pilots were SF metaphors for re-fighting World War II to defend Japan (and Japanese cultural traditions) against western social influences,” writes anime critic Fred Patten. (Hornyak, 60.)
On the other hand, “Real Robots” originated in the early 1980's with the Mobile Suit Gundam franchise, created by Yoshiyuki Tomino, and the Super Dimension Fortress Macross series, and emphasize smaller, more realistic mass-produced hardware, military pilots, and the use of ranged weapons. In some circumstances, tanks are more than a match for mecha in real robot some series. According to Hornyak, the robots of Real Robot series are just tools or weapons.

Instead of making the robots heroes, the series focuses on its human characters and their heroic roles in the space war. But can they become heroes only by encasing themselves in a massive machine, sealed off from the environment? “Think of it like a Formula One driver,” Tomino says. “It's a symbol of the relationship between human and the tool. The characters themselves are just common people. But influenced by a machine, there is something heroic about them.” (Hornyak, 64.)

Similar series, such as Patlabor, also deal with the isolation of mecha crew members from their outside world, looking through the limited view of thermal scopes and heads-up displays. At the same time, however, they continue the concept of the noble Japanese samurai, in design and occasionally in the form of armament, especially in the Gundam franchise.
Regardless of type, both types of fighting robot were a marketing success, spawning a profitable empire of action figures, books, and model kits in addition to the original manga and anime. A life-sized version of the iconic Gundam RX-78 mobile suit was built as a temporary art installation in Odaiba, Tokyo. Many a video game is based on the real robot concepts, such as the Armored Core series (Hornyak, 68.) Tomino is actually somewhat unhappy about the rampant commercialization of his works, but he is happy about the artistic impact his series has had in Japan. This holds true for many series about robots, from Astro Boy to Neon Genesis Evangelion, and fits one of the definitions of popular culture—that it can be purchased.

However, there are more cynical portrayals of robots in Japanese popular culture, such as those in the mid-90's Neon Genesis Evangelion, which is considered a biting criticism of both super and real robot series. Created by Hideaki Anno and Studio Gainax, it is heavily influenced by a Japan falling from the economic highs of the 1980s and reeling from the 1995 Aum Shinrkyo nerve gas attack. The heroes are psychologically troubled youths whose post-apocalyptic world is slowly going to pieces. In the words of Anno himself,

I belonged to the generation that grew up hearing that science is wonderful, science is great, science rules the world. We also heard that due to the benefits of science we'd definitely have a bright future. But then pollution became a social problem. We also had the oil shock, and then people started saying totally different things, like the future didn't look so good. We wondered whether our future with science would be good or bad (Hornyak, 70.)

Hallmarks of this mature series include obsessive references to Christian mysticism, its unique take on
half-biological giant robots, and dealing with a protagonist who, much like postwar Japan, has severe trouble with creating its own future. Depending on which version of the series you're watching, however, the hero, Shinji Ikari, does manage to produce the world he wanted. This is about as close as Japan comes to portraying robots negatively, although even here, they are no more than tools, and so are their pilots.

In reality, robots are also generally portrayed in positive roles, such as tireless manufacturing workers, emergency services, entertainers, and elder care assistants. As of 2004, Japan was the largest user of industrial robots, with 356,483 units, according to the International Federation of robotics, with Germany a distant second at 120,544 units in service. (Krebs, 64.) Not surprisingly, Tachibana Takashi, a Japanese science journalist, refers to Japan as the robot kingdom, or “robotto okoku.” In addition to the long history of robots and other automations in Japanese popular culture, other factors influence the Japanese acceptance of robots. In Krebs' article, “Japan, Land of Robots,” he writes:

Mostly economic factors, religious and socio-cultural dispositions are cites as reasons for the high social acceptance of robots: the system of lifelong employment, the cooperation of unions, the high educational level, and the special situations on the labor market in times of full employment are listed as reasons for the successful and extensive introduction of industrial robots in the 1980's. Employees in the firms in question need not fear for their positions, and could often take on more highly qualified tasks. Therefore, the robots were not seen as competitors.” (Krebs, 64.)

