Opportunities for Women in Robotics

By Bram Vanderborght

During the 2017 IEEE International Conference on Robotics and Automation, my two-year-old daughter traveled with me to Singapore and attended the social events. She felt like Alice in Wonderland; I had a hard time keeping up with her as she ran through the crowd. We both particularly enjoyed the high-tech Gardens by the Bay. Sometimes I ask myself if and how she would be inspired as a young researcher attending conferences and other robot-related events. We have excellent female role models in the IEEE Robotics and Automation Society. Robohub has established an annual tradition of listing the "women in robotics you need to know about." The site features inspiring #womeninrobotics because robotics is growing and there are many new stories to be told. I also recall a male Italian professor I know who traveled with his daughter to meet several famous female robotics researchers in the United States before she decided which university program to follow. Still, we need to do more to give all young people access to such inspiration. It is now 2020, and there are yet occasions when only men are at the dais opening our conferences and delivering the keynote addresses.

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By now, we all know that the tech industry is largely dominated by men. While women were among the first programmers in the mid-20th century and contributed substantially, the tech industry's image is typically that of the "boy geniuses" like Bill Gates, Steve Jobs, Jeff Bezos, Elon Musk, Jack Ma of Alibaba, and Pony Ma of Tencent. All male. Despite the high job demand, computer sciences and engineering disciplines are not yet attracting enough women. And this is very bad for our field.

Some studies show women tend to be more empathetic [1], [2], more collaborative with other scientists [3], and more flexible socially. These capabilities are extremely important for our interdisciplinary research work in robotics. Increasingly, robots are entering our daily life. They are being given humanlike capabilities, so it is now time to talk about robot gender stereotypes. Scientists are starting to consider how gender biases materialize in physical robots. The danger is that robot makers, consciously or not, may reinforce gender stereotypes and inadvertently create even greater deterrents for young, underrepresented people interested in joining our field.

Marcie O'Malley (Rice University, Houston, Texas) asked on LinkedIn why the keynote speakers at the 2020 Ubiquitous Robots conference are only male. She offered specific suggestions on what we can do: "Ask conference organizers about the gender diversity of their invited speakers, suggest women you know, and make your participation contingent on inclusivity." During her plenary talk at the 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems, Katherine J. Kuchenbecker (Max Planck Institute for Intelligent Systems, Stuttgart, Germany) made a call for more diverse research teams. She then highlighted a YouTube Lean In talk, "Creating a Level Playing Field" by Shelley Correll (Stanford University, California), that lays out six strategies to reduce bias:

1) educate yourself and decision makers on bias
2) establish clear criteria in advance of making decisions
3) scrutinize the criteria being used
4) hold decision makers—and yourself—accountable
5) be transparent in progress toward goals
6) vouch for the competence of all women.

Maja Mataric (University of Southern California, Los Angeles) has put together a database of women in robotics (https://us-women-in-robotics-research.github.io).

All of us who hold a leading position are shaping our future, our society, and our economy; we thus have the opportunity, and responsibility, to show that

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occupational settings. The device was able to reduce perceived task difficulty and discomfort in the lower back, with greater effects observed in workers having preexisting back pain. Furthermore, it increased objective performance in several tasks but decreased it in others. While the long-term effects of the device were not examined, the authors suggest that wearable robots have potential as pain-management devices in physically demanding occupations.

In the sixth article, Jacob L. Segil et al. review a new myoelectric postural-control algorithm for upper-limb prostheses involving two amputees performing a standard clinical test. While comparison to a standard control algorithm showed mixed results and was limited by the small sample size, it identified several clinically important factors, creating a solid basis for the future design and development of practically useful and comfortable prostheses.

Lukas Gabert et al. present a polycentric design of a powered ankle-foot prosthesis. The design is lightweight and fits within the anatomical foot profile and provides physiological torque, energy, and range of motion. While further evaluations and improvements in closed-loop control are still necessary, the proposed design addresses the limitations of commercially available ankle-foot prostheses and could thus achieve broad adoption among a diverse population of lower-limb amputees.

Finally, Florian L. Haufe et al. detail a novel instrumented crutch system that can be used to analyze arm support during robot-assisted motion. Specifically, such instrumented crutches can provide vital information about how much the user (rather than the robot) contributes to assisted motions, such as gait and sit-to-stand. The authors use these crutches in three studies of the wearable robots RYSEN and MyoSuit; the studies illustrate the manifold ways in which such instrumented technology can support wearable-robotics research and development.

Wearable robots are, without a doubt, an exciting new technology that promises to greatly improve humans' quality of life by alleviating physical disabilities and augmenting existing capabilities. However, despite remarkable advancements in the field, there are still important technological and theoretical barriers that impede mass adoption of such robots. We hope our readers find this special issue an interesting and invigorating insight into these barriers and the solutions being developed to address them. Perhaps some readers will be stimulated to create exciting technologies and tools that break current technological barriers, enabling the next generation of wearable robots to become an almost natural and symbiotic extension of homo sapiens.

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women, men, and people with other gender identities should have equal ease of access to resources and opportunities. I hope that, when my daughter grows up, the lines for the restrooms in conferences are equally long.

This issue is also an occasion to present to you the new *IEEE Robotics and Automation Magazine* associate editors. From the many candidates, we selected Elena De Momi (Politecnico di Milano, Italy) and Yue "Sophie" Wang (Clemson University, South Carolina) for these roles. Congratulations on your new positions! These additions to our team mean we have now a 50/50 gender balance on our editorial board. I also want to express my gratitude and appreciation to our outgoing associate editors, Panagiotis Artemiadis (Arizona State University, Tempe) and Lorenzo Sabattini (University of Modena and Reggio Emilia, Italy), for several years of effective service to the magazine.

This special issue centers on wearable robotics, and I am very grateful for the good work of its guest editors, Domen Novak (University of Wyoming, Laramie), Carlos Rodriguez-Guerrero (Vrije Universiteit Brussel, Belgium), and Jan Babič (Jozef Stefan Institute, Ljubljana, Slovenia). Enjoy the issue!

References

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