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The Odds That a Panel Would 'Randomly' Be All Men Are Astronomical

One mathematician's formula suggests that all-male lineups don't "just happen," despite what conference organizers might claim.

Steve Marcus / Reuters

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All-male speaker lineups are so commonplace that there's at least one Tumblr blog [dedicated to mocking them](). The endless stream of them can leave one

overwhelmed and perhaps even convinced that they're inevitable.

Enter the mathematician Greg Martin, who has devised a statistical probability analysis that even amateurs can (mostly) understand. Working with a "conservative" assumption that 24 percent of Ph.D.s in mathematics have been granted to women over the last 25 years, he finds that it's statistically impossible that a speakers' lineup including one woman and 19 men could be random.

His explanation of the formula is a rollicking one involving marbles and a potentially suspicious roommate. The underrepresentation of women on speakers' lists doesn't "just happen," despite many conference organizers' claims that it does.

After doing the math, as Martin has, the argument that speakers are chosen without bias simply doesn't hold up. In fact, when using the formula to analyze the speakers' list for a mathematics conference—which featured just one woman and 19 men—he found that it would be five times as likely that women would be overrepresented on the speakers' list than underrepresented.

The formula can just as easily be applied to other fields; all that's needed is reliable data on the field's gender distribution, which can usually be gathered by way of industry associations and/or government statistics.

I spoke with Martin about his analysis, its implications, and whether it might finally convince conference organizers to stop making excuses.

Lauren Bacon: What prompted you to calculate the statistical probability of all-male speakers' lists?

Greg Martin: While I'd love to claim it was my idea originally, that's not the case—I came across a Conference Diversity Distribution Calculator by Aanand Prasad on the web. Prasad further credits inspiration for the idea to comments by Dave Wilkinson and Paul Battley.

As a side note, following Prasad's links to those comments leads to two web pages —this one and this one—concerning tech conferences within the last three years that were criticized for inviting men almost exclusively; reading the rest of those comment threads reveals how truly dismissive and defensive people get when gender disparity is pointed out. Sadly, we still have a long way to go.

Bacon: If I understand your conclusion correctly, the odds of having zero women speakers at a math conference are next to none.

Martin: If conference speakers were being chosen by a system that treated gender fairly (which is to say, gender was never a factor at all), then in any conference with over 10 speakers, say, it would be extremely rare to have no female speakers at all— less than 5 percent chance, depending on one's assumption about the percentage of women in mathematics as a whole.

Turning that statement around, we conclude that any such conference without any female speakers must have come into being in a system that does not treat gender fairly.

Bacon: So then why do so many STEM events still have so few women at the front of the room?

Martin: There are many possible reasons why a STEM event might have vanishingly few women among its speakers. Outright sexism and misogyny are rare these days (I hope!), but it still happens. Much more common, I believe, is that all of us carry implicit biases—internal prejudices, difficult to detect in any individual instance, against the idea that women can excel in science and math. These biases have been shown to literally alter our perception of women in STEM fields, so that we evaluate them as being less accomplished as men with identical CVs. This (unintentionally) unfair evaluation of women by conference organizers, together with the psychological tendency to first call to mind stereotypical representatives of categories (for example, male mathematicians), lead them to come up with speaker lists consisting disproportionately of male speakers.

Unless we consciously try to observe the gender composition at conferences, the same biases cause us not to even notice that there are far too few women to be the result of a fair process; and so the injustice is perpetuated.

Bacon: In the technology sector, there's an almost evangelical adherence to the religion of meritocracy, no matter how many studies come out proving that we all have unconscious biases—and therefore, so do the structures and processes we create (like job postings, university programs, and calls for speakers). Is that true in the math world? What would you tell event organizers who argue that they're not trying for a random selection of speakers, but are simply choosing the best (however that's measured)?

Martin: The idea of meritocracy is very much a part of mathematical culture—both that meritocracy is the desired state of our discipline and (more implicitly) that it is also the state of our discipline in practice. Unfortunately, as the aforementioned research into implicit bias shows, in practice we are not really that good at fairly evaluating people's success independent of cultural prejudices like gender (and ethnicity and age and affiliation...).

When addressing an event organizer (or anyone) who on meritocratic grounds opposes paying attention to gender, the crucial step is to draw explicit attention to their underlying assumption: they are assuming that the current system is purely meritocratic *in practice*, and that efforts to introduce gender into the decision-making is necessarily an *addition* of unfairness. Helping someone learn by presenting them with the truth, after all, will never work if they already have a conflicting falsity in their minds.

So I think it is important to assert explicitly that the current system, in practice, is flawed and systematically biased, and that efforts to introduce gender into the decision-making is actually a *subtraction* of unfairness—an effort to bring reality closer to the theoretical meritocracy we all desire.

Bacon: One of the more compelling points you make in your analysis is that if speakers' lists were truly selected without bias, we would be 18 times more likely to see an overrepresentation of women speakers than an underrepresentation. Have you ever seen a speakers' list (at an event not geared specifically towards women, that is) that leaned heavily in favor of women?

Martin: That's a great question, and I do not remember ever being in that situation —being at a conference where over one third, say, of the speakers have been

women, much less over half (depending on how one interprets "leaned heavily").

The January Joint Meetings of the American Mathematical Society and the Mathematical Association of America tend to have a decently large percentage of women speakers, between 25 percent and 30 percent. However, there are internal stratifications in place: the more prestigious a speaking position or session is, and the more it is associated with hardcore mathematical research, the smaller the percentage of women speakers.

There is also a significant correlation of the gender composition of a session's speakers with the presence of one or more women on its organizing committee—these sessions have nearly twice as many female speakers on average.

It's therefore important for us to realize that implicit bias doesn't just affect sheer numbers of speakers, it also affects whether we select them for, say, keynote spots or supporting roles.

Bacon: How do you hope people will use your statistical probability formula?

Martin: In my mind, using this sort of calculation has limited effectiveness as a proactive tool. Changing from the real-life situation to a probabilistic model is quite an imperfect process, and people can rightly criticize details of that change to the point where the underlying message is obscured. However, when people choose to resist the idea of gender inequity based on probabilistic statements ("having few women just happens by chance"), then they're the ones holding out the petard to be hoisted by. I like the idea of using this probabilistic tool in response to such statements—"Ah, well, if *you* are going to suggest that probability is the right way to examine the situation, let's see how that works out for you...!"

ABOUT THE AUTHOR

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