



MPI for Dynamics and  
Self-Organization

**Bernstein Centers  
Göttingen**



# **Gender bias in scholarly peer review**

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Andreas Neef, Demian Battaglia

# 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

OPEN ACCESS

**Edited by:**

Stephen J. Ceci,  
Cornell University, USA

**Reviewed by:**

David I. Miller,  
Northwestern University, USA

Meredith Meyer,  
Otterbein University, USA

Sarah-Jane Leslie,  
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**Specialty section:**

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a section of the journal  
Frontiers in Psychology



## 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

Name  Gender

*Algorithmic assignment based on name databases*

*[http://japanese.about.com/library/blgirlsname\\_\[a-z\].htm](http://japanese.about.com/library/blgirlsname_[a-z].htm),*

*[http://japanese.about.com/library/blboysname\\_\[a-z\].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>)*

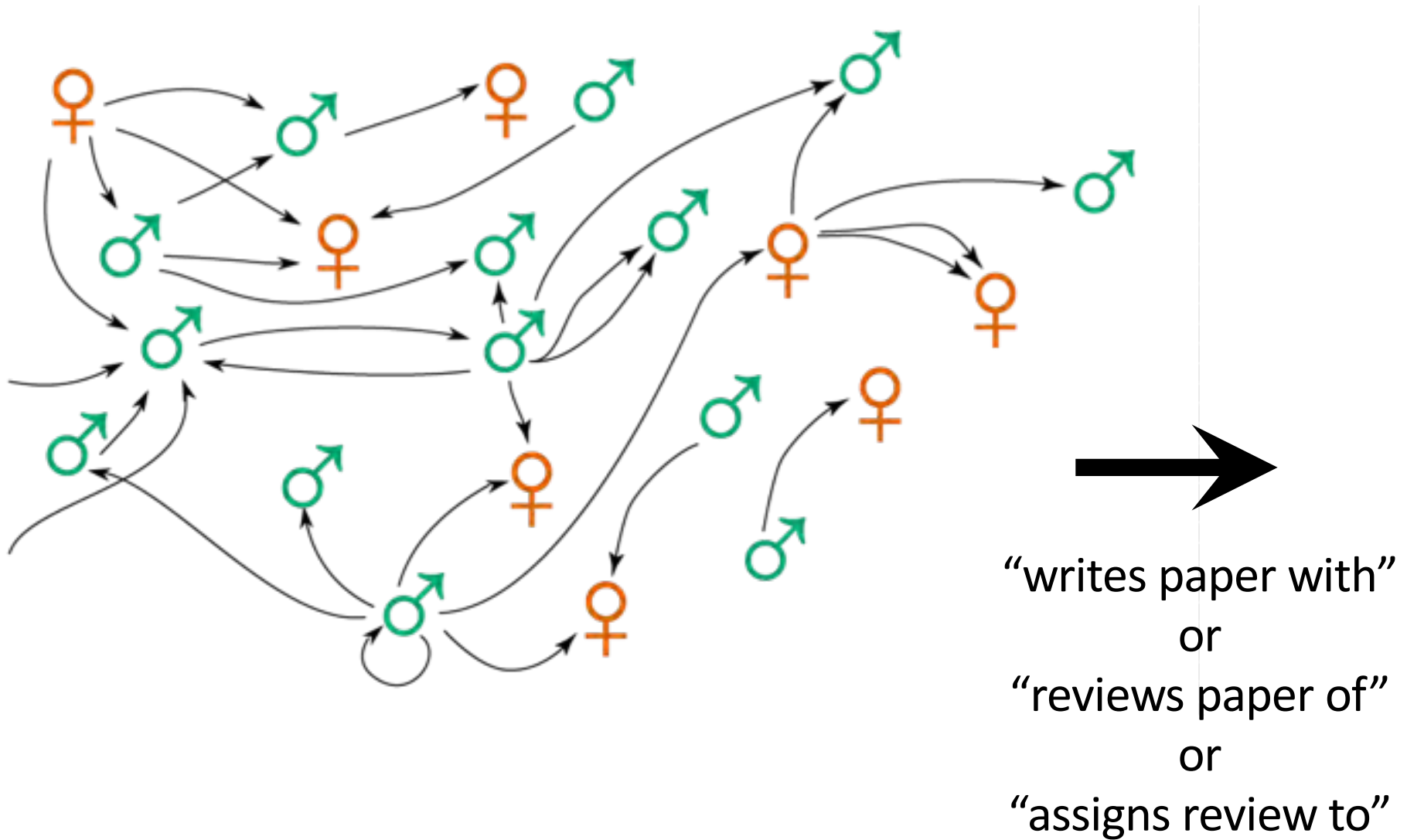
we hand-checked random subset 1053 scientists (app. 1%)

