a partial list of bridge and post-baccalaureate programs in math in the United States.

We advertise through a mix of email, social media, and word of mouth. We maintain a list of participants from past lunches and are able to email reminders about upcoming meetings and advertise on online platforms like the Algebraic Geometry Discord channel (as both organizers are algebraic geometers). Additionally, participants advertise to their departments and colleagues.

How to Start Conversations

Our primary goal with "Lunch in the Time of Covid" was (and still is) to start conversations about issues that are affecting young mathematicians. With this in mind, each lunch starts as a panel discussion but slowly becomes a broader discussion where anyone can contribute. No matter your time constraints as an organizer of an event like this, it is wise to include time near the end for the audience to make their voices heard. This can be a formal Q&A, perhaps with questions collected throughout the panel as many webinar platforms allow, or a more informal call for audience members to chime in. (In the spirit of our more informal format, we opted for the latter with great success.) Fortunately, all of the lunch topics after the first week were suggested by past audience members, so we can say with confidence that our audience is passionate about being involved and sharing their experiences.

We have been very open about our own limitations—both organizers are white and have a postdoctoral position. For this reason, we make extra efforts to invite panelists and participants that have different experiences than us. Early on, we began reaching out to trusted mathematicians in our lives who, in one way or another, are not traditionally represented at these types of events. We asked them who would make a good panelist, what topics we should not neglect, and generally how we were doing so far. We have received valuable advice at every step of the way, and continue to benefit from the wisdom of these peers and mentors. Beyond broadening the conversation, we want to send a clear message that all are welcome in these conversations. For anyone who is considering planning a similar event in the future, we encourage you to think early and often about *who* your audience is and *how* you are serving their needs.

How to Keep the Momentum Going

After the first week, all of our topics have been developed from audience suggestions. Often, a participant shares their passion and experience for a particular topic and they are able to serve as a panelist in a future lunch. This is one of the real strengths of an event series, as opposed to a standalone event: we have been able to dedicate time and future events to focus on important topics brought up by the audience. However, even with a one-time panel, you can solicit feedback ahead of time. As with all things organizational, reach out to people you trust to diversify your perspective on what is important and what should be emphasized. Furthermore, as one participant pointed out, planning an event like this *with someone*, particularly someone whose background or viewpoints are different than your own, is good experience for the types of collaboration and service that you will be doing the rest of your career.

In Conclusion

Based on participant and panelist feedback, "Lunch in the Time of Covid" has been an essential series of conversations for many early-career mathematicians. Both organizers saw a need for an online community to discuss what things are really like during a global pandemic. We encourage anyone who sees a similar need in their community to follow our model (or their own path!) as we continue to face the challenges brought on by the COVID-19 pandemic.

One of the unique benefits of going virtual during the global pandemic has been the ability to host these lunches for participants across many branches of mathematics and start conversations and community-building that would be unlikely to happen otherwise. Even as the world recovers from COVID-19, we believe in the importance of these informal discussions and hope to inspire others to start something similar.


Kristin DeVleming


Andrew Kobin

Credits

Photo of Kristin DeVleming is courtesy of the author.
Photo of Andrew Kobin is courtesy of the author.

Unconscious Bias in Academic Mathematics

Danny Krashen

In recent years, as a society, we have made significant progress at reducing explicit sources of bias. We now understand that we cannot explicitly discriminate on the basis of gender, race, and other protected categories in a range of situations. On the other hand, it has also become strikingly

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clear that despite this progress, bias still exists in our society, and this has highlighted the importance of being aware of systemic and unconscious (implicit) bias. Here, I would like to primarily focus on unconscious bias. This is much more subtle than explicit bias, as it is intrinsically connected to the ways in which we see the world, and assumptions we make without knowing it.

Academic life involves fairly constant evaluation of others, whether it is the grading of student exams, reading applications to graduate school, peer review of articles, or evaluation of grant applications, we seem to always be making judgments, often of great consequence to others. In each of these situations of evaluation, I have had to deal with unconscious bias in myself as well as in others. Understanding this bias is important for those of us whose decisions directly affect those entering our field. It is equally important for early-career mathematicians to understand the culture they are entering, with its pitfalls and complexities.

Unconscious bias can be difficult to deal with because it is... unconscious.

On the other hand, this statement also highlights the principal tool we have to mitigate it: making more things conscious and explicit. While it would be nice to be able to completely rid ourselves of the tendency towards bias, I can't envision any constructive way of moving towards this. Instead, I would suggest that by making processes more public and transparent to scrutiny by ourselves and others, we can make real and substantial progress towards reducing the negative effects of bias in practice.

How does unconscious bias arise? Let me start with an example. Let's imagine how I might evaluate a new job candidate at my department. While this may not be the case for many others, from my own experience as a faculty member at more than one university, I have never received any particular instructions on evaluation criteria for new job candidates. Therefore, my typical process used to be something like this. I would browse through their job application, letters, and their work online, see them give a talk, and maybe have lunch with them when they come for a campus interview. Perhaps the following day, I would vote in a departmental hiring meeting based on my "gut" feeling about them as a candidate. This would be based on a combination of how impressive their work was, how well I imagined they would fit in with my department, combined with my ability to visualize them as a colleague. This internal imagination and visualization carries quite a lot of weight, and it is, in its nature, unexamined. We are not well equipped to ask questions such as "Why does this person feel impressive, while this other person doesn't?" More often, we simply look to confirm our intuition, generally using details of the applications or our interactions with them, or consonant opinions of our colleagues. We thereby grant ourselves further license to leave our methods unexamined.

