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Stefan Krebs:

On the Anticipation of Ethical Conflicts between Humans and Robots in Japanese Mangas

Abstract:

The following contribution examines the influence of mangas and animes on the social perception and cultural understanding of robots in Japan. Part of it is the narrow interaction between pop culture and Japanese robotics: Some examples shall serve to illustrate spill-over effects between popular robot stories and the recent development of robot technologies in Japan. The example of the famous Astro boy comics will be used to help investigate the ethical conflicts between humans and robots thematised in Japanese mangas. With a view to ethical problems the stories shall be subsumed under different categorical aspects.

Agenda

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Japan: Land of Robots

According to the International Federation of Robotics (2005), 356.483 industrial robots were in use in Japan in the year 2004. Due to different categorisations, the Japanese figures are not directly comparable to the European and US-American statistics. And yet the distance to the second greatest robot user, Germany, speaks for itself: In the Federal Republic the year 2004 saw only 120,544 industrial robots, approximately a third of the Japanese number.

In the development of humanoid robots as well, Japan has played a leading role for years. The research activity in this field at the university go back to the 1970's. The elite university of Tokyo, Waseda, started the Wabot-Project under the leadership of Ichiro Kato already in 1973. The research platform, Wabot-2, won fame through a concert with the Tokyo NHK Symphony Orchestra, in which the robot played the organ.

In 1985 the car manufacturer, Honda, began the development of humanoid robots and presented its first development to the public ten years ago: P1, a 182 cm tall and 210 kg, seemingly monstrous robot. Four developmental stages later, P4, alias Asimo, had shrunk to 120 cm and weighed only 43 kg. Asimo emphasises Japan's leading role in the development of humanoid robots through its ubiquity in the media, and has become a national icon. In August 2003, the robot accompanied the Japanese premier, Junichiro Koizumi, on a diplomatic visit to the Czech Republic.

Asimo represents a prime example in the development of so-called personal- or partner robots. These, mostly humanoid robots are to perform a series of everyday services, and are to be utilised especially in the care of the elderly and of children in the near future. The Japanese Robot Association (2001) hopes that the sale of partner robots may become a strongly growing market. Numerous prototypes were presented to the visitors of the world exhibition 2005 in Aichi, among them, robots of large industrial corporations, such as Honda, Toyota, Sony or NEC.

With astonishment and alienation, Western media reported that the Japanese did not feel the aversion to the "mechanical monsters" common in the West (Faiola 2005; Wagner 2005). Yet even in the Japanese self-perception such write-ups can be found. For example, Tachibana Takashi, one of the best known Japanese science journalists, speaks of Japan as the robot kingdom – robotto okoku (Iwao 2003). The enthusiasm of the general public for robot exhibitions confirms this. The Japanese Robodex 2003 – an exhibition of entertainment- and service robots – boasted alone 70,000 visitors.

Mostly economic factors, religious and socio-cultural dispositions are cited 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 labour 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 needed not fear for their positions, and could often take on more highly qualified tasks. Therefore, the robots were not seen as competitors (Schodt 1988: 118-153). Even the Shinto idea of all-animation, which can also extend itself to inanimate objects, as well as a historically conditioned positive fundamental attitude toward technology contribute to the acceptance of robots (Schodt 1988: 198-200).

The long history of robots in Japanese pop culture, though, is also cited again and again. In 1951 Tetsuwan Atomu was born, a comic figure created by Osamu Tezuka. His story is set in the year 2003, and Tetsuwan Atomu – known outside of Japan as Astro Boy or Mighty Atom – is a robot who resembles a young boy on the outside, and who possesses superhuman powers, thanks to the most modern technology.

Tetsuwan Atomu appeared 18 years in Shonen Magazine, a comic magazine whose target audience is boys between the ages of 10 and 15. In 1963 Astro Boy was broadcast on Japanese television as the first cartoon series with 193 episodes in all. And in 2003, on Astro Boy's supposed birthday (his birthday was said to be April 7, 2003) new episodes were produced for Japanese television; and the Japan Mint announced special coin sets to commemorate his birth.