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%

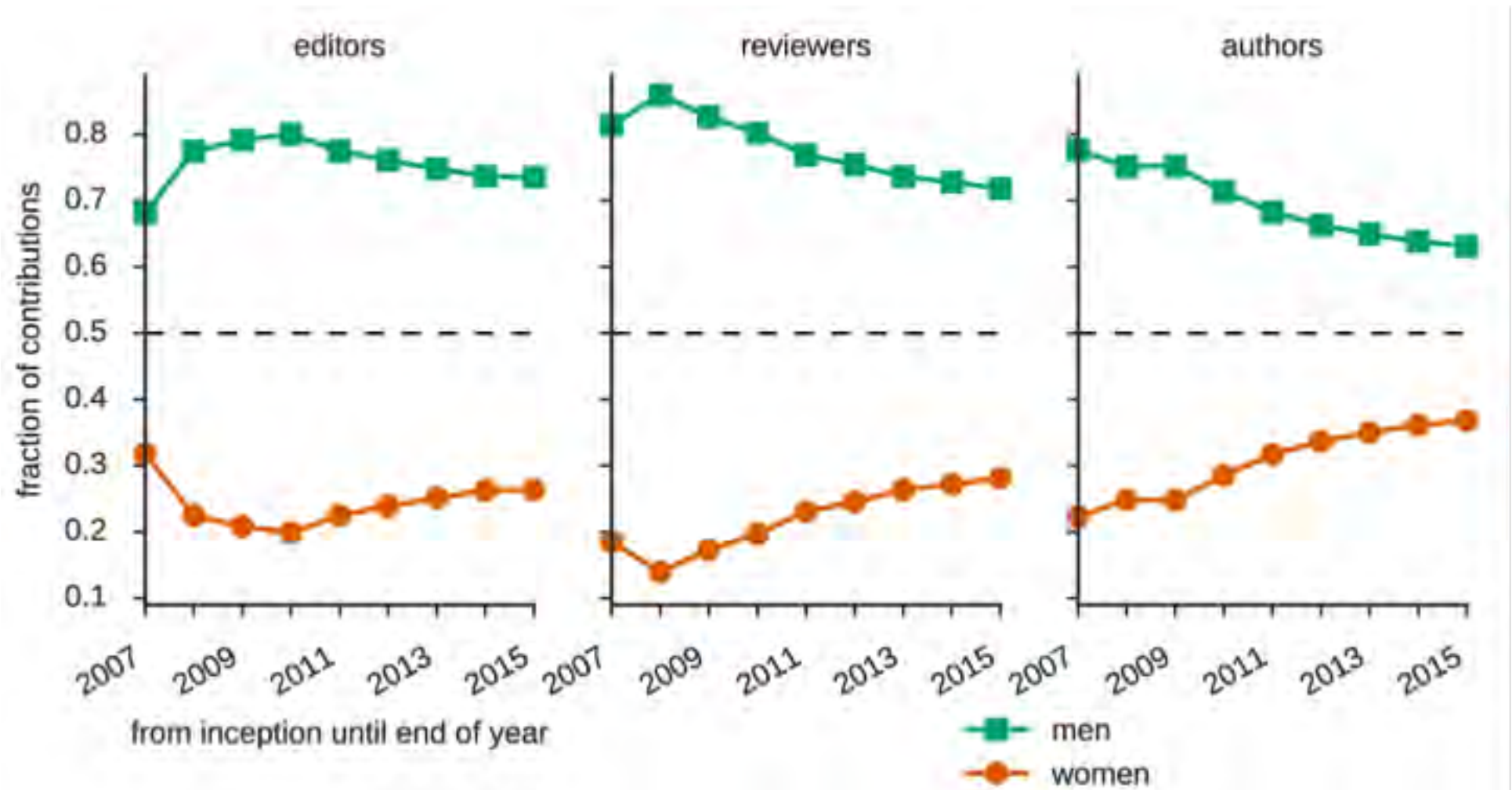
# A network of scientists – and interactions



