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Phil Husbands and Ezequiel Di Paolo

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# The Gomi legacy

Phil Husbands<sup>1</sup> and Ezequiel Di Paolo<sup>1,2,3</sup>

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Ever since meeting Inman Harvey at a workshop in the early 1990s (see Inman's main article in this special issue, Harvey, 2014), Takashi Gomi was a regular visitor to our group at Sussex. He organized numerous invited talks and demonstrations, often in Japan, showcasing our work; hooked up with us at countless international conferences; sent his engineers to work with us; and tried to encourage us to commercialize our research. He had a real impact on the group and will be sorely missed. The fact that he was CEO of a Canadian-based AI company made his unique contribution all the more remarkable.

Takashi was unlike any businessman we'd ever met. It was often unclear to others (but never to him) exactly what his role was. Facilitator? Contributor to the main intellectual debates around AI and robotics? Pioneering engineer? Salesman? He was all of these and more. Several of our Ph.D. students regarded him as a mysterious Zen figure riding the Jungian highways of the collective unconscious. Although this latter view was largely a product of youthful over-excitability, there was a grain of truth in it. His pronouncements were sometimes inscrutable and he enjoyed setting up encounters and situations without forewarning or explanation; situations that would often lead to fruitful outcomes. His emails could be playful, with gnomic phrases such as 'you are walking up the hill to the pub at 4 km/hour every afternoon with expectation while the earth is rotating at 1,666.666 km/hour' appearing out of nowhere, or jokey requests to remind the 'fat philosopher' (Inman) about something or other.

As Inman mentions in his article (Harvey, 2014), although Takashi's company, AAI, is based in Canada, its ties to Japan are very strong. He was fiercely proud of his Japanese heritage and this was brought home one sunny afternoon in a pub on the edge of the Sussex campus where we'd gone for lunch during one of his visits. This would have been in 1994 or 1995 and we (Inman Harvey, Phil Husbands, Dave Cliff, Nick Jakobi, Adrian Thompson, maybe some others) were discussing our latest research with him over egg, chips and beer. He was, as usual, recording everything on his video camera. Long before the age of the smart phone, this was relatively unusual behaviour at the time and

attracted the attention of some other customers who made vaguely disparaging remarks. There was a slightly racist undercurrent with a whiff of sneering at Japanese tourists and their cameras. Takashi turned to them and gave a rousing speech about Japan's unrivalled post-war economic development and the brilliance of its engineers, before veering into stern talk of the coming new age of the Samurai. He winked at us then carried on explaining the way of the warrior and the power of the katana sword. The offending drinkers meekly apologized and shuffled off in embarrassment.

An important part of his mission seemed to be to marry western and Japanese approaches to science and technology to the mutual benefit of all. Hence the series of ER symposiums he organized between 1993 and 2001. Always held in Japan, mainly Tokyo, the meetings were used to expose the local audience of researchers and industrialists to what Takashi thought were the most interesting and promising areas of research from leading labs around the world. There would be about 10 speakers, usually including some from Japan. Each meeting included extensive proceedings, the final edition of which was published internationally (Gomi, 2001). The ER stood for evolutionary robotics, and while that was an important focus of the symposia, the scope was always much wider – encompassing most of nouvelle AI and non-classical approaches to robotics. Our Sussex group was represented at nearly all the meetings (often by two speakers, including Inman, who was invited most years) and they were an important platform from which to build further links with Japanese researchers and organizations, as well as the other invitees. This was greatly enabled by Takashi's tireless and charming hospitality. As well as arranging many extracurricular activities, he would often organize further talks for us while we were in Japan, which helped develop our networks of contacts; several of

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these led to postgraduate exchange visits between Sussex and a number of Japanese universities. All this cost a significant amount of money, which Takashi and his colleagues at AAI somehow managed to raise each year.