Comics (mangas) and cartoon films (anime) are uncommonly more popular in Japan than in Europe and the USA. In 2002 mangas constituted 38,1% of all Japanese printed matter (JETRO 2005). Manga

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magazines and books are not only for children and adolescents, but also for adult readers. Their genres are as numerous as they are different, and among them is an entire universe of robot-mangas. Aside from characters located in the Japanese culture of cuteness – kawaii – like the cat robot, Doraemon, there have been numerous giant robot stories since the 1970's. These are usually not about autonomous robots, but rather remote controlled machines. A 1981 survey shows that 73 percent of all works at that time fell into this category (Schodt 1988: 82).

In Japanese self-perception, the part played by these pop-cultural role models in the general acceptance of robots is considerable. Tachibana Takashi writes: "Thanks to Astro Boy, Japan has become one of the most robot-friendly nations in the world, and Japanese workers raised few objections to the introduction of industrial robots into the workplace." (Iwao 2003) 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." (Rees 2001)

Pop Culture and Robot Technology in Japan

Three examples shall serve to illustrate the spill-over effects between popular robot stories and the development of robot technologies in Japan.

The humanoid robot, HRP-2, which was developed by the National Institute of Advanced Industrial Science and Technology together with Kawada Industries, received its outer form from Yutaka Izubuchi. Izubuchi is a manga artist, and is famous for his work for the cartoon series, Patlabor. Labors, in this series are giant humanoid robots that function i.a. as police vehicles, and are controlled by human pilots. The HRP project team gave the necessity that the appearance of the robot should make a friendly impression on people as the reason for their cooperation with Izubuchi (Kaneko 2004). This seems strange in light of the fact that HRP-2 rather resembles a military war robot. This is only explicable through the great popularity of mangas and animes, i.e. the positive image of robots to be seen in them: they help the main human characters and usually fight not against people, but against other machines. At the same time, the form of HRP-2, with horn-like protrusions on its helmet ties in to deeper lying cultural stratum from samurai tradition.

Soya Takagi, chief engineer at Toyota and his team took their cue from the anime idol, Gundam, in the development of the robot, I-foot (Wagner 2005). The Gundam robots are not autonomous robots, but rather fighting machines, controlled by human pilots, like the Labors. Toyota did not copy the military appearance of the anime models, though, but only the conceptional idea of the Gundam series. Thus, the pilot of I-foot sits in the robot's "chest". In the comics, Gundam are the further development of so-called robot suits. These can be worn as mobile technology, like an exoskeleton, and are intended to increase the bodily powers of those who wear them. In real 'life such a robot suit, HAL-3, was developed at the Tsukuba University of Tokyo, and displayed along with I-foot at the Expo 2005 (Leis 2006: 40-43).

The Atom Projekt would go yet a step further. Inspired by the anime series, Tesuwan Atomu, a robot is to be developed under massive public financing over the next three decades that has the mental, physical and emotional capabilities of a five-year-old child. Astro Boy serves as the direct template for the formulation of research goals. Mitsua Kawato, director of the computational neuroscience laboratories of the Kyoto-based Advanced Telecommunications Research Institute, supports the initiation of the Atom Project. He compares the ambitious goals of the program with those of the American space travel program, Apollo. The Atom Project as a technological vision is intended to free scientists from the pressure of applicational demands on research, and its short-term requirements. Thus, the question is not posed, why a robot with the capabilities of a small child ought even to be developed (The Japan Times 2003).

Even for the self-location and motivation of Japanese engineers and scientists, the robots from the manga- and anime series seem to play an important role. Ryoza Kato of Toa University explained his enthusiasm for the development of humanoid robots in the Journal of the Robotics Society of Japan thus: "We are the Mighty Atom Generation, and we were brought up looking at Atom in comics and animation, so it just seemed like it would be a great deal of fun to create something that can walk." (Schodt 1988: 83) Minoru Asada, a leading roboticist at Osaka University, adds: "Atom affected many, many people. I read the cartoons an watched the TV program. I became curious to know what human beings are. I still am … and that's why I build ro-

bots." (Hornyak 2006: 54) And Shuji Hashimoto, professor of robotics at Waseda University, explains: "The machine is a friend of humans in Japan. A robot is a friend, basically. So it is easy to use machines in this country." (Jacob 2006)