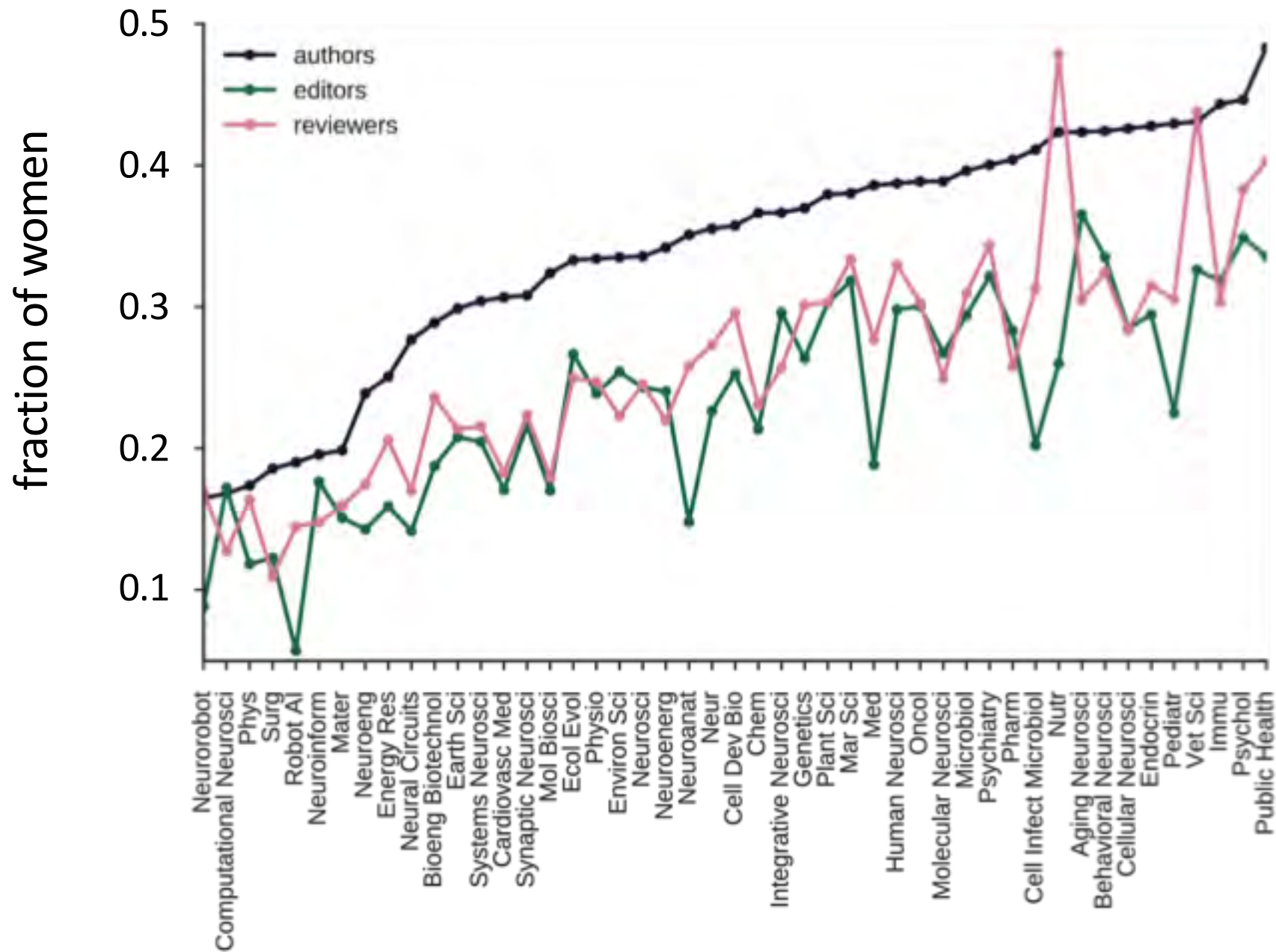
# Underrepresentation of women

|                         |            |     |
|-------------------------|------------|-----|
| fraction of women among | authors:   | 38% |
|                         | reviewers: | 29% |
|                         | editors:   | 26% |

