

into words—perhaps more eloquent words than you’ve ever previously sought—what you find exciting about your research field and where you fit into that mathematical story. Try to have fun with it, to take pride in both your writing and your research. Rejections are inevitable, but the experience of crafting a beautifully written proposal will serve you well no matter what.



Emily Clader

Credits

Photo of Emily Clader is courtesy of Kenzie Allen.

What is Broader Impact?

Max Lieblich

Introduction

This is a brief discussion of the notion of “Broader Impact” in an NSF proposal. The NSF has a nice website [NSF21] about what Broader Impact means, with several examples. The NSF Proposal and Award Policies and Procedures Guide (PAPPG) [NSF20] currently states: “The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.” Peter March wrote a useful (but perhaps slightly dated) memo [Mar07] in 2007, laying out a vision for the types of societal goals that a proposal could seek to achieve.

This article is written more or less as a series of examples meant to complement the documents above, phrased in the form of questions that I hope will stimulate thought and (perhaps) conversations with mentors. My examples start with things that are not Broader Impacts, and proceed to those that are.

I have drawn on my own experience talking to people, reading proposals, and serving on panels to generate examples. One reason I encourage you to talk to other senior

Max Lieblich is Craig McKibben and Sarah Merner Endowed Professor of Mathematics at the University of Washington. His email address is lieblich@uw.edu.

DOI: <https://dx.doi.org/10.1090/noti2316>

mathematicians is to have the opportunity to draw on their experiences, too.

Broader Impact Develops over a Career, not over a Year

Just as with research, Broader Impact activities evolve over time.

You can’t do it all

I certainly do not want anyone to think that trying to do *all* of these things at once is a remotely good idea. Doing something well takes effort and time, and that includes the Broader Impact work you do. Your career will change over time, and you should expect that you will start and stop activities as you go. Choose a Broader Impact (or a few) to work on for the next five years. Each year think about your goals and accomplishments, and tweak your plan. If, after five years, you feel like it might be time to move on, then switch to something new! Eliminating activities is just as important as starting new ones. On the other hand, if you are still passionate about the work, by all means keep doing it, making it better as you go.

The best any of us can do is to leave things better than we found them.

Start simple and grow

Many of the things we see around us took people years of hard work to achieve. As a young PI, you are at the start of your journey. If you’re interested in writing a textbook, start writing it and talk about your ideas, plan, etc. If you have a vision for a series of professional development conferences for young people, talk about your vision and think of your proposal as a request for seed money.

In my experience, NSF panels work very hard to understand what different career stages look like, and read proposals with this in mind.

What Broader Impacts Are Not

Doing your job

If you can substitute “I will do my job” for whatever it is you think might be a Broader Impact, it is probably not a Broader Impact.

- Are you planning to teach a graduate course on geometric measure theory from scratch?
- Are you planning to put your papers on the internet and give talks about them at conferences?
- Are your office hours a welcoming space for undergraduates?
- Are you collaborating with female and BIPOC faculty in your field?
- Are you serving on several departmental committees or organizing the department colloquium?

It is good that you are doing your job. Please keep doing your job.

Impacting other areas of mathematics

This seems to be a somewhat common misinterpretation of the meaning of “Broader Impacts.” *It is not at all what it means.* Please remember this. This is great for Intellectual Merit, though!

- Did you figure out how to solve a PDE using model theory?
- Do your results in algebraic combinatorics imply something about resolution of singularities?
- Does your research on division algebras have some application to the theory of machine learning?

While this might seem like a Broader Impact (one item even involves the word “machine”), it almost certainly is not.

Pretending

If you don’t have any appreciable Broader Impacts, you should be broadening yourself over time. It’s better to simply explain that you are working on expanding your Broader Impacts than to try to fake it. We all have growth areas, and growing as you progress in your career is an admirable aim. On the other hand, it is easy to tell when someone is pretending.

- Did you really just write the word “cryptography” to explain the potential Broader Impact of your research on L -functions?
- Are you planning to keep that sentence in your proposal where you ramble about the applications of mathematics throughout history?

If you would laugh (or cry or yell) at what you wrote, were it written by someone else, take it out. Since it is hard to be properly critical of one’s own writing (case in point: this article), this is an area where having a trusted critic can be helpful.

What Broader Impacts Are

Doing your job exceedingly well

Many of the items on this list go beyond what a young faculty member is expected to do. (On the other hand, by midcareer, few of these would count as a Broader Impact if they are not significantly larger in scope.)

- Have you started writing a textbook?
- Are you mentoring graduate students and postdocs?
- Are you (co-)organizing conferences and workshops?
- Are you deeply engaged in rethinking the undergraduate curriculum at your institution?
- In the course of organizing the colloquium, did you think carefully about what a colloquium should be, join with like-minded colleagues at other universities, and start a program to teach young mathematicians about mathematical communication?

Congratulations: even though these activities are closely related to your core job, they are Broader Impacts.

Teaching people

Education is not restricted to our classrooms. We can bring our expertise to society at large by teaching in a lot of different ways.

- Are you leading or teaching in one or more math circles?
- Do you direct or teach in a summer program for young students interested in mathematics?
- Are you experimenting with new methods to engage students from diverse backgrounds with mathematics?
- Are you teaching in prisons?
- Are you working on (or have you written) a popular mathematics book for a general audience?
- Are you running a MOOC with thousands of students around the world?