Tetsuwan Atomu and the Difficult Cohabitation of Humans and Robots

Starting from the influence of robot comics on both the perception and the development of robots in Japan, the Tetsuwan Atomu will now be used to help investigate the ethical conflicts between humans and robots thematised in Japanese mangas. Osamu Tezuka's stories are a convenient example, as the comic takes at its theme from people's prejudices and ressentiments vis-à-vis robots. Astro Boy, on the other hand, pleads for equal rights for robots and humans and their co-existence in partnership. The author's explicit goal is to build a bridge between the two cultures – human and machine (Matthews 2004).

Two anomalies of the Astro Boy mangas are especially noteworthy: On the one hand, Astro Boy lives in a completely normal human environment; his parents are also robots, but he goes to school with other kids. This everydayness facilitates young readers' access to the stories especially. On the other, Astro Boy's powers are drawn not from some magic sources, in contrast to those of most American superheroes, but from the science and technology of the 21st century. This is especially emphasised repeatedly through supposedly scientific and technological explanations and the design of Astro Boy's electro-mechanical inner life. The sequel to this story, The Atom Chronicles, which was conceived especially for adult readers, and appeared from September 1968 to February 1969 in the daily newspaper, Sankei Shimbun, takes up this apparently real side of the robot (Patten 2004: 332).

With a view to ethical problems the stories can be subsumed under three aspects: firstly, conflict situations that show the robot as an agent acting autonomously; secondly, those that concern the human developers and users of robots; and thirdly, those that have the fundamental cohabitation of humans and robots as their subject.

Just as the American science fiction author, Isaac Asimov in his famous robot tales, Tezuka formulated robot laws, that are intended to guarantee the conflict-free cohabitation of humans and robots. In contrast to Asimov's three laws, there are ten such laws in Tetsuwan Atomu: i.a. that a robot must not injure or harm a human; but also that a robot must not leave the country without permission, or that a robot shall not change the gender allotted to it (Schodt 1988: 77).

Like Asimov, Tezuka constructs moral dilemmata in which Astro Boy or other robots find themselves confronted with the choice of following the robot laws or breaking them in the name of a higher moral good. E.g. Astro Boy must leave the country in secret in the story "Die Geistermaschine" (2000a) in order to save his mentor, Dr. Ochanomizu, from a criminal. The limits of an all too rigid, rule-based robot ethic, come to light in the different stories. Thus, neither the different everyday situations, nor the exceptional cases can be portrayed in a simple program code.

Inasmuch as Astro Boy must override the norms placed upon him, Tezuka reveals the actual focal conflict in the development of autonomous robots: autonomy is finally only attainable at the price of overcoming rigid rules and a central control.

The user- and developer-related conflicts have to do mostly with the abuse of robots – for example, for criminal or military purposes. Once again, problems with robot autonomy come to light: such as when robots refuse to perform the immoral orders given them by humans, as in the story, "The Greatest Robot on Earth" (2002b). Aside from this, Tezuka is also concerned with the question of what ethical responsibility scientists and engineers bear: are they allowed to construct robots for military or criminal purposes? In the sense of an engineering ethics, there is a concern with the anticipation of possible abuse. In the story, "Die Geistermaschine", already mentioned, the question is raised of whether scientists ought not pursue a strict policy of non-proliferation of robot technology vis-à-vis public agents who do not live up to the standards of democracy and civil rights. The robots, with the exception of Astro Boy, have a value neutral attitude. They cannot defend themselves, even when they recognise their moral misuse, due to the robot laws, so that they themselves are finally the victims of human agents (Hornyak 2006: 49).

For the cohabitation of humans and robots, Tezuka takes a strict stance in favour of equal rights. In "Seine Hoheit Dead Cross" (2000c) and the short story "Mad Machine" (2002a) he makes a topic of what civil and political rights robots ought to have.

In the former, a robot is elected president. A human opposition group rebels, and attempts to seize power illegally. From Astro Boy's perspective the long, hard path toward robots' political emancipation is told. In "Mad Machine" a political official, himself a robot, demands a work-free day for robots: Machine Day. Here, too, human agents resist at first, and threaten to plunge the entire country into chaos. In both cases the robots attain their rights in the end and are recognised as humans' equals.