# Trend towards equity



# Gender bias in different fields



# A network of scientists – and interactions



Remove Self-assignments from the editor → reviewer network

# A network of scientists – and interactions



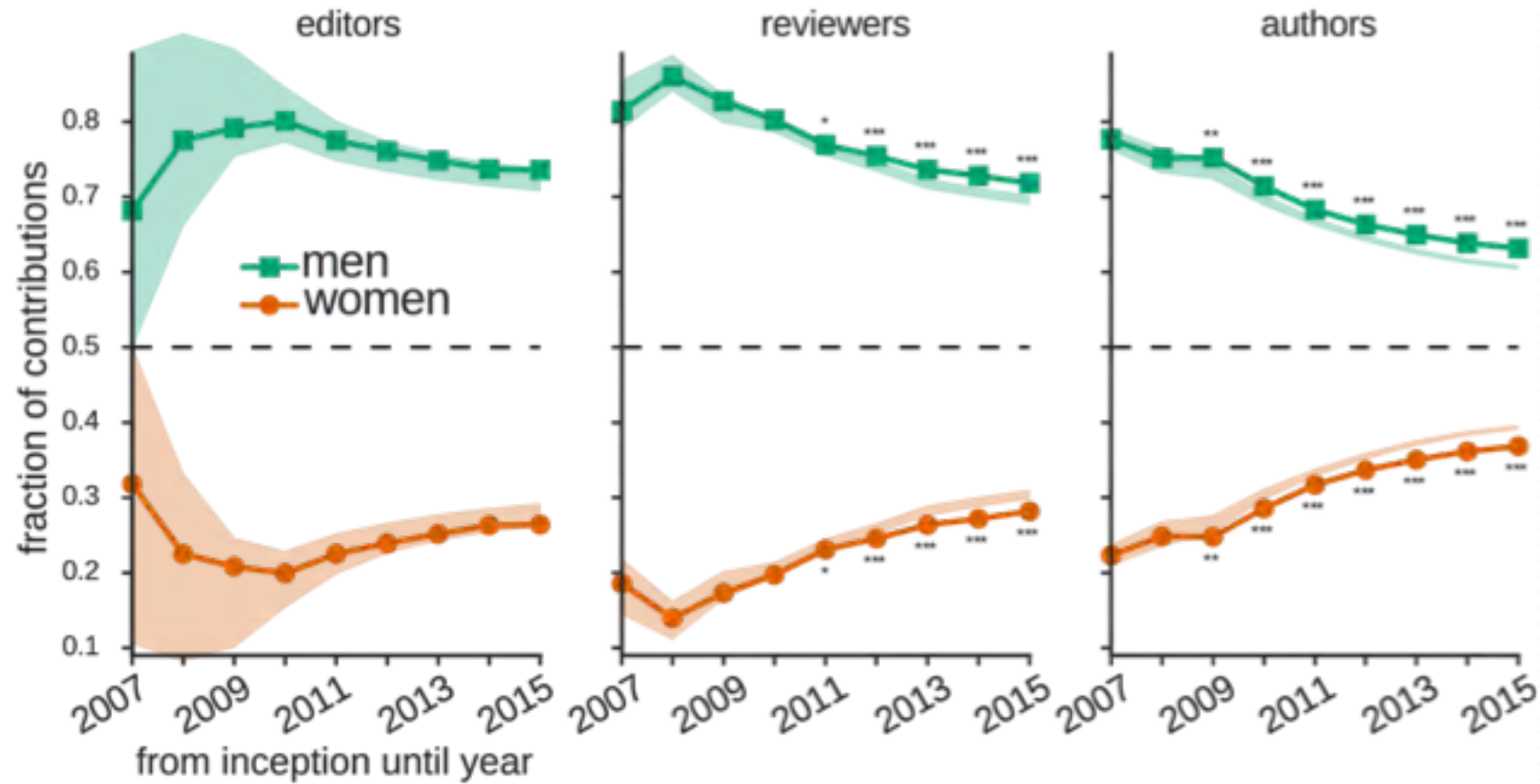
Does the structure of interactions reflect bias of the node choices?