His invitations to Japan did not stop at the ER symposia. He had a hand in numerous other talks and demonstrations that various members of the group gave. These included a memorable lecture tour of various Japanese institutes that Inman Harvey and Phil Husbands were asked to do in the late 1990s. As usual, hospitality was exceptional, with many intriguing forays into local culture. Each night the current host professor would take us to a restaurant and treat us to a local delicacy. The dishes seemed to get more and more exotic as the trip wore on, as if the professors were trying to outdo each other. The final night involved a drink incorporating gold leaf and tiny transparent ‘dancing’ fish.

Takashi’s commitment to helping groups he believed in, such as ours, was quite extraordinary: he helped raise sponsorship from Japanese organization for conferences we organized in Brighton, procured one or two donations to our lab funds and sent his own engineers to help with our research. This was always on his own initiative and usually with no obvious benefit to him or his company.

In 1995, we purchased an OCT-1a octopod robot from AAI for use on an EU funded project on evolutionary robotics. Fred Gruau developed the first evolved controllers for the machine using on-board evolution and interactive selection, whereby the experimenter scores each controller by hand (Gruau & Quatramaran, 1997). Takashi sent his engineer, Koichi, over to install the robot in our lab, and while he was here he was instructed (by Takashi) to try and deconstruct the low-level hardware controllers for our gantry robot (Harvey, Husbands, & Cliff, 1994) in order to design a more streamlined, fully real-time version. The controllers had been designed in-house at Sussex and were actually pretty good, even if implementing real-time processing (or an approximation thereof) was a little tricky. Koichi struggled valiantly on with this very difficult task until his boss grudgingly admitted that the realization of a new design would take significant effort, involving major hardware and software engineering, and that the time and resources required were beyond even his munificence. Meanwhile Nick Jakobi did further work on evolving impressive locomotion controllers for the OCT-1a using his minimal simulation techniques (Jakobi, 1998) and we built up a collection of software controllers that Takashi used for demonstrations of the robot.

The memorable 1996 Artificial Life V conference was held in Nara, Japan. Takashi paid for Phil Husbands and Nick Jakobi to go to the meeting and present a demonstration of various evolutionary

robotics work, including evolved controllers for Khepera robots and of course the OCT-1a. Because the fitness function used for developing the particular octopod controller we were demonstrating involved moving as fast as possible, the machine sprinted through the hall at break-neck speed with Takashi scuttling after it fretting about how hard we were driving the actuators (beyond their mechanical stops!). Fortunately, there were no disasters and the robot held up during several hours of demos and looked very impressive as it charged around the room. On Inman’s advice, and because it was actually cheaper to do so, we returned to Brighton via a 3-day stopover in Sri Lanka, allowing us to explore that wonderful island. When Takashi found out about this, he was not impressed. As far as he was concerned, it was 3 days wasted when we could have been hard at research. Trying to explain to him the advantages of a healthy work–life balance was useless.

As Inman has commented, Takashi was a hard taskmaster, expecting everyone to toil as relentlessly as he did. Over the years, he tried to recruit several of our postgraduate students to work for him as interns. A number considered it but decided the conditions would be too tough (Takashi did give them some warning). However, Sampsa Sojakka took the plunge and worked for AAI between finishing his undergraduate study and embarking on his Ph.D. under Ezequiel Di Paolo. He seemed to quite enjoy it. Later one or two students were employed by Takashi to work on projects such as the development of a fruit-picking robot. Although the work was successful, and they enjoyed the spirit of the company, they found it difficult to handle the stringent (essentially Japanese) work ethic. This cultural difference, between Japan and particularly Europe, was something Takashi was not willing to compromise over.

But it should be stressed that he had an enormously generous and friendly nature, shot through with a mischievous and anarchic sense of fun. An abiding memory is of him turning up in the lab with random gifts (dictaphones, short-wave radios, bizarre health concoctions) that he thought might be helpful to the general cause. Some are still in use 20 years later.

Although we often forgot it, he was at heart a businessman – albeit a highly unusual one. Hence he made efforts right from the start to commercialize our work. These efforts probably left him a little frustrated, because we were not as receptive as he might have hoped, but he never showed it, and it certainly didn’t dent his enthusiasm for our research. An early example will suffice to illustrate the disparity in our views on this topic. In 1993, Nick Jakobi produced what was probably the first detailed, physics-based, simulation of a Khepera robot as part of his M.Sc. project. Takashi was very keen to turn it into a commercial product as he could rightly see the potential. However, the

software had been produced for research purposes only and it was clear that it would need significant further work to turn it into an acceptable product. Or at least that was what Nick and his supervisor (Phil Husbands) thought and their priorities were much more towards pure research, so their enthusiasm waned. Takashi couldn't see why research and commercial software development shouldn't be done simultaneously, after all there are 24 hours in a day. But something may have rubbed off, because after completing his Ph.D. and a short post-doc career, Nick became an energetic businessman himself.

As mentioned by Inman, Takashi's projects were imbued with his uncompromising ethical stance towards technology. He thought its role should always be in increasing welfare, not in an abstract way, but in so many concrete applications. Takashi had a keen eye for matching a novel idea to a not immediately obvious social need, as shown by his inspiring robotic projects for care of the elderly. The relentless drive that saturated his down-to-earth enterprises was mixed with an almost utopian vision of intelligent robots for the betterment of society and as catalysers for a change in our attitudes towards others, our environments and ourselves. These two passionate aspects, his pragmatism and his idealism, not only contrasted with each other, but they were both paradoxically embodied in a soft-spoken, normally rather tranquil person.

How deep did Takashi's ethical concerns really run? Sometimes people draw attention to important, unmet social needs and after doing so, leave the stage and don't think or do much about them. He certainly wasn't one of those people whose socio-ethical worries run surface deep, nor was he fascinated by the technological side of his work to the neglect of the human side. Social goals were not simply an afterthought for Takashi but in many cases, a given social problem must have been worrying him deeply and for a long time. On one occasion, during one of his presentations at Sussex dedicated to his work on the behaviour-based wheelchair, one of us (Ezequiel Di Paolo) felt compelled to probe how much Takashi had really considered what it would mean for a user (say a patient with Parkinson's disease) to use a wheelchair capable of steering itself semi-autonomously (Gomi, 2002). Wouldn't there be a risk that the user felt not more enabled in her dealings with the world, but more dependent? He appreciated the question and his reply involved going back to the subsumption architecture diagram for the wheelchair controller. He pointed to a part of the control layer that would always override all the others layers because of its position in the hierarchy, and that was the user's

command signal. The technological design was supposed to assist the user, not overtake her functions and decisions. There was no doubt that he not only approached a problem from the technical side, but also from a human one.

Takashi Gomi's legacy for us at Sussex is a concrete impact on the development of the group. His work in promoting and encouraging our research, especially in the 1990s, was a significant contribution to it becoming widely known, particularly in Japan. This in turn led to further opportunities and a growing band of international students coming to work with us. He helped to spread the word about Adrian Thompson's pioneering work on evolvable hardware, which quickly became deservedly celebrated. As Nick Jakobi comments, thinking back to his days as a Ph.D. student,

The main thing for me was that he was such a big fan of ours and connected to the outside world in a way which really helped the 'anything is possible' vibe of the time. Also the faith he had in Adrian Thompson and me, getting us out to Japan and exposing us to that whole world right at the start of our careers, was extraordinary and inspiring. (Jakobi, 2014)

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**Phil Husbands** is research professor of artificial intelligence at the University of Sussex. He co-founded the Evolutionary and Adaptive Systems (EASY) group and the Centre for Computational Neuroscience and Robotics (CCNR) there. He has a BSc in physics from the University of Manchester, an MSc in computer systems engineering from South Bank Polytechnic and a PhD in AI in engineering from the University of Edinburgh. His research interests are in bio-inspired approaches to robotics, evolutionary systems, computational neuroscience, creative systems and the history and philosophy of AI and cybernetics.



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