

Predicting the Future of Robotics and Making It Matter for Industry

By Dominik B.O. Bösl

For the past two years, I have had the honor of serving as vice president of the IEEE Robotics and Automation Society (RAS) Industrial Activities Board (IAB) (Figure 1). During this time, I have learned a lot about myself, but even more about our wonderful Society, its even greater members, and academia itself. In fact, it may have played a role in my decision to change the focus of my career. Recently, I accepted a part-time (for now) professorship at the Bavarian School of Economics in Munich and now have feet planted firmly in both the line industry and academia domains.

What I learned about our Society is, foremost, not a real lesson but more a confirmation of what I already had felt or even known deep down. Our Society brings together many great characters, shining in many different colors and defining every day the future of among the most disruptive sets of technologies: robotics and automation. But I also found proof that walking the thin line between academic ingenuity and industrial hands-on mentality can feel like herding cats—and you had better bring our well-trained, domain-specific Babel fish [9]. (According to Douglas Adams, “The Babel fish . . . excretes into the mind of its carrier a telepathic matrix formed by combining the conscious thought frequencies with the nerve signals picked up from the speech centres of the brain which has supplied them. The practical upshot of all this is that if you stick a Babel fish in your ear you can instantly understand anything said to you in any form of language.”) Unfortunately, I didn’t have one in the beginning, and it sometimes still seems to garble its output and feed some Klingon translation back to me.

Overall, the RAS IAB is guided by the question of how best to foster interaction among the RAS, its mostly academic membership base, and industry. Hence, the board and its subcommittees are always on the hunt for the “silver bullet” to, on the one hand, attract industrial partners and provide content for them and, on the other hand, not be too revolutionary and upset well-established “academic” processes.

This column and the “Industry Activities” column in the March 2020 issue of *IEEE Robotics and Automation Magazine* provide some insight into the work and achievements of the past 24 months. This opportunity would have never been possible without our great collection of board members and associate vice presidents (Tamas Haidegger, Craig Schlenoff, Edson Prestes, and Sebastian Bedacht), the ongoing support of RAS President Wolfram Burgard, all of our Administrative Committee (AdCom) and Executive Committee members, and, maybe most importantly, the good souls of our Society: Kathy Colabaugh and Amy Reeder. My deepest, warmest thanks to all of them and to you, the

members of our wonderful, lively, colorful, and sometimes a bit nerdy and quirky (in a good way) Society.

Reshaping the Industry Forum

When addressing “the industry,” it surely makes sense to offer industry-related content at RAS flagship conferences. The Industry Forum has always been one way to engage representatives from companies and corporations and bring them to our conferences. Unfortunately, the structure, content, and, thus, the quality of past forums showed too wide a spectrum. Subsequently, the RAS IAB was given a mission by the AdCom to reshape and restructure the Industry Forums to ensure continuity and evaluate content so that it resonates with the target group. The first attempt at this possible new structure was launched at the 2019 IEEE International Conference on Robotics and Automation (ICRA) in Montréal [1]. The new structure, which immediately attracted more than 100 attendees, combined keynote presentations by industry leaders (who discussed robotics from a different angle, i.e., agricultural or naval applications)



Figure 1. Members of the RAS IAB (from left): Tamas Haidegger, Craig Schlenoff, Dominik Bösl, and Sebastian Bedacht.

with the joint IEEE/International Federation of Robotics Innovation and Entrepreneurship Awards in Robotics and Automation startup pitches and presentations selected from contributions in the translational research track.

The event was accompanied by an invitation-only executive luncheon, which connected C-suite executives from robotics and automation companies with RAS leadership. In addition, Jeff Burnstein, current president of the Robotic Industries Association, joined the luncheon. All participants had a productive exchange about the real added value industry members receive by attending ICRA. Encouraged by positive feedback, the RAS IAB is working closely with Conference Activities Board and the future Conference Organizer Boards (COBs) to refine a harmonized agenda for the Industry Forum, while ensuring flexibility for the conference organizers. The next test run is planned for ICRA 2020 in Paris, so stay tuned, and check out the respective website at www.ras-industryforum.com.