Zero Hypothesis: the graph is result of gender-blind interactions

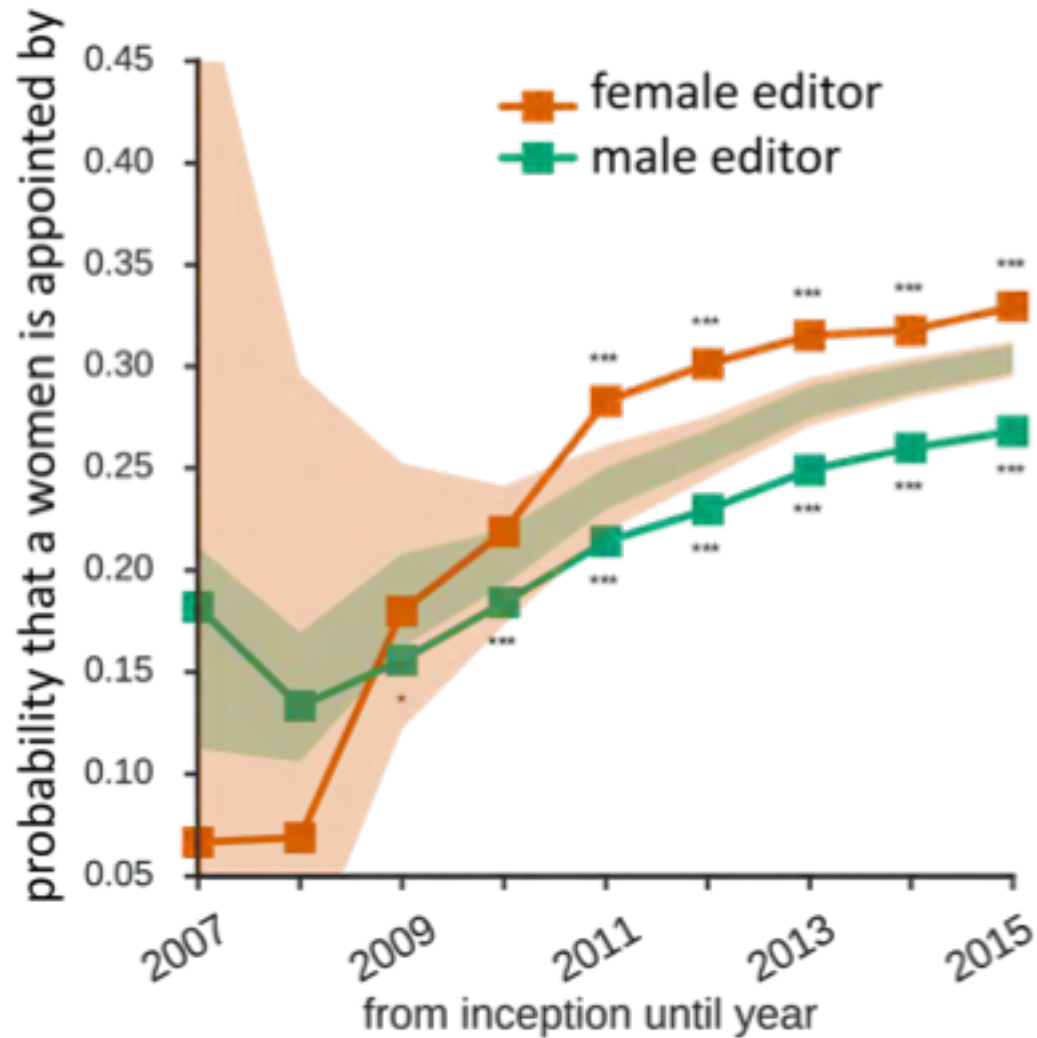
Test: keep the network edges (structure) and  
randomize the gender labels

