OPINION

Venturing Outside the Silo

Hans G. Kaper and Hans Engler

Note: The opinions expressed here are not necessarily those of Notices.

Pushing the boundaries of our discipline ensures that mathematics has an impact across fields. As mathematical scientists, we continue to make significant advances and expose new areas of application. But how good are we at communicating the results of our efforts outside our silo? Some scientists are well aware of the contributions we can offer to their discipline; however, too many are not, and consequently invent their own mathematical approaches. Decision-makers rarely recognize mathematics' significant contributions to the "real world." Even well-educated members of the general public believe that most—if not all—mathematical problems were solved a long time ago. Our profession clearly has a communication problem.

We recently organized a scientific session on the "Mathematics of Planet Earth" (MPE) at the 2018 American Association for the Advancement of Science (AAAS) Annual Meeting, held in Austin, Texas, in February 2018. Entitled "MPE: Superbugs, Storm Surges, and Ecosystem Change," our session featured the following three applications of mathematics: "Unseen Enemies: Surveilling, Predicting, and Controlling Epidemic Outbreaks" (Glenn Webb, Vanderbilt University), "Spatial Self-Organization and Its Implications for Ecosystems" (Corina Tarnita, Princeton University), and "Resilient and Sustainable Coasts: How Mathematics and Simulations Play a Role" (Clint Dawson, University of Texas). The meeting allowed us to experience first-hand how other scientists view mathematics and how we can communicate science.

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The AAAS is the world's largest general scientific society. It fulfills its dual mission "to advance science and serve society" through many initiatives in science policy, education, and science communication. Thousands of scientists attend AAAS annual meetings, which feature prominent non-scientist speakers, such as the keynote presentation by former vice president Joe Biden at the 2018 meeting. Many science journalists and writers from around the world frequent the meetings, which leads to wide media coverage.

"Mathematics" is Section A among a total of 24 AAAS Sections—recognition of its integral and enabling role in the larger scientific enterprise. Despite this status, very few mathematicians regularly attend the meetings, and mathematics rarely features prominently in the program lineup.

We left Austin with the impression that mathematicians had missed another opportunity to engage with other scientists and the general public. We also witnessed other scientists' increased proficiency in communicating the importance and relevance of their work. Not engaging sufficiently with our peers and failing to regularly and skillfully share our work with a broader audience can only hurt our profession in the long run.

Why does our community not engage more actively with the world outside our silo? Some of the reasons are apparent. We often find it difficult to determine the questions that drive projects in other disciplines, or see little opportunity for interesting mathematics in these projects, so we tend to stay within the comfort zone of our own discipline and its reward system. Our training compels us to emphasize correctness and generality over accessibility and illustrative examples, even more so than other sciences. We are used to the inevitable trade-off between accuracy and mathematical tractability of our models, but the price is that our results are harder to communicate. Additionally, mathematicians tend to use their own jargon. Many of

us believe that our work is too complicated to explain in terms that are accessible to a general audience. Too often we communicate to address a few dozen peers or perhaps a special community of other scientists, when in fact we could be reaching thousands. Unfortunately, many of us have experienced that those more extensive audiences are not surprised by the narrowness of our message.

Effective communication should not be left to professional societies, and we as mathematicians can change our habits. The 2018 AAAS Annual Meeting featured many engaging presentations on a variety of topics, including "What Citizens Think About Science: Survey Data and Implications for Science Communicators," "Science for All: Using Social Media to Take Your Research Around the World," and "Advancing Artificial Intelligence: From the Lab to the Street." See the accompanying inset for additional examples.

Engaging AAAS Offerings

- In a session titled "Universal and Industrial Quantum Computing," speakers from Google, IBM Research, and TU Delft presented different strategies to increase quantum computation's error resistance and broad availability, and develop new hardware approaches for this task.
- In a flash talk session titled "Developing Robotics to Assist Humans," speakers employed videos and animations to generate a lively discussion about the technical and societal challenges that result from robotic advancement.
- In a plenary address titled "When Facts are Not Enough," Katharine Hayhoe, an atmospheric scientist at Texas Tech University, offered suggestions for connecting with climate skeptics, including bonding over a shared love of gardening or concern for national security.

Persuasive science communication is a major challenge, especially for our discipline, and requires a shift in our collective thinking. We must recognize that it is not enough to be heard by a gathering of peers; there are broader audiences worth reaching. And we should find ways to prepare our students for this challenge, perhaps by encouraging them to obtain scientific training beyond their narrow specialty or by rewarding them for improved communication skills.

To get you started, consider the following questions. Can you summarize the impact of your work in 200 words, or even a few tweets? Could you explain your research in a 30-second elevator pitch to a dean or provost? Would you be able to get a three-minute video about your work produced and published? By venturing outside our silo, we learn how to strengthen our discipline's communication efforts and spread awareness of mathematics' relevance and value.


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Credits

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