Even the manufacturing robots, which are thought of as rather staid automatons in the west, often have cheery blue and white exterior colors and had endearing mockup heads attached for their appearance at a robotics exhibition. Workers view them as a positive development instead of a machine that will take away their job. Most western utility robots, such as the Roomba, have all the personality of a whistling horseshoe crab.

Robots are also expected to save lives in emergency services applications, such as the Tmsuk T-52/-53 Enryu “Rescue Dragon” units intended to clear earthquake debris and rescue trapped people (Tmsuk.) According to Lucille Craft, author of “Help! I Need Some 'bot-y,”

Earthquake evacuations will never be the same. Meet T-53 Enryu®, a fearsome, 11-foot-
tall robot with giant, multi-jointed arms and the growl of a tractor. Designed to rescue trapped victims, this ambidextrous creature can move into a devastated zone and pick up and toss aside heavy wooden blocks and other large debris like so many chopsticks.

While more akin to the power loader piloted by Ripley in the movie Aliens than humanoid robot rescuers, the Enryu-series robots are the beginnings of the robot rescue squad that made many an appearance in Astro Boy. In the somewhat clumsy words of Tmsuk itself, on its “History of Robotic Development” web page,

The new rescue robot T53 Enryu was produced for rescue work at disastrous places where rescue workers cannot go into. T53 is the 3rd generation Tmsuk rescue robot. It is a successor technology of T52 Enryu in 2004. Tmsuk has worked closely with national fire department to develop T53, which thus has been embedded with much desired functions. T53 is made more compact than the previous rescue machines. It has maximized maneuverability for emergency operations. Furthermore, the synchronous robot arm systems have sophisticated motion control capabilities of operators.

Lucille Craft’s statements on the T-52 also show the difference between Western and Eastern views on robots. While Tmsuk’s company page talks about it as a strong mechanical hero that assisted with rescue operations during the Kashiwazaki City earthquake of 2007, Craft speaks of it in a monstrous, describing it as a “fearsome” robot with “giant arms” that “growls.” Tmsuk also makes other robots, such as the net-launching T-34 security guard robot that can safely immobilize burglars and call the police, the cute T2-5 Rukuru shop promotion robot with its bright casing and internal video projector, the Tmsuk-4 telepresence robot which can be used for shopping, and the “T/” robot lifesaving chair,
which can monitor vital functions and provide medical help in remote areas until emergency personnel arrive.

Another big role for real-world robots in Japan is entertainment, which started with karakuri and Gakutensoku. The concept of a social machine built solely to make people happy has continued well into the present day, with a large number of corporations using robot development programs for PR. Honda's Asimo and Sony's Qrio act as ambassadors as their parent companies, but have also provided useful research into how to produce more capable bipedal walking robots that can move using a faster, more flexible dynamic gait like humans instead of a wind-up toy's static gait. (Hornyak, 105-108) In the case of Asimo,

Asimo is the most famous robot in Japan, and the world's most advanced bipedal robot. At a mere four-feet, three-inches tall, it looks like a child from another world arrived on earth via the depths of space, Antonie de Saint-Exupéry's Little Prince in a pressure suit. It is also very white and very antiseptic looking in the way with think the future ought to be.

