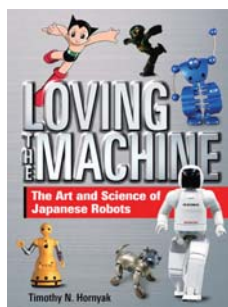


# Robotopia Rising

— Next Generation of Robots in Japan Brings SF Closer to Fact —

By Tim Hornyak

Photos: Greg McCartney



Tim Hornyak, author of "Loving the Machine: The Art and Science of Japanese Robots," says Japan's leadership position in robotics is driven by both practical needs and a deep cultural passion.

The children were completely immersed in the battle being fought before their eyes. Two teams struggled to gain control of the ball, get it across the pitch and slot it home into the enemy's net. When at last one of the strikers booted it between the posts, the kids cheered with delight. This was soccer with a twist — all the players were robots, humanoid machines that kids can build and control themselves. It is the latest trend in a technological revolution that is sweeping Japan as robots are finally moving out of the factory and into homes across the country.

## Big in Japan

Japan has dominated global robotics development since robots began working in manufacturing plants in the 1970s. Ironically, the industrial robot was an American invention imported in 1969 by Kawasaki Aircraft Co., which teamed up with pioneering US firm Unimation Inc. to produce the Kawasaki-Unimate 2000, Japan's first domestically produced industrial robot. Since then, factory automation has been developed and implemented on a massive scale in Japan. Tireless, blind-

ingly fast industrial robots have been turning out everything from luxury sedans to printer cartridges, batteries, and, of course, more robots. Japan became the most automated place on earth, but now a new generation of robots designed to help and entertain ordinary people instead of improving corporate productivity is quickly growing up.

The 2005 Aichi Expo held outside Nagoya was a world fair that stood out not only for its 22 million visitors but for showcasing about 70 types of new robots that included security patrol machines working on-site, humanoids that marched in a musical band, and lifelike, interactive androids. In fact, robots stole the show. Such exhibitions are nothing new — Expo '85 in Tsukuba, northeast of Tokyo, for instance, featured a Waseda University humanoid robot that played J.S. Bach's "Air on the G String" on the keyboard along with the NHK Symphony Orchestra — but the Aichi event demonstrated that major Japanese electronics firms and university-industry ventures had joined the robot development race. The goal? To develop robots that can help people.

Photos: (left&center) Tim Hornyak, (right) Osaka University Intelligent Robotics Laboratory



The 2005 Aichi Expo was a landmark in humanoid robot development in Japan, delighting visitors with many intelligent machines, including household robot Wakamaru (left), android receptionist Actroid (center) and Repliee Q1expo (far right), an android shown here with its human model, NHK TV announcer Fujii Ayako.

## Cybernetic Caregivers

Robots are not simply exhibitions or prototypes in Japan. They are already being deployed in a variety of real-world applications oriented at everyday users. An increasingly important area is patient care facilities. Aizu Central Hospital northeast of Tokyo recently introduced the country's first receptionist and porter robots to work in a hospital. The receptionist, made by Tmsuk Co., greets visitors and responds to queries with its voice recognition system, while the porters transport luggage and guide visitors to elevators. "We wanted to make this place less like a hospital and more fun – we wanted to –give it a brighter atmosphere," says Narita Naoya, an official at Aizu Central. "The robots give people a good feeling and can ease their stress. It shows that hospitals don't have to be just a place for sickness." The Tmsuk robots follow the success of *Paro*, a therapeutic robot seal developed by Shibata Takanori of the state-backed National Institute for Advanced Industrial Science and Technology (AIST). *Paro* looks like a cuddly baby

harp seal, but it is laden with sound and tactile sensors. When *Paro* is stroked or hugged, it responds by wriggling around or cooing in a soothing manner. Now in use at dozens of care facilities for elderly people in Japan, *Paro*'s relaxing effect has been shown to reduce stress levels in patients and caregivers. As a commercial product, the robo-seal is also becoming popular as a home companion for pet lovers.

Meanwhile, scientists such as Sankai Yoshiyuki of the University of Tsukuba are helping prepare for the significant social challenges Japan faces as its population and workforce shrink. Japan is a rapidly aging society, and the low birthrate means about one-third of Japanese will be over 60 by 2050. Sankai's Hybrid Assistive Limb (HAL) is a robotic exoskeleton that users can strap on to boost their physical strength by tapping into the body's bioelectric signals through the skin. Such "power-assist suits" could be used not only to help move bedridden elderly, but for rehabilitation therapy and to help seniors live independently for longer. Another example of robots that could

Photo: Shibata Takanori, AIST



The therapeutic robot seal *Paro*, developed at Japan's AIST, is proving effective in care facilities.

help old folks in the future is AIST's prototype HRP series, sophisticated humanoids designed to act as personal assistants and obey everyday commands. The HRP-2 can navigate its environment with a laser vision and mapping system, distinguish human voices from background noise, and carry out tasks like fetching a drink from the fridge. Researchers at AIST are continuing work to improve its artificial intelligence abilities. A consortium headed by the University of Tokyo, meanwhile, is planning for robots that can tidy up a room by 2008, make a bed by 2013 and lift elderly patients by 2016.