Translational Research Track

It is always difficult to accommodate the needs of both academia and industry, especially when it comes to the difficult topic of publications. Industry often claims that purely academic publications are “too academic” and that the results and findings are not robust or applicable enough to industrial settings. Academia, on the other hand, deems industrial “papers” as lacking scientific novelty and rarely meeting the high formal requirements and, hence, as rarely able to pass a rigorous peer-review process. The result is frustration on both ends. To address this issue, the RAS IAB subcommittee, chaired by Tamas Haidegger, has made it its mission to embed a translational research track into all RAS flagship conferences. The first test run was successfully completed at ICRA 2019 in Montréal [1], [2]. Based on the high number of submissions and very positive feedback, the next trial will be carried out at ICRA 2020 in Paris (see “Call for Papers: RAS

Industry Partners–Submit Your Research to the ICRA 2020 Translational Research Track”). At the time of this writing, the RAS IAB and ICRA 2020 COB teams are working on establishing a separate conference track so that their publications can be handled alongside “normal” submissions in the conference system. If this test also proves to be successful, the next step will be the continuation and rollout of the translational research track to other conferences.

Standards Strategy Meetings

One of the RAS IAB’s tasks is to coordinate standards activities across the RAS. This effort has been shaped over the past two years by Craig Schlenoff of the National Institute of Standards and Technology. As reported in [3]–[5], the associated subcommittee instantiated a series of recurring standards

strategy meetings, inviting representatives from all other major standardization organizations to our IEEE RAS flagship conferences. The one-day workshops aim to coordinate and harmonize standardization efforts in the robotics domain across these different organizations. A frequently discussed topic at the recent ICRA gathering in Montréal was the harmonization of robot terminology. Future efforts will include finding core definitions for essential terms, e.g., *robot*. Because of the very positive feedback, the importance of the matter, and the impact already visible, Schlenoff has been awarded the IEEE Standards Association Standards Medallion.

Delphi Study “Robotics 2050+”

“Robotics will change the world! It will unleash the same, if not an even greater, disruptive and transformational power

Call for Papers: RAS Industry Partners–Submit Your Research to the ICRA 2020 Translational Research Track

Translational research is defined as the application of scientific knowledge gained through basic research to studies that could support the development of new products.

To offer better visibility to potentially high-impact, innovative R&D projects that demonstrate substantial engineering quality but may not qualify for acceptance based solely on their scientific novelty due to the research-centric nature of typical IEEE International Conference on Robotics and Automation (ICRA) sessions, the IEEE Robotics and Automation Society (RAS) Industrial Activities Board, together with the ICRA 2020 COB, have launched a new conference track.

Successful industrial innovation projects can span many years and include ideation, designing, prototyping, and testing phases, which may all generate substantial and valuable engineering knowledge that is rarely documented in the RAS’s traditional academic format. Some fields, especially medical device and technology, recognize the merit and effort needed to successfully integrate different disciplines (e.g., designing, implementing, and successfully bringing a medical device into clinics) and that best practices should be presented for the field’s benefit. The RAS could learn from this example.

The translational research track will be a concurrent special session at the Paris conference, which is currently soliciting applications from a broader range of participants, including innovation hubs, start-ups, and industrial engineering teams with a more product development focus. Attendees can submit their work as a standard IEEE format paper, following the instructions on the ICRA 2020 website (<http://icra2020.org/call-for-papers>). The review process will consider the special conditions of these manuscripts, valuing both impact and engineering soundness.

Industry and applied research partners are cordially invited to showcase your true innovation projects. Allow us to better focus on industry-relevant ideas and provide more hands-on demonstrations at the flagship conference.

Learn more at <http://icra2020.org/call-for-papers>.

Deadline: 31 December 2019.

Please send questions or comments to: haidegger@ieee.org.

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within the next 50 years as did mainstream IT and the Internet over the last half a century” [6]. For some time now, I have been writing these lines often and in different forms, and you, the members of our Society, know that. In fact, it is the reason we are IEEE’s RAS, because we know that our topic is there, that it is big, and that it has come to stay and disrupt the world. Many of you, having worked in the domain for decades, will agree; some might smile, and a few might roll their eyes, but we all are certain of it. But what we are not so very sure about is the “when.”