However, it is not just an impersonal machine, and in the tradition of its ancestors such as Gakutensoku, it too is a social robot, wowing audiences by relating to them,

Asimo introduces itself in an androgynous voice both buoyant and youthful, in contrast to the dark, somewhat sinister visor fronting its faceless head. But what is most remarkable is how fluidly this three-quarter-size person moves. It glides with graceful ease through turns and half-steps, skirting obstacles while swiveling hips, arms and shoulders in perfect sync with its gait. Asimo, short for Advanced step in innovative Mobility—no official relation to Asimov—boasts agility and coordination unprecedented in walking machines. (Hornyak, 104)

Asimo was inducted into the Carnegie Mellon University's Robot Hall of Fame in 2004. According to
Carnegie Mellon, “Asimo is a four-foot mechanical masterpiece, with a remarkable sense of balance, agility and grace. It surpasses all other robots in its simulation of human movement.” (Hornyak, 104)

And was, like many other humanoid robots created by the Japanese, inspired by Astro Boy. In fact, the secret directive for Honda's program was, in the words of roboticist Masato Hiroise, was to “build Mighty Atom” (Hornyak, 104.)

In the case of QRIO, a gnome-sized, more childlike robot from Sony is the showman compared to the more staid Honda Asimo. Qrio's name was short for Quest for Curiosity, and was a reflection of Sony's consumer electronics experience. According to Hornyak, “Qrio's most powerful asset was its devastating charm, a charisma that banished disbelief utterly.” It was the consummate social robot, conducting orchestras, dancing in formation, and interacting with visitors using its 60,000-word vocabulary. It also possessed a capable 3D visual navigation system and locomotion abilities similar to Asimo, and was capable of running, balancing on one leg, and performing a tai chi routine. Even its limitations helped it surmount the human-robot emotional barrier.

And if an experiment by the Sony intelligence Dynamics Laboratories was any indication, another of Qrio's weaknesses—a basic need to follow human cycles of activity and rest to charge its batteries---may have been a hidden source of endearment. When it was enrolled in a University of California, San Diego nursery school along as part of a study of human-machine interactions, its classmates' interest in its dancing dwindled after about a dozen performances. Yet each time Qrio would lie down on the floor for a regular system shutdown, the children would crowd around to cover the robot with a blanket and wish it goodnight (Hornyak, 113.)

Sadly, Sony axed its entertainment robot division on January 26, 2006 for economic according to MacWorld, killing off the AIBO and ORIO programs (Williams.)

RoboCup is a research-oriented robot applications competition held in various locations
worldwide, dealing with various areas such as soccer, rescue, and the seemingly mundane, yet surprisingly complex field of household chores and social interaction. The RoboCup program started in 1997 in Nagoya, and was founded by Minoru Asada of Osaka University and Hiroaki Kitano, head of the Sony Computer Science Laboratory. In the words of Asada: “Just as there are many researchers who longed to become robot experts because of Mighty Atom, there will be many kids who want to make robots after seeing Vision's performance” (Hornyak, 118.) According to the RoboCup website, RoboCup Soccer is their main program, with leagues of robots at multiple scales, ranging from a mostly virtual reality environment with thumb-sized robots up to half-meter boxlike robots, assorted humanoid designs, and the humanoid Standard Platform League Nao robots. The latter robots, while not as sophisticated in some ways as Asimo and Qrio, can stand up on their own after taking a tumble or being knocked over, according to their manufacturer's demonstration videos.

Their second competition, RoboCup Rescue, is a competition between various robots to safely navigate a hostile disaster area and complete various search and rescue missions. In the words of RoboCup, robots explore a specially constructed disaster site, including mannequins with various signs of life, such as waving hands, shouting noises and heat, hidden amongst stairs, platforms and building rubble. The robots, some under human control, must find and approach the victims, identify their signs of life and produce a map of the site showing where the victims are located. The aim is to provide human rescuers with enough information to safely perform a rescue. Each team is scored based on the quality of its maps, the accuracy of the victim information and the number of victims found.

This competition, much like RoboCup Soccer, has both real and virtual-reality leagues. Much like the T-52 Enryu, these robots are designed to aid emergency personnel and act as rescuers themselves.
Last, but not least is the RoboCup @Home competition started in 2007, which deals with household chores, social interaction, and functioning in a kitchen and living room environment. Although RoboCup is more of a research competition than a major spectator sport, it is very popular with the Japanese.