..... 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

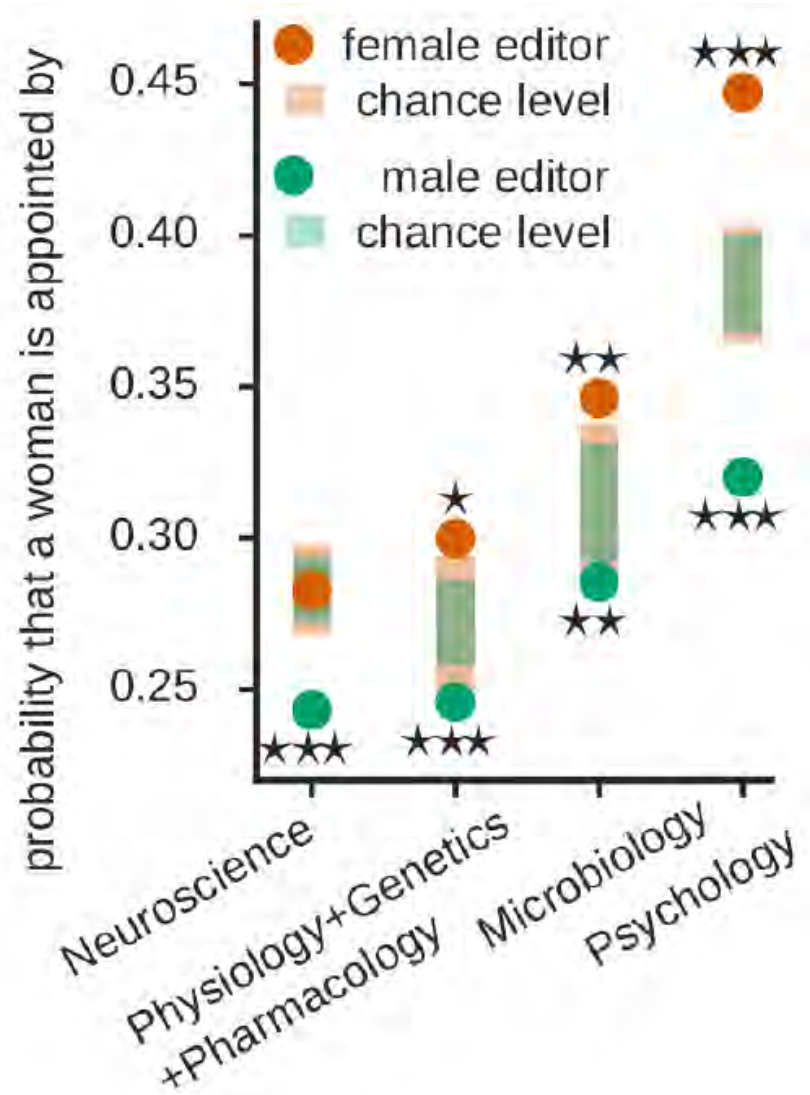
# Analysis of *local* network

Define scientific neighbourhood

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

