WOMEN IN ROBOTICS GALA

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MIT Samberg Conference Center

Thank you all so much. I am incredibly honored and thrilled to be standing here today, among an extraordinary group of roboticists – both those who are luminaries in the field and those who are just launching their careers. Thank you to MassRobotics and you ALL for being here to celebrate the accomplishments of women in robotics.

One of the things I love about this field is that there is an opportunity for everyone to contribute. No matter your gender, age, or background, this is a field that needs not only technical expertise, but also creativity, domain expertise, and, well, humanity to have a positive impact on human health, well-being, and prosperity. Right now there is so much concern about the potential negative impact of AI and, by extension, robotics, on our lives. We need to remember that it is our choice what role robotics will play. Most people make that choice only by what they accept and use in their daily lives, but as roboticists we are in the unique position of defining that future by our own designs. Whether you design software or hardware, or whether you are a specialist or generalist, you will be making decisions every day that determine how robotics will make the world a better place. This is a great privilege and responsibility.

When I was growing up, I didn't think much about this opportunity and responsibility. Unlike many people in this field who were inspired by science fiction, I did not fall in love with the robots I saw in the movies, and I did not imagine the amazing world of robotics we see emerging today. I just knew what I liked to do. I liked math and physics, and I liked using computers, thanks to my parents buying a very early Apple computer, where I would spend hours programming the Logo turtle to make patterns. And I was lucky: my parents, both chemistry professors, gave me every encouragement, and growing up with a mom who was a scientist, when women with Ph.D.s were rare, made it feel completely normal. I also liked movement for my own body – from dance to roller skating to martial arts. Through classes as an undergraduate at UC Berkeley (California native here!), I learned that I enjoyed the specific fields of mechatronics and control, which eventually led me to pursue graduate school in robotics.

Although I certainly didn't like being one of the few women in a class (and several times early in my career, being the only woman at a conference), I had a few strategies to get my girl power on. As an undergraduate, I took a bunch of women's studies classes, where the gender distribution was entirely flipped. As a graduate student, I helped found the Mechanical Engineering Women's Group at Stanford, which still exists today and offers an annual seminar series on Women's Perspectives in Engineering. I'm overjoyed to now be the faculty advisor for

that group. And now I play in a women's ice hockey league. These are places where I can experience the joy and camaraderie of other women, so I regularly get to feel the kind of energy we have in this room tonight! Yes, it's a good life.

I was really introduced to the field of robotics by my Ph.D. advisor, Professor Mark Cutkosky at Stanford. I knew I enjoyed research from a wonderful time in Professor Dennis Lieu's lab at Berkeley, but the topic had been design visualization, and I felt I had a lot more to learn about robotics. So I applied to graduate programs and fellowships, and then Mark reached out to me saying, "Would you like to come to Stanford and study robot hands in my lab?" That sounded amazing, so I crossed the San Francisco Bay, thinking that I'd try a Master's degree and see where it led. It turns out that Stanford was the perfect place for me to study robotics and mechatronics, and to connect those topics to design and creativity. I stayed for the Ph.D. and did my thesis on haptics, specifically touch-based exploration with robot fingers.

I also worked part-time at a startup company called Immersion, which was a leader in the relatively new technology of haptic devices, which give touch feedback to humans. So while I spent my days giving robot hands the sense of touch, I was spending nights and weekends developing touch feedback in virtual environments for humans. This is what compelled me to pursue a faculty career, to understand how engineering and human touch go hand in hand, and to work together with an army of students to make progress in this field.

During my faculty job search in 2000, I learned about the growing field of medical robotics, which seemed like an ideal place to integrate human touch, from teleoperated surgery to training in virtual environments to rehabilitation after stroke. So this California girl packed up and moved to Baltimore, Maryland, to take a faculty job at Johns Hopkins University, where I found the most amazing scientific collaborators and mentors I could ask for. I gave myself 3 years to see if I liked faculty life, and those 3 years quickly turned into a decade. I was making teleoperation and virtual environments more "transparent," such that surgeons could feel haptic interactions via devices that were as close as possible to the experience of touching real environments. We also started to develop new ideas for making the surgical robots better, designing thin, flexible needles that could steer through tissue and perform surgery with minimal invasiveness. From developing control theory for systems with both continuous and discrete dynamics to designing wearable gadgets and tentacle-like robots, working with my students to make compelling haptic and robotic experiences, and, even better, seeing people use what we created, was THE BEST.

My favorite part of being a faculty member was, and still is today, sitting with my graduate students hashing out and testing ideas. In the beginning, teaching made me VERY nervous, and standing up in front of a classroom has never been my favorite thing. But similar to what I do in research, I love sitting with students one-on-one and helping them understand difficult concepts in dynamic systems, control, and robotics – and eventually I learned to bring that same energy to the larger classroom.

Now I am a professor at Stanford University. About 15 years ago, the opportunity to move closer to family in California was too great to pass up. By that time my husband Lester and I had two children. Lester is here tonight – hi Lester! – along with my daughter, Nora. I am super proud that Nora is now a CS graduate student! Having family in California to help us all out has been wonderful, and even right now my dad is at our house in California keeping my teenage son Eric company – although who is watching who may be open for debate. And this is a good time to point out that Lester is the most ardent feminist I know. He has shown it over and over during our 26 years together by supporting my work, while also being an amazing teacher and leader in his own right.

Moving to Stanford also opened up new research opportunities, because of the design thinking mentality that is so embedded in our department there. We still work on haptics and medical robotics, but there is now a more creative flair to my lab's work, and I've become especially passionate about using robotics to help older adult populations live more independent lives, as well as supporting their caregivers. Beyond surgery and rehabilitation, we are now working on 3D printing hearts for better transplants, creating adaptive robotic garments that can put themselves on the body, and using vibrations in smartphones to help diagnose and track how touch sensation is lost from diabetes. I'm a big believer in creating the right robot for the right job, and I think we are just scratching the surface of a Cambrian explosion of robots and haptic devices that expand capability and opportunity, not replace people.

Speaking to the young folks in the room now, it's important to know that when you hear this story and see where I and other senior roboticists in this room are today, it may seem like a carefully planned path. But when you are traveling that path, exploring the many options and dealing with setbacks, it does not feel that way at all. I am generally a very positive person, and sometimes I forget to talk about the times I felt lost and confused, and all the times I tried to do things and failed. You may have heard about some people writing a "CV or resume of failures" – all the jobs they didn't get, the ideas that didn't work, the proposals that weren't funded, and the papers that got rejected. I've often thought that I should write my own CV of failures, but it would take SO long to write, as it would be much longer than the list of successes that I put into my regular CV. But I'd rather not dwell on those. There are so many fun opportunities in life – that's where I place my focus. Thinking about one's career is important, but concentrating on the key research to be done, the impact that robotics can have, and how to learn and teach and collaborate together is how we will ALL succeed.

I want to thank the people who have helped me to learn all these valuable lessons. From my research mentors and collaborators to the brilliant students in my lab to my family, there are so many people who have supported me and my work. I especially want to recognize the incredible women who have stood before me on this stage, some of whom are here tonight, for being such an inspiration. They have led the robotics field both technically and in forming a community that makes it a place where everyone can thrive. Thank you all!