You are helping mathematics make a broader educational impact on the world! (Be careful with social media. It might feel meaningful, but it’s mostly shouting into the void. I’ve never seen a convincing case at an NSF panel about someone’s Twitter feed being a Broader Impact. Blogs are a potential gray area, depending upon the quality of the entries.)

Impacting other fields

While contributing to other fields of pure mathematics is usually not a Broader Impact, making meaningful contributions to applied mathematics, science, medicine, public policy, or humanities could be a good Broader Impact. This is a somewhat gray area. A purely theoretical contribution to another field (for example, algebraic geometry in string theory) may not be considered as a Broader Impact, while something that yields a concrete product (for example, a patent) will almost surely count.

- Did you figure out how to solve inverse problems that are essential in geology or medical imaging and then collaborate with scientists to do something new?
- Have you contributed to key methods that enable large-scale sentiment analysis in Old English, and coauthored several papers about Beowulf?
- Did you step away from equivariant intersection theory to work with engineers on new methods in signal analysis, resulting in IEEE papers and a patent?
That is some nice Broader Impact you have there.

Serving the profession

Mathematics is a community. Working to keep that community strong, healthy, and growing is a good Broader Impact.

- Are you running conferences aimed at improving mentoring of junior faculty at institutions large and small?
- Are you working to grow the LGBTQ+ pipeline into postdocs and faculty positions?
- Are you on an AMS or MAA committee?
- Are you doing editorial work for books or journals?
Keeping our research community strong is a societal value.

Serving society at large

Mathematicians have a responsibility to society to use what we have learned in constructive ways that support basic national values.

- Are you working to quantify bias in employment and student admissions?
- Are you working with other mathematicians to understand and quantify gerrymandering efforts? Did you submit an amicus brief to the Supreme Court?
- Are you organizing a series of public lectures on mathematics and its connections with art, music, poetry, literature, or film?

Thank you for doing that. Keep going!

ACKNOWLEDGMENTS. I received invaluable comments from Angela Gibney, Wei Ho, Aise Johan de Jong, Daniel Krashen, Michelle Manes, Davesh Maulik, Martin Olsson, Linh Truong, and an anonymous reader while I was preparing this note.

References

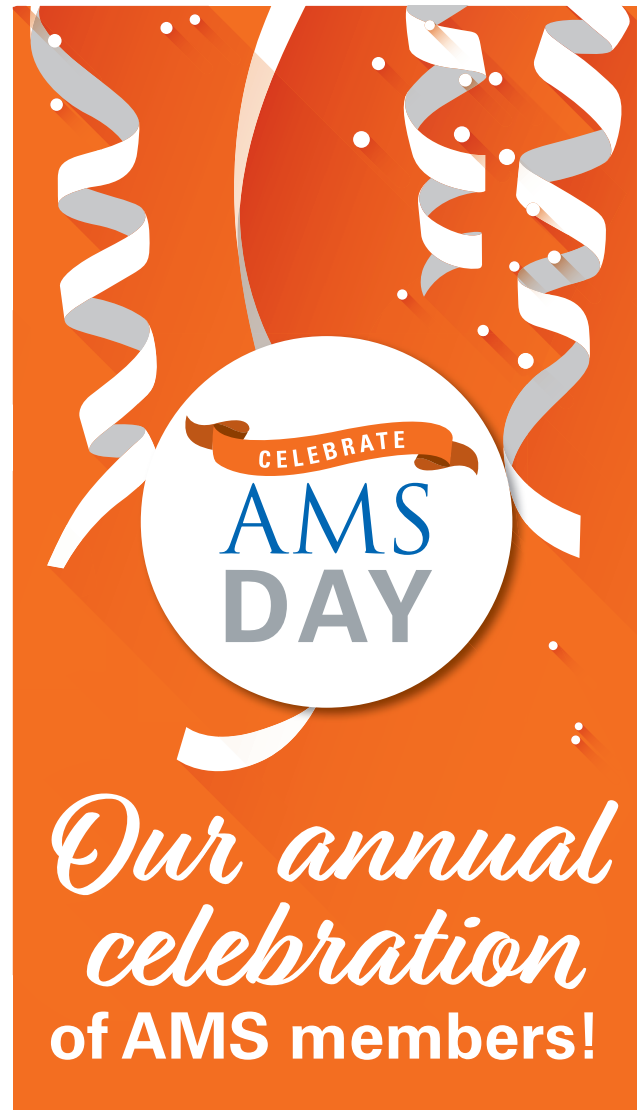
- [Mar07] Peter March, *Broader Impacts Review Criterion*, 2007.
[NSF20] NSF, *Proposal and Award Policies and Procedures Guide*, 2020.
[NSF21] NSF, *Broader Impacts, Improving Society*, 2021.



Max Lieblich

Credits

Photo of Max Lieblich is by Dorothée Brand.



Join us on Monday, **November 29th** as we honor our AMS members via “AMS Day,” a day of specials on AMS publications, membership, and much more! Stay tuned on social media and membership communications for details about this exciting day.

Spread the word
about **#AMSDay** today!