Given its aging population and declining birth rate, coupled with a long average life expectancy, Japan will soon have a large number of senior citizens to take care of and not many young people to take care of them. The service industry also needs new workers. According to Lucille Craft,

Now, the nation that has long dominated industrial robotics is grappling with ways robots can tackle society’s other challenges... Yet a more complicated problem looms, that of how Japan’s shrinking workforce will care for a growing elderly population. Officials once were confident that robots would provide a panacea for a worker shortage, boasting, “We don’t need immigrants.” But the need for nursing care has outpaced such projections, forcing Japan to set aside its wariness of foreigners and admit 1,000 Indonesian nurses in 2008.

Paro, a robot that resembles a white, fluffy harp seal pup, is a therapy robot for the elderly. According to Paro Robots USA, the stateside distributor for the Japan National Institute of Advanced Industrial Science and Technology's experimental program that produces the handmade robots for approximately $3,500-$6,000 US, Paro can reduce patient stress, improve social interactions between patients, and both relaxes and motivates old people when therapy animals are unavailable or impractical. In various videos, normally passive old people open up to the very cute robot. In the words of Hornyak,

Paro looks like a stuffed animal, down to its snow-white antibacterial pelt. It can't do much except wriggle, moving its head, tail and flippers, and whine in disarming fashion, but it does respond to its environment. Pick up Paro for a hug and its big black eyes close as if it's sleeping. Stroke it and it will try to repeat whatever action triggered the stroke. Ignore it and Paro gets upset. It can also be given a new name and respond to it as well as simple expressions of greeting or praise (Hornyak, 90-92.)
The robot was based off of a seal pup, as people would be less likely to notice differences between it and the real animal than they would if it was modeled after a dog or a cat.

Buddhist and Shinto philosophies dealing with inanimate objects are more open than those found in much of Western philosophy. The Japanese have a tradition of granting spiritual properties to inanimate objects. Shinto itself is the colorful animist religion native to Japan. Shintoism views the world as unified, instead of a world where mind and matter are separate. Among the most famous proponents of applying this view to robots is Masahiro Mori, a famous roboticist who wrote a 1974 book entitled The Buddha in the Robot: A Robot Engineer's Thoughts on Science and Religion. “All things have Buddha nature,” says Mori (Hornyak, 88.) More secular philosophers attribute this phenomenon to traditional Japanese beliefs that say that all objects can have life, such as the mythological tsukumogami. These special objects are 100-year-old items that have attained life, such as old lanterns, tea kettles, and sandals. If abused, they become malicious spirits. In fact, the Shingon sect of Buddhism permits inanimate objects to attain enlightenment (Hornyak, 89-90.)

The Japanese were also notable for assigning a name for the issues that affect how we related increasingly human robots, and effect called the “uncanny valley,” another of Masahiro Mori's concepts. In his own words “as robots appear more human-like, our sense of their familiarity increases until we come to a valley.” (Hornyak, 141.)
If a robot looks too human, its small flaws become noticeable and disturbing. This can even apply in the case of non-humanoid robots, such as the US-made BigDog mechanical mule, with its jerky movements, rattling engine, and lack of a head or face. While the Japanese have made great strides in producing human-like robots such as the Geminoid and Actroid designs, they prefer stylized humanoids and familiar animals, and only tend to produce realistic versions of animals people are less familiar with in order to avoid this problem.

The Japanese tendency to anthropomorphize objects is one of the main reasons for why they possess a positive view of robots compared to the West. They also create popular robotic heroes to express their hopes for what technology can do while the West expresses its fears of a dehumanizing menace. All aspects of popular culture are interconnected, as Astro Boy influenced the development of many real robots, and real-world philosophical issues arising from the applications of robots are dealt with in manga and anime. Robotics are interwoven with the cultures of both the United States and Japan, but even small differences in culture and attitude can result in the changes that lead to anti-robot militias in one nation and ceremonies for the birth of a robotic hero in another.
Works Cited:


