

## LETTER FROM JAPAN

## Humanoids for the Home

**E**VERYONE IN JAPAN KNOWS the exact date on which the Age of Robots began: April 7, 2003, Astro Boy's birthday.

Astro Boy was the cartoon robot created by legendary Japanese animator Osamu Tezuka in 1951. Featured in a hit TV series in Japan and the United States in the 1960s, Astro Boy had rockets in his legs, searchlights in his eyes, and machine guns in his shorts. He inspired a generation of roboticists. Tezuka set his birthday in 2003, because he was sure that by then autonomous humanoid machines would be everywhere.

Tezuka wasn't that far off—in Japan, anyway. The most visible example is a herd of toys (“entertainment robots,” in the jargon) jamming upscale-Tokyo-store shelves, among them Sony's well-known Aibo robot dog, Sega Toys' Poo-chi (a big-headed, blue-eared pooch), and scheduled for spring, a robot cat from toymaker Bandai.

The toys are just the beginning. Japan's Ministry of Economy, Trade, and Industry plans for robots to become one of the country's key industries, as important as automobiles and consumer electronics. The government is disbursing \$28 million this year for robot development; industrial powerhouses like Fujitsu, Honda, Toyota, and Kawada also have robot projects. By 2010, the ministry hopes, full-fledged, humanoid robots will be common sights in middle-class homes.

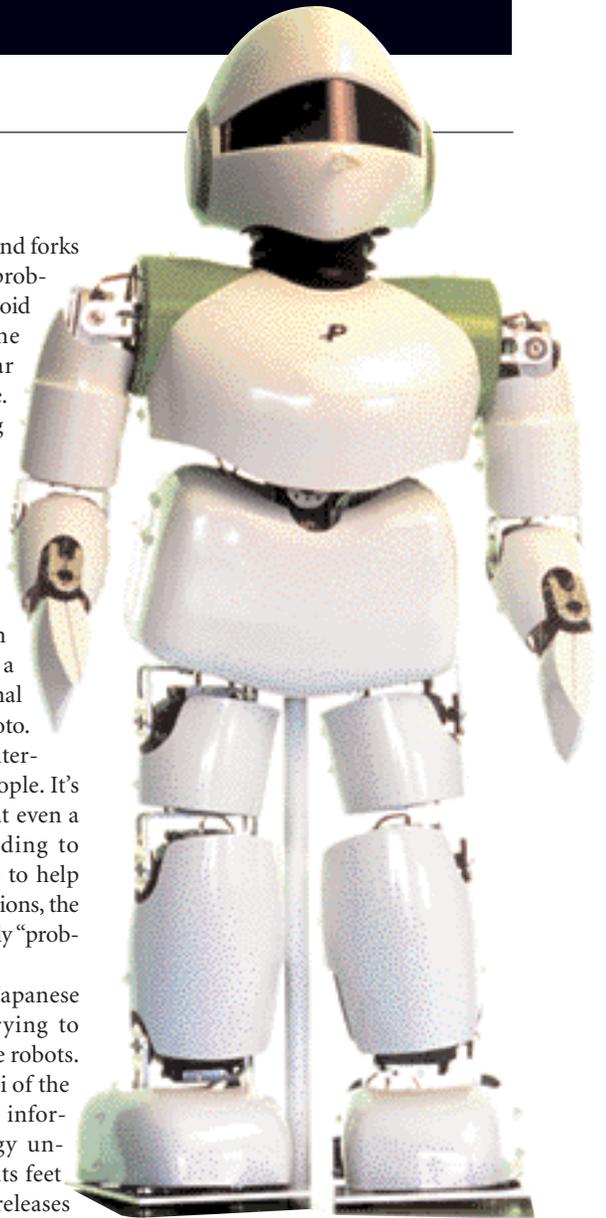
Some scientists outside Japan have disparaged this goal, because robots, strong and heavy, will pose a danger to their owners. “What if it thinks Grandma's head is a vase and tries to put it away?” asks Mark W. Tilden, a well-known U.S. researcher who has built robots for NASA and is now working on the design of a walking toy robot called Robosapien. Building machines to perform even simple tasks like dish-washing is a formidable challenge: they will have to recognize the difference between a plate and a Frisbee, manipulate glasses and crockery without

breaking them, and stick knives and forks in the appropriate drawer. The problems are compounded for humanoid robots. Simply reproducing the bipedal walk has been a near intractable engineering challenge. “And after all that, you're building a half-million-dollar machine to wash the dishes,” Tilden says.

Roboticists in Japan argue that the upside of humanoid robots far outweighs the downside. “Everything in the environment is already scaled for human beings,” said Gordon Cheng, a roboticist at ATR Computational Neuroscience Laboratories in Kyoto. “People already know how to interact with things that look like people. It's a natural, intuitive interface that even a child can understand.” According to Cheng, who is developing ways to help robots better interpret human actions, the safety and cost obstacles are simply “problems that need to be solved.”

To that end, researchers in Japanese industry and academia are trying to develop nimbler, more adaptable robots. Last September, Yasuo Kuniyoshi of the University of Tokyo school of information science and technology unveiled a robot that can leap to its feet from a supine position. Press releases touted the accomplishment as a harbinger of tomorrow, when robot maids, nurses, and babysitters will tiptoe deftly about the home.

Help in negotiating the complex environment of a modern home, enthusiasts argue, will come from a network of tiny radio frequency identification chips. At the National Institute of Advanced Industrial Science and Technology in Tsukuba, scientists are training robots to sort and wash dishes by combining visual data with RFID input. If a robot sees something round and platelike, it scans the object. The plate's RFID chip reports, in essence, I'm a plate! I get washed and put in the corner cupboard, second shelf!



Tatsuya Matsui designed Pino, a walking child-sized robot, to be cute and nonthreatening.

“We must make this work,” says Tatsuya Matsui, a robot designer for the Kitano Symbiotic Systems Project, a government-funded effort to combine ideas from biology and computation. Japan, he points out, has both a very low birthrate and a very high average life span. Simple arithmetic suggests that the nation's relatively small cohort of young and middle-aged people will have trouble taking care of its huge population of senior citizens. “I am making the technology that will help me in my old age,” Matsui says. “It's like putting retirement money into the bank.” **Charles C. Mann**