The main point here is that there may be a large number of reasons that a candidate feels "impressive" and these may have a lot to do with factors such as gender, race, and many other things, which if made explicit, would be somewhat horrifying to most of us. I know that I have fallen into this at various points in the past—making assumptions about other people based on my "gut feeling," without realizing that this feeling was an effect of their gender or racial identity and my own bias.

As a mathematician, I feel that my training has made me particularly vulnerable to this. In mathematics, we are trained to hone our intuition and imagination to seek out pattern and truth, and then use formal logical arguments to establish what we find. Unfortunately, in the real world, this often amounts to: go with your gut and then rationalize. Practical problems, such as hiring decisions, require a different process entirely.

How do we mitigate bias? One useful strategy is to minimize the unconscious influence by establishing predetermined criteria for our decision making. This need not be overly formal, and *for a job candidate* may simply include such factors as: high quality research contributions, establishment of a long-term research program, synergy of research area with departmental interests, and success mentoring graduate students, postdocs (and probably more things as well). Of course these are fuzzy concepts, particularly from the point of view of a mathematician; however, the point is not that we can pretend to accurately "measure" these things, but rather that these things are what we have decided are of value to us, and these things should explicitly guide our discussion and evaluation. When comparing two candidates, we can then think more about "do they have high-quality research contributions?" and less about "do I feel like they seem really smart/strong?"

The National Science Foundation, in its grant reviewing panels, does a fairly good job at this by presenting criteria against which applicants are judged. While not perfect, and perhaps it is the nature of group dynamics that perfect solutions are not realistic, such a setting still prevents the more egregious abuses.

We see the same pattern throughout various other evaluations we perform in academia.

When grading an exam, do we first look at the numerical scores, and then try to "feel" what a passing score is like, based on our impressions of the students. If so, we are setting ourselves up for unconscious bias. We can prevent this by deciding on what criteria we should look for for particular letter grades, deciding in advance roughly what kind of a score should correspond to which letter grade. These can be modified if we realize later that the exam was not as well written as we wanted, and some problems were harder or easier than we had assumed, but starting with some idea of how grades will work is essential.

When accepting students into a graduate program, it is tempting to focus on numerical scores, such as GRE subject

exams, the pedigree of schools, and status of letter writers. While these are not irrelevant data points, in order to prevent bias, it is important to start by asking what kinds of things we are looking for evidence of. We may be looking for evidence of strong background knowledge, of ability to do creative research, and/or intellectual independence and maturity. We can then consider the various pieces of evidence within the application towards these ends. For example, we can ask: what does a particular GRE score tell us about one's ability to do creative research? Or about their general background knowledge? In fact, evidence seems to show that it only gives very limited information about these things, and does it in a way which is very much skewed along gender and racial lines. In using this for evidence, one therefore needs to take these factors into account, or, as many are doing, ignore these scores entirely. Such criteria can also be very helpful in reading letters of recommendation. Letter writers often exhibit a range of biases themselves, and as we read such letters, we have to constantly consider how their narrative helps or doesn't help us evaluate a candidate according to our criteria in order to protect ourselves against their biases.

How do we know these things? While I am compelled to point out that I am speaking beyond my own expertise, nevertheless, the questions I've sought to address here, on how to address bias in various aspects of academic life, are not beyond our ability to answer. These are questions of social science, which various people have endeavored to study and provide some answers. Below I'll point out just a bit of the literature that I've looked at which relates to some of the assertions I've made here.

There are many studies of *unconscious bias in hiring*, which suggest the adoption of explicit criteria (evidence-based approaches to hiring). While not specifically about academia, this article summarizes various studies and points to explicit and transparent evaluation criteria as a method to reduce implicit bias in hiring and promotion: https://doi.org/10.1111/0022-4537.00234.

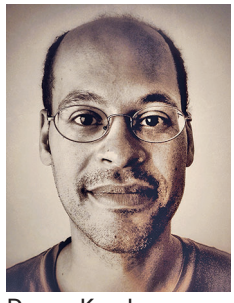
It does seem to be true that awareness of bias lessens its effects, as was discussed here: https://doi.org/10.1038/s41562-019-0686-3. However, we should not imagine implementing formal training for all of us to "remove bias" will necessarily solve the problem. To this effect I'd point out this nice review: https://doi.org/10.1146/annurev.psych.60.110707.163607, which highlights a real lack of evidence of efficacy of such programs.

The resistance of people to implement procedures to reduce bias has also been documented: https://doi.org/10.1108/02683941111138985.

Gender bias in letters of recommendation is something which needs to be taken into account. This has been discussed in a number of places in the literature. I found these articles informative: https://doi.org/10.1037/a0016539 and https://doi.org/10.1038/ngeo2819.

As we look for unbiased criteria for graduate students, *GRE subject scores seem problematic*. While I haven't found data on the math subject score as a predictor of success, the usefulness of subject tests has been examined in general as well as in physics in particular. While moderate positive correlations seem to exist between GRE subject scores and grades during the first year of graduate school (https://doi.org/10.1037/0033-2909.127.1.162), it didn't seem correlated to other measures of success for physics graduate students (https://doi.org/10.1126/science.274.5288.710). Besides this, evidence that GRE subject scores in physics suffer from gender bias is discussed in various places, for example: https://www.aps.org/publications/apsnews/199607/gender.cfm.

These studies really just scratch the surface of a literature in which I am still largely uninitiated; however, I believe that they do serve to illustrate that these are ideas whose validity can be reasonably explored, tested, and refined as we try over time to make the moral arc of our profession bend towards inclusion.



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Rethinking the Teaching and Learning of Mathematics in Light of COVID-19

Della Dumbaugh and William McCallum

Viewing the Pandemic as an Opportunity

During the spring of 2020, COVID-19 prompted the nonprofit Bill McCallum cofounded, Illustrative Mathematics (IM), to put considerable energy into developing resources

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