To answer this question, the RAS IAB initiated what will be the biggest global Delphi Study, “Future of Robotics 2050+” [7], [8]. The study seeks to question more than 200 worldwide robotics experts (mostly from our community) to gain maximum diversity and collect as much input as possible. Since the kickoff in 2016, several preparation workshops have been held at major IEEE RAS conferences, and a senior advisory committee has been instantiated, involving Wolfram Burgard, Oussama Khatib, Henrik Christensen, Raja Chatila, Satoshi Tadokoro

and Dong-Soo Kwon. After being discussed at this year’s IEEE/Robotic Society of Japan International Conference on Intelligent Robots and Systems in Macau, China, the questionnaire has been finalized and is now ready to be distributed to the experts. The goal is that, by ICRA 2020, the first round of answers will have been collected and analyzed so that the results can be presented in Paris before the second round starts. The experts taking part in the study will be carefully selected, and the list will be approved by the senior advisory committee. To learn more about the Delphi Study, please visit the website at www.robotics2050.org or contact me at boesl@ieee.org.

References

- [1] T. Haidegger and D. Boesl, “Industry forum at ICRA 2019 [Industry Activities],” *IEEE Robot. Autom. Mag.*, vol. 26, no. 3, pp. 93–94, 2019.
- [2] T. Haidegger and D. Boesl, “Looking back at IROS 2018,” *IEEE Robot. Autom. Mag.*, vol. 26, no. 2, pp. 107–108, 2019.
- [3] C. Schlenoff, S. Balakirsky, H. Li, F. Amigoni, S. Redfield, and A. Downs, “IEEE RAS

- standards update [Standards],” *IEEE Robot. Autom. Mag.*, vol. 26, no. 3, pp. 105–111, 2019.
- [4] C. Schlenoff, “IEEE RAS standards update [Standards],” *IEEE Robot. Autom. Mag.*, vol. 26, no. 2, pp. 109–110, 2019.
- [5] C. Schlenoff, “Results of the IEEE RAS Standards Strategy Meeting,” *IEEE Robot. Autom. Mag.*, vol. 26, no. 1, pp. 105–107, 2019.
- [6] D. Boesl and B. Liepert, “4 Robotic Revolutions—Proposing a holistic phase model describing future disruptions in the evolution of robotics and automation and the rise of a new Generation ‘R’ of robotic natives,” in *Proc. IEEE IROS*, 2016. doi: 10.1109/IROS.2016.7759209.
- [7] D. Boesl, “A look into the crystal ball: Predicting the future of robotics [Industrial Activities],” *IEEE Robot. Autom. Mag.*, vol. 23, no. 4, pp. 10–19, 2016.
- [8] D. Boesl, E. Prassler, and M. Bode, “Proposing a Delphi-study as non-biased alternative to studies and roadmaps predicting the future of robotics, automation and A.I.,” in *Proc. IEEE Int. Conf. Current Trends Computer, Electrical, Electronics and Communication (ICCTCEEC)*, 2017. doi: 10.1109/CTCEEC.2017.8455133.
- [9] D. Adams, *The Hitchhiker’s Guide to the Galaxy*. London: Arthur Baker, 1979.



PRESIDENT’S MESSAGE *(continued from page 6)*

student members of our Society or students from developing countries.

Further student-directed initiatives include our Best Student Paper Awards and the variety of educational material we create for the benefit of our young members. Thus, our Society is doing a lot for young members, but we are aware that we can always do more

and so are constantly considering additional ideas. We would be particularly happy to consider initiatives coming directly from our young members, who may have good ideas about the best options for their and, thus, our Society’s future.

I end this column with a personal statement, because this is the last one I

will write in my role as president of the RAS. I particularly enjoyed serving you all, and I truly hope that you viewed everything my team and I did throughout the past two years as what we all aimed for—a positive development of our Society.

Thank you for your support!

