Pioneer Women in Robotics

By Gentiane Venture

If you look around you, there are not yet many women working in the fields of science, technology, engineering, and mathematics (STEM), and it is not easy to find women professionals with a long and successful career in robotics. There are very few women who have seen the birth, developments, and progress of robotics. Starting today, I would like to introduce these leading women in our field in this column "Women in Engineering." The first woman I chose is definitely one of these few pioneers. Prof. Ruzena Bajscy (University of California, Berkeley) has been leading robotics research for the past 40 years using the best of math, control theory, sensors, and computer science, always with an eye on human psychology to understand human behavior (Figure 1). Recently, I had the immense pleasure of meeting with her to ask her a few questions about her career and vision. I am pleased to share what I have learned.

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With a father who was an engineer and a mother who was a pediatrician who always advocated that women should be self-supported, it was obvious to Bajscy that working was important. Inspired by her father and gifted in mathematics, STEM was a natural pick. Bajscy believes that the family environment plays an important role for children in deciding which career they will embrace: both her daughter and granddaughter are in the STEM fields. However, in the 1950s, it required a lot of strength and resoluteness for a woman to become a professional in engineering. Actually, she thinks it still does, even though things are slowly changing.

Figure 1. Prof. Ruzena Bajscy.

Bajscy's research and career show her fascination with how people behave, how the body moves, and how math can be used to explain that. For her, it is evident that math and engineering tools and, more particularly, robotics can be used to explore and explain human behavior. Naturally, the perception and computations have a direct relation with the sensing and mechanics. During her career that stretches over 50 years, she has seen the evolution of computing power, memory, sensors, and mechanisms, but she remembers that ideas and behaviors were there even before this technology. "At first, there was no practical application in mind," she says, "it only came after, when the technology started to be really efficient. There was not one thing more important than another; it was a convolution of many things that makes robotics progress." She has never been disappointed by the slowness of technological developments.

Bajscy calls herself a realist. She is always working with what is available and accepting things as they are. For example, she did not expect better cameras for computer vision in the 1970s but instead dealt with the available technology without delay and without blaming it for not being good enough, efficient enough, or precise enough. "In fact, technology changes faster than humans!" she told me. Still, everything takes time, and the collaborative effort is tremendous. For Bajscy, robotics is evolutionary. There are more and more systems, but they are incremental improvements. "I try to look at things holistically, but it is not so clear, not so pure. I dream of understanding fundamental dynamics of human; it is painful to see how much time it takes."

In 2002, Bajscy gave an interview for the IEEE Global History Network (http://www.ieeeghn.org/wiki/index.php/Oral-History:Ruzena_Bajcsy), which I recommend you watch. In this interview, where she talks about her life and career, she said something that I found extremely important for women trying to make their way in the STEM

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fields: "I never found that my male colleagues were putting obstacles in my way, but, at the same time, they were not really supportive." I realize how much this is still the case. Even now, the number of women, both students and professionals, in STEM is very low, and a lot of us are facing the same situation that Bajscy faced 40 years ago. I asked her for a hint on how to successfully handle this type of situation, to which she responded: "the only way to convince my colleagues of what I can do was to build systems and show to them what these systems could do. It requires a lot of patience, and it's a long-range commitment." According to her, the current academic system, not only for women but also for men, requires incessant publications, and it is difficult for young researchers since, to respond to that pressure, they tend to solve small problems instead of looking at the problem from a holistic point of view.

Finally, I was curious to know what Bajcsy's expectations are for robotics research. According to her, human–machine collaboration is where we, robotics researchers, can make a big impact. We should work to develop robots as a mechanism that can help people, not replace people. "Robots are good at manipulation tasks, tasks requiring force and precision, but the cognitive part is hard," she said. "On the other hand, humans are good at that. So we should use human–robot collaborative work and take benefit of each one."

Biography

Prof. Bajscy is one of the research pioneers in robotics. She was born in 1933 in Czechoslovakia, where she earned a master's degree and a Ph.D. degree in electrical engineering from Slovak Technical University. She worked as an engineer in a factory and then as maintenance engineer at the Slovak Technical University's computing center. In 1967, she joined Stanford University and received her second Ph.D. in computer science. At the University of Pennsylvania, she created the General Robotics and Active Sensory Perception Laboratory. She also headed the National Science Foundation's Computer and Information Science and Engineering Directorate. She is now a professor at the Center for Information Technology Research in the Interest of Science at the University of California, Berkeley.

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For more info about Prof. Bajscy's life and career, please read the IEEE oral history article published in 2002 at http://www.ieeeghn.org/wiki/index.php/Oral-History:Ruzena_Bajcsy.