Photos: Aizu Central Hospital



Aizu Central Hospital, seeking a more cheerful atmosphere, deploys two guide robots to help visitors by providing directions and carrying baggage.



Photo: Tim Hornyak

## Pulp Fiction Heroes

Aside from the demographic need for robots, Japanese clearly have a deep-seated passion for them that is propelling development. It is a decades-old love affair born of manga and anime, featuring superhuman robots and awesome “mecha” combat vehicles as in Tomino Yoshiyuki’s *Mobile Suit Gundam* series. Such fantastic tales portrayed robots as heroes and helpers, machines that humans could turn to in times of crisis or control themselves to defeat the forces of evil. Tezuka Osamu’s iconic comic book and screen hero *Astro Boy*, conceived shortly after the bombings of Hiroshima and Nagasaki, was powered by an atomic engine. In the hugely influential series, *Astro Boy* fought for peace in the near future and served as a bridge between people and the robots that serve them. His manmade “soul” made him deeply conflicted, longing to be more human yet caring deeply for his fellow robots. In contrast to US author Isaac Asimov’s famous Three Laws of Robotics, which focus on robot obedience to humans, Tezuka envisioned a declaration of robot rights in which robots are granted the same status and freedoms as people. *Astro Boy* “affected many, many people,” says Asada Minoru, a leading Japanese roboticist at Osaka University. “I read the cartoons and watched the TV program. I became curious to know what human beings are. I still am...and that’s why I build robots.”

Tezuka died in 1989, but his cultural legacy of robots as helpers lives on. In the recent Japanese film *Hinokio*, a boy who has become a shut-in due to injury and loss of his mother, sends a humanoid robot to school in his stead, remotely controlling it and interacting with classmates. Eventually, the machine helps him return to society. This positivist view of robots stands in stark contrast to Western cultural stereotypes of robots as Terminator-like killer machines. Postwar Japanese science fiction is partly responsible for this, but the religious heritage of animism in Shinto and Japanese Buddhism, particularly with regards to



Robot soccer is drawing more and more fans in Japan as players continue to evolve. The inaugural Kondo Cup held in Tokyo’s Akihabara electronics mecca featured remote-control athletes made from DIY kits.

inanimate objects, is another factor. At Buddhist temples, thanksgiving and funeral ceremonies are regularly carried out for tools such as needles. I have seen echoes of this in secular activities like a little league baseball game, in which the kids lined up after the final inning, and bowed to the field to express their thanks. Indeed, Japanese seem to possess a greater willingness or ability to empathize with nonliving objects and project emotions onto them. So instead of fearing humanoid machines as potential Terminators, Japanese are eagerly anticipating peaceful coexistence with them as partners and friends.

## Science Fiction & Fact

It is no wonder, then, that events like robot soccer games at the 2006 Akihabara robot athletic meet are such a hit with the younger generation. While sophisticated consumer robots like ZMP Inc.’s \$7,000 sensor-laden, preassembled Nuvo remain prohibitively expensive for most, a new generation of do-it-yourself robot kits has been attracting a growing following since the 2004 launch of Kondo Kagaku Co.’s KHR-1, the first complete humanoid robot available as a kit. It is a remote-controllable machine that is popular with the Robo One combat tournament

crowd for its kung-fu moves and acrobatics, and the latest version is only around \$750. But adult male hobbyists raised on *Mobile Suit Gundam* are not the only ones spending their yen on kits. “We get a variety of customers, including women and seniors,” says Goto Yamato of Tsukumo Robot Kingdom, a robot retailer in Tokyo’s Akihabara that sells over 100 humanoids per month.

The science-fiction dream of personal robots is coming true in Japan, but it is taking an unexpected path. Instead of being the next must-have universal appliance, robots are emerging as niche market products in Japan, helpers for the elderly and entertaining projects for hobbyists. As the personal robot market grows, the cost of the average robot is expected to drop, making it more likely that they will become as common as cars or refrigerators in the future. Until then, however, Japanese robot makers and fans will have sci-fi heroes like *Astro Boy* to lead the way.

J.S.

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