The story "Die künstliche Sonne" (2000b) treats the fragile borderline between machine and man in a secondary story line. Through the character of the detective, Homespun, who must be operated upon several times, so that he is gradually transformed into a robot, the comic poses the question of a cyborg's self-understanding. At first, Homespun protests against his transformation into a cyborg, but later accepts it. Here, too, Tezuka arrives at the conclusion that robots and humans are fundamentally similar, so that the transition from human to machine is not a qualitative change.

Conclusions

The Japanese manga author, Osamu Tezuka, paints a quite technically euphoric, optimistic picture of the 21st century "robot society." For him, the actual conflicts are between the developers and users of robot technology, and not between robots and humans. Robots appear as neutral tools or as humans' partners. In the Japanese reception of the Tetsuwan Atomu mangas, the ethical conflicts are the burden of human agents alone (Leis 2006: S-2).

The ethical conflicts that Tezuka portrays are, in spite of their fictitious character and their embeddedness in strongly oversubscribed superhero stories, relevant to today's and tomorrow's robotics. The main conflict of the development of adaptive, non-linear robot systems is one focus of today's research projects (Christaller 2003). This is visible, i.a. in the commotion caused by the lecture "Fast, Cheap and Out of Control" by Rodney Brooks at a NASA conference in 1994. Brooks had described the development of autonomous bio-robots, which are supposed to explore planets autonomously and without direct human control (Becker 1997; Brooks 1989).

The Japanese robot developers also recognise the question of non-proliferation of militarily useful robot technology: Takeru Sakurai, one of the developers of the robot suit, HAL-3, wishes to ensure explicitly for those items to be distributed that the suit be used solely for civil purposes (Wagner 2005). But on the other hand the JRA complains in a strategy paper from May 2001 of a lack of Japanese arms research in the area of robotics (2001).

Tezuka offers no real attempts at a solution for the ethical conflicts between humans and robots in his stories. To expect this would hardly do justice to the manga's humble pretences. Still, at the end there remains an uncritical attitude toward technology. Here a widespread ideology of a value neutrality of science and technology shines through which can also easily be found in the West (Hornyak 2006: 47-51).

The efficacy of pop cultural role models in Japanese robot development must not be underestimated. George Basalla (1976) points out rightly what an enormously broad influence comics, cartoons and movies have. The producers of pop culture can reach an uncommonly larger audience than can the classical popularisation of science. Due to their broad readership, which spans many age groups, Japanese mangas form not only childhood socialisation, but also the adult imagination. Science fiction writer Hideaki Sena (2003) believes Astro Boy's role as an intermediary between fantasy and science goes even further: "We may be able to gain a realistic view of the environment for robots in Japan by thinking of robot stories as interfaces between culture and science. Images are being passed back and forth between fiction and real-life science, and these two realms are closely interconnected. This is perhaps the legacy of Astro Boy." Thereby, pop culture often perpetuates and pronounces stereotypes and simplified ideas of science and technology. The Tesuwan Atomu mangas were intended to buttress the techno-euphoria of the years of recuperation from the lost Second World War, thus contributing to the country's recovery (Schodt 1988: 75-79). For this, their current effect ought to be examined all the more critically.

References

Basalla, George. 1976. "Pop Science: The Depiction of Science in Popular Culture." In Gerald J. Holton, ed. Science and its Public. Dordrecht: Reidel, pp. 261-278.

Becker, Egon et al. 1997. "Out of control. Biorobotik, Science Fiction als wissenschaftlich-technische Innovation." In Werner Rammert, ed. Innovationen – Prozesse, Produkte, Politik. Frankfurt a.M.: Leipziger Univ.-Verlag, pp. 175-193.

Brooks, Rodney and Flynn, Anita M. 1989. "Fast, Cheap and Out of Control." Journal of the British Interplanatory Society 42: 478-485.

Christaller, Thomas and Wehner, Josef, eds. 2003. Autonome Maschinen. Wiesbaden: Westdeutscher Verlag.

