Gender bias in scholarly peer review

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Map out *interactions* between scientists

All authors are physicists / neuroscientists

study network layouts to learn about interactions between nodes

use data-driven (model-free) statistics to test significance of findings (randomization)

Today: take you through the process of validating the findings

Trust in the data makes for compelling arguments.

Analysis is readily generalized and easy to implement.
Dataset

- Open peer-review
  Editor and reviewers are published

- Wide range of topics (59 journals)
  representative of the scientific community
  from Nutrition to Artificial Intelligence

- 41k articles  126k authors  43k reviewers  9k editors
Open information on editor and reviewers

ON THE GENDER–SCIENCE STEREOTYPES HELD BY SCIENTISTS: EXPLICIT ACCORD WITH GENDER-RATIOS, IMPLICIT ACCORD WITH SCIENTIFIC IDENTITY

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Women’s representation in science has changed substantially, but unevenly, over the past 40 years. In health and biological sciences, for example, women’s representation among U.S. scientists is now on par with or greater than men’s, while in physical sciences
Retrieve information on gender

Algorithmic assignment based on name databases
http://japanese.about.com/library/blgirlsname_[a-z].htm,
http://japanese.about.com/library/blboysname_[a-z].htm
http://www.top-100-baby-names-search.com/chinese-girl-names.html,
http://www.top-100-baby-names-search.com/chinese-boys-names.html
http://www.babynames.org.uk
US census data (https://www.ssa.gov/oact/babynames/limits.html)

we hand-checked random subset 1053 scientists (app. 1%)
searched on the web (home institutions, linked-in, research gate)
found gender-associated expressions for 924 scientists (“he”, “professoressa”)

confirmed algorithmically assigned gender in 96%
A network of scientists – and interactions

“writes paper with”
or
“reviews paper of”
or
“assigns review to”
Underrepresentation of women

fraction of women among authors: 38%
reviewers: 29%
editors: 26%
Trend towards equity
Gender bias in different fields

Fraction of women

- Authors
- Editors
- Reviewers
A network of scientists – and interactions

Remove Self-assignments from the editor → reviewer network
A network of scientists – and interactions

Zero Hypothesis: the graph is result of gender-blind interactions
Test: keep the network edges (structure) and randomize the gender labels
..... thousands of times
Fewer contributions from women
Homophily in editor–reviewer interaction

Editors prefer to appoint reviewers of same gender → Homophily

Baseline homophily? i.e. caused by inhomogeneous network composition?

OR

Inbreeding homophily? i.e. caused by biased choices
Analysis of *local* network

Define scientific neighbourhood

- by scientific topic

- by network distance “can be reached in 5 steps or less”

Compare editors choice with the *randomized* choice in the *neighbourhood*
Inbreeding homophily across scientific fields

homophily also in fields with weaker gender bias
Inbreeding homophily in neighbourhood

homophily also in fields with weaker gender bias
Widespread homophily amongs men

Few women show pronounced same gender bias
More men show this bias

Probability to reproduce the editor’s gender preference through random selection from neighbourhood

same gender overrepresentation

same gender 50%
Summary

• Large, multidisciplinary dataset (accepted papers only)

• Underrepresentation of women across scientific fields and across roles (authors, reviewers, editors)

• Slow trend towards equity

• Same-gender preference amongst women and men

• Data analysis with randomized controls

• Heterogeneity of scientific fields taken into account

• Analysis is straight forward. Implementation and interpretation is simple.

• Allows for system-wide and personalized feedback.
Suggestions

Journals should use our metrics for continuous evaluation.

| Intervention                           | Pro                                      | Contra                                                              |
|----------------------------------------|------------------------------------------|----------------------------------------------------------------------|
| Quota                                  | Enforcement possible                      | Enforcement necessary → creates unintended counter dynamics          |
|                                        | Readily evaluated                         |                                                                       |
|                                        | Potentially fast effects                  | Does not address homophily                                           |
|                                        |                                          | Undermines meritocracy                                              |
|                                        |                                          | Neglects baseline homophily                                          |
| Nudging, raising awareness of the bias | Potential to change culture               | Slow effect                                                          |
|                                        | Addresses homophily                       | Takes effort to be done well                                         |
|                                        |                                          | Limited effect                                                       |
| Internal and public bias reports       | Public pressure                           | Possibly zero result                                                 |
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