Editors' Vox

Perspectives on Earth and space science: A blog from AGU's journal editors

Who Are Your Collaborators?

Analyzing how people collaborate in AGU's meetings and publications according to gender, age, and ethnicity provides clear evidence for diversifying networks and collaborating with new people.

Poster Hall at AGU Fall Meeting. Credit: Event Photography of North America Corporation

By Paige Woodenon 7 May 2020

Think about your scientific colleagues – those in your research team, those you write papers with, those in your immediate network. How do these groups form? Maybe they're influenced by the hiring practices of your institution, the research projects you choose or are assigned to you, or the location of the meetings you attend. Are your collaborators people just like you? Do you actively seek out opportunities to make new connections and diversify your network? Could the demographics of your network affect your career and your collaborators' careers?

We all want science to be more diverse and inclusive. We want people who are under-represented and historically excluded to have a greater presence and a louder voice, and to be free of underlying biases that slow this progress. But making that a reality takes awareness and effort. AGU is committed to greater diversity, equity, and inclusion in the Earth and space sciences and embodying that in our organization. We have devoted additional efforts in the past few years, best illustrated by AGU's Ethics and Equity Center initiatives, appointment of an AGU Diversity and Inclusion Advisory Committee, and adoption of a new Diversity and Inclusion Strategic Plan (https://www.agu.org/Learn-About-AGU/About-AGU/Diversity-and-Inclusion). But how are we doing in practice?

Where did the data come from?

We analyzed how people interact as co-authors, looking for patterns by gender, age, and ethnicity.

We analyzed how people interact as co-authors, looking for patterns by gender, age, and ethnicity. We have a treasure trove of information: about 25,000 annual abstracts for our annual meeting, 15,000 annual submissions to our journals, and close to 100,000 members or others who have provided gender, age, and ethnicity over the recent years.

Who is connected with whom? How are connections associated with successful publication and citation?

Stripping out all personal identifying information, we looked at who is connected with whom, and how these connections are associated with successful publication and citation. Having

age data is critical for separating out the historic decreased participation of women and minorities in the Earth and space sciences.

Our results were published recently in two articles. The first, Age, Gender, and International Author Networks in the Earth and Space Sciences: Implications for Addressing Implicit Bias (https://doi.org/10.1029/2019EA000930) [*Hanson et al., 2020*], used AGU Fall Meeting abstracts from 2014 to 2018, which provided 400,000 unique author-author connections and allowed us to construct co-author networks by age, gender, and country. The second, Association between Author Diversity and Acceptance Rates and Citations in Peer-reviewed Earth Science Manuscripts (https://doi.org/10.1029/2019EA000946) [*Lerback et al., 2020*], analyzed 91,000 submissions to AGU journals from 2012 to 2018, which included 440,000 authors. This data set was used to compare levels of diversity among groups of authors to acceptance and citation rates.

What did we find?

Men and women in all age cohorts tended to be most connected with those around the same age, the exception being those in their 20s.

What did we discover about these author networks? In terms of the annual conference, we found that men and women in all age cohorts tended to be most connected with those around the same age, the exception being those in their 20s whose networks were weighted towards colleagues 10-20 years their senior. Women's networks tended to include equal (or slightly higher) proportions of women within each age group, while men's networks included fewer women.

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Younger people had a higher 'rate of insularity'— that is, the proportion of their collaborators from their own country. Older age cohorts tended to have more international networks. The rate of insularity was highest among scientists from the United States and Japan, and lowest among scientists from Switzerland, Netherlands, and Spain. With a few exceptions (Canada, UK, Switzerland) women's networks were generally more insular than those of men.

And what did we discover about the scientists who have published articles in our journals? Looking specifically at papers with two to four authors (because large author teams are typically more diverse), we found that 32% of author teams were international, 10% were multi-gender, and 91% were multi-career stage teams.

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Papers with internationally diverse author teams had higher acceptance and citation rates than single-nation team papers, while gender diverse teams had higher acceptance rates but lower citation rates than single-gender team papers.

Though the analysis of ethnic diversity only applies to U.S. authors (6% of the submissions in our data set), racially/ethnically diverse teams had lower acceptance rates and lower citations but the latter was not statistically significant.

What does this mean for particular cohorts?

Our findings about the characteristics of networks suggest that age-affinity bias coupled with gender bias could be a double-whammy for younger female scientists.

Our findings about the characteristics of networks suggest that age-affinity bias (people interacting more with those from the same age cohort) coupled with gender bias (men interacting more with men than women) could be a double-whammy for younger female scientists who need to develop a strong network of collaborators to advance their research and careers. This is a concern as younger women make up a significant proportion of AGU's membership.

A triple whammy is that women are often not equally placed to take advantage of opportunities to collaborate internationally compared to their male counterparts.

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Meanwhile, our findings about the characteristics of author teams show that gender and international diversity can positively impact science, but there is still bias with regards to

ethnic and racial diversity, which has also been recently highlighted in other studies. This bias may be occurring at the time of peer review and/or prior to peer review as underrepresented minorities navigate and advance in their STEMM careers.

While the study was possible in the Earth and space sciences thanks to the great information provided by AGU members, these findings likely extend to other disciplines.

What next?

Analyzing this data set has been challenging and fascinating. It has given us a quantitative snapshot of how Earth and space scientists interact with one another through AGU's annual meeting and publications program. This is vital as we seek to deliver our goals for diversity and inclusion.

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But our data came from you and your behavior; it was an analysis of your coauthors, borne out of your collaborations and networks. The commitment to increasing diversity and inclusion in our science rests on us all. Next time you reach out to someone to collaborate or provide input on hiring or lab assignments, ask yourself: Could we be more diverse? Whose voice is missing from this group? Could my research be enriched with a perspective from someone new?

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