Faiola, Anthony. 2005. "Humanoids with Attitude." Washington Post 11 March [online]. Available from: http://www.washingtonpost.com/wp-dyn/articles/A25394-2005Mar10.html [cited 8 September 2006].

Hornyak, Timothy N. 2006. Loving the Machine. The Art and Science of Japanese Robots. Tokyo, New York, London: Kodansha International.

International Federation of Robotics. 2005. The World Market of Industrial Robots. [online]. Available from: http://www.ifr.org/statistics/keyData2005.htm [cited 8 September 2006].

Iwao, Sumiko. 2003. "Japanese Creativity: Robots and Anime." Japan Echo 30 [online]. Available from: http://www.japanecho.co.jp/sum/2003/300403.html [cited 8 September 2006].

Jacob, Mark. 2006. "Japan's robots stride into future." Chicago Tribune 15 July [online]. Available from: http://www.sanluisobispo.com/mld/sanluisobispo/15109663.htm [cited 8 September 2006].

Japanese Robot Association. 2001. Summary Report on Technology Strategy for Creating a "Robot Society" in the 21st Century. [online]. Available from: http://www.jara.jp/e/dl/report0105.pdf [cited 8 September 2006].

JETRO (Japan External Trade Organization). 2005. Japanese Publishing Industry. [online]. Available from: http://www.jetro.go.jp/en/market/trend/industrial/pdf/jem0507-2e.pdf [cited 8 September 2006].

Kaneko, Kenji et al. 2004. "Humanoid Robot HRP-2." Proc. IEEE International Conference on Robotics and Automation [online]. pp. 1083-1090. Available from: http://ieeexplore.ieee.org/iel5/9126/29025/01307969.pdf?isnumber=&arnumber=1307969 [cited 8 September 2006].

Leis, Miriam J.S. 2006. Robots – Our future Partners?! A Sociologist's View from a German and Japanese Perspective. Marburg: Tectum Verlag.

Matthews, James. 2005. Animé and the Acceptance of Robotics in Japan: A Symbiotic Relationship. [online]. Available from: http://www.generation5.org/content/2004/anime-robotics.asp [cited 8 September 2006].

Patten, Fred. 2004. Watching Anime, Reading Manga. 25 Years of Essays and Reviews. Berkeley: Stone Bridge Press.

Rees, Siân. 2001. "Robot's Best Friend." The Journal of the American Chamber of Commerce in Japan (5): 52-57.

Schodt, Frederik L. 1988. Inside the Robot Kingdom. Tokyo, New York: Kodansha International.

Sena, Hideaki. 2003. "Astro Boy Was Born on April 7, 2003." Japan Echo 30 (4): 9-12.

The Japan Times. 2003. 30-year robot project pitched. 20 August [online]. Available from: http://search.japantimes.co.jp/cgi-bin/nn20030820b8.html [cited 8 September 2006].

Tezuka, Osamu. 2000a. "Die Geistermaschine." In Osamu Tezuka. Astro Boy. Vol. 4. Hamburg: Carlsen Comics, pp. 121-206 [First serialized January 1957 in Shonen Magazine].

Tezuka, Osamu. 2000b. "Die künstliche Sonne." In Osamu Tezuka. Astro Boy. Vol. 5. Hamburg: Carlsen Comics, pp. 145-207 [First serialized between December 1959 and February 1960 in Shonen Magazine].

Tezuka, Osamu. 2000c. "Seine Hoheit Dead Cross." In Osamu Tezuka. Astro Boy, Vol. 2. Hamburg: Carlsen Comics, pp. 3-97 [First serialized between September and December 1960 in Shonen Magazine].

Tezuka, Osamu. 2002a. "Mad Machine." In Osamu Tezuka. Astro Boy. Vol. 3. Milaukie: Dark Horse Comics, pp. 189-208 [First serialized August and September 1958 in Shonen Magazine].

Tezuka, Osamu. 2002b. "The Greatest Robot on Earth." In Osamu Tezuka. Astro Boy. Vol. 3. Milaukie: Dark Horse Comics, pp. 7-187 [First serialized between June 1964 and January 1965 in Shonen Magazine].

Wagner, Wieland. 2005. "Land der Roboter." Der Spiegel (6): 136-138.