Attracting and Retaining Young Japanese Women in Robotics

By Gentiane Venture

Japan is well known for having one of the lowest percentages of women pursuing careers in engineering (<10%), both in industry and at the academic level. Although some efforts have been made to attract women, cultural traditions are still too strong to be tackled, and only a few girls enter universities to study engineering (~11% versus 65% in social science and literature). Despite efforts to increase it, this figure has been stable for the past ten years. For mechanical engineering, the percentage drops to less than 10%, making female students, faculties, and professionals almost marginal.

The Tokyo University of Agriculture and Technology, also known as Nodokai, is one of the very few national universities in Tokyo, with a faculty of engineering active in robotics research. Nodokai is also one of the most popular faculties of engineering among young females in Japan (with >20% female students enrolled in engineering, twice the national average). Nodokai's scalable size, green atmosphere of the campus, and location in a quiet residential area that is still easily accessible by public transportation, play an important role. However, the university and the engineering faculty are also working to attract and recruit female students and faculty. The university has several programs intended to reach women from the junior high school level to the researcher and faculty level to promote scientific paths and careers. These programs include summer schools, experimental programs, lectures, café-style discussions, a mentoring program, research grants, and support after childbirth, to name a few. I consider myself lucky to work in this environment, which promotes diversity. I would like to introduce and highlight two of these programs with which I have the chance to be involved for many years.

The first program is actually two in one: a summer school and an experimental program (Figures 1–3). Every summer, there are two major events targeting young female students interested in science and engineering. One is organized at the university level and the other at the engineering faculty level. They both offer motivated students an opportunity to visit research labs, hear lectures, and attend experimental classes designed especially for them, where they can manipulate research equipment. Both events are scheduled for a full day. They each attract ~100 participants, but participants often do not come alone. More than one-third of them come with a chaperone, either their mother or their father. It might seem odd to welcome chaperones to our programs, but in Japan, statistics show that parents' choices and advice are crucial to students when choosing a major and a university. In about two-thirds of the cases, the parents' decision strongly guides the student's final decision. I believe this figure is even higher for young girls because sociocultural parameters inherently decide what is suitable or not for a girl to learn, unconsciously reducing her degree of freedom. Therefore, by welcoming the parents to our program, we have a unique opportunity to work directly with the decision makers. I put a lot of effort into trying to convince parents that engineering and robotics are perfectly suitable and decent paths for their daughters. There are a variety of opportunities and possibilities. Robotics is great as we use it everywhere, every day. At a low level now, we will use it much more in the future. Here, there is a vision where their daughter can be an active part of the shaping of the future. It gives them validation to be confident and that it is worth trying extreme challenges like preparing an experimental program, where students have to program a robot to complete a given task and think logically!

Figure 1. The gait pattern analysis during an experimental program.

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The second program is a mentoring program. This program has two aspects: 1) for undergraduate students and 2) for early career researchers (at the post-doctoral and assistant professor level). A pool of volunteer graduate students has been assembled to offer mentoring for undergraduates. Students can choose a mentor depending on their future career path, major, or affinity. The mentors offer counseling, discussions, tips, and experiences. For the researchers, a pool of faculty members has been assembled to answer mentees' needs. Ideally, mentor and mentee pick each other. There is only one rule: the mentee and mentor should contact each other at least once a month to discuss the points the mentee wants clarified or problems for which she wants some advice. I have mentored a few young researchers in our department for three years now, and I found it very enjoyable. It does not take up much of my time; we sometimes meet but often exchange e-mails. We talk a lot about career choices and students' supervision. I hope to be good at listening and give some good pieces of advice. Of course, each person's experience is personal and unique, but it is important to share with each other what we have learned from our mistakes. The mentees can be on the fast track, and the mentors are always kept up to date with the advances or stagnation of the youngest Women in Engineering's (WIE's) conditions.

Figure 2. The lecture before the experimental program explaining the aim of the experiments.

Figure 3. The demo of the NAO robot before programming it to analyze its center of pressure (CoP) trajectory with a Nintendo Wii.

Promoting WIE is an important duty for me that I enjoy fulfilling. I have had the chance to choose freely and entirely my career path and am fully supported in each decision by my family, my superiors, and my peers. I hope that each young girl can be offered the same opportunity and, for that, I want to reassure them and their parents that there is nothing that a woman cannot do. In particular, robotics is such a broad and emerging field that there is room for every talented and motivated young woman. More than covering the fields of mechanical engineering, electrical engineering, and computer science, robotics also makes it possible to work closely in collaboration with so many other fields, including medicine, psychology, design, and arts, that there is definitely a career path that fits each individual.

TC SPOTLIGHT *(continued from p. 25)*

George M. Whitesides (Harvard University), Peter Fratzl (Max Planck Institute), Brad Nelson (ETH Zürich), Fritz Vollrath (University of Oxford), and Norman Packard (European Centre for Living Technology).

To promote this research field, the cochair of the TC participates on the Editorial Board of *Soft Robotics*, a peer-reviewed journal dedicated to the science and engineering of soft materials in mobile machines, with the first issue available in spring 2014. The cochair also coordinates Robosoft, coordination actions on activities related to soft robotics research on a European scale. Robosoft is sponsored by E.U. Framework Programme 7 and will be started in October 2013.

Future Challenges

In the next ten years, many scientific and technological challenges will be addressed by the TC . The first challenge is to meet the requirement of developing functional and intelligent materials with controllable mechanical properties and adaptive functions for sensing and actuating, which are capable of being fabricated and assembled, mass producible, and safe. The second is obtaining a thorough understanding of the way soft bodies are used in animals on the basis of the guidance from biology and other related disciplines. Third, the establishment of a simulation and modeling technique of soft bodies behavior, particularly for boosting collaboration among researchers from various disciplines. Finally, the integration aspects that will make the research ready for practical applications, such as biomedical or rescue scenarios, must be explored.

To address the challenges effectively, the TC has formed several communication channels. The main one is a public homepage (softrobotics.org) and its associated mailing list, with 265 registered e-mail addresses as of June 2013. Since May 2013, the TC produced a bimonthly newsletter to organize and promote the latest achievement of its members. We always encourage new members to join us. Anyone can subscribe to the mailing list by visiting https://sympa.ethz.ch/sympa/info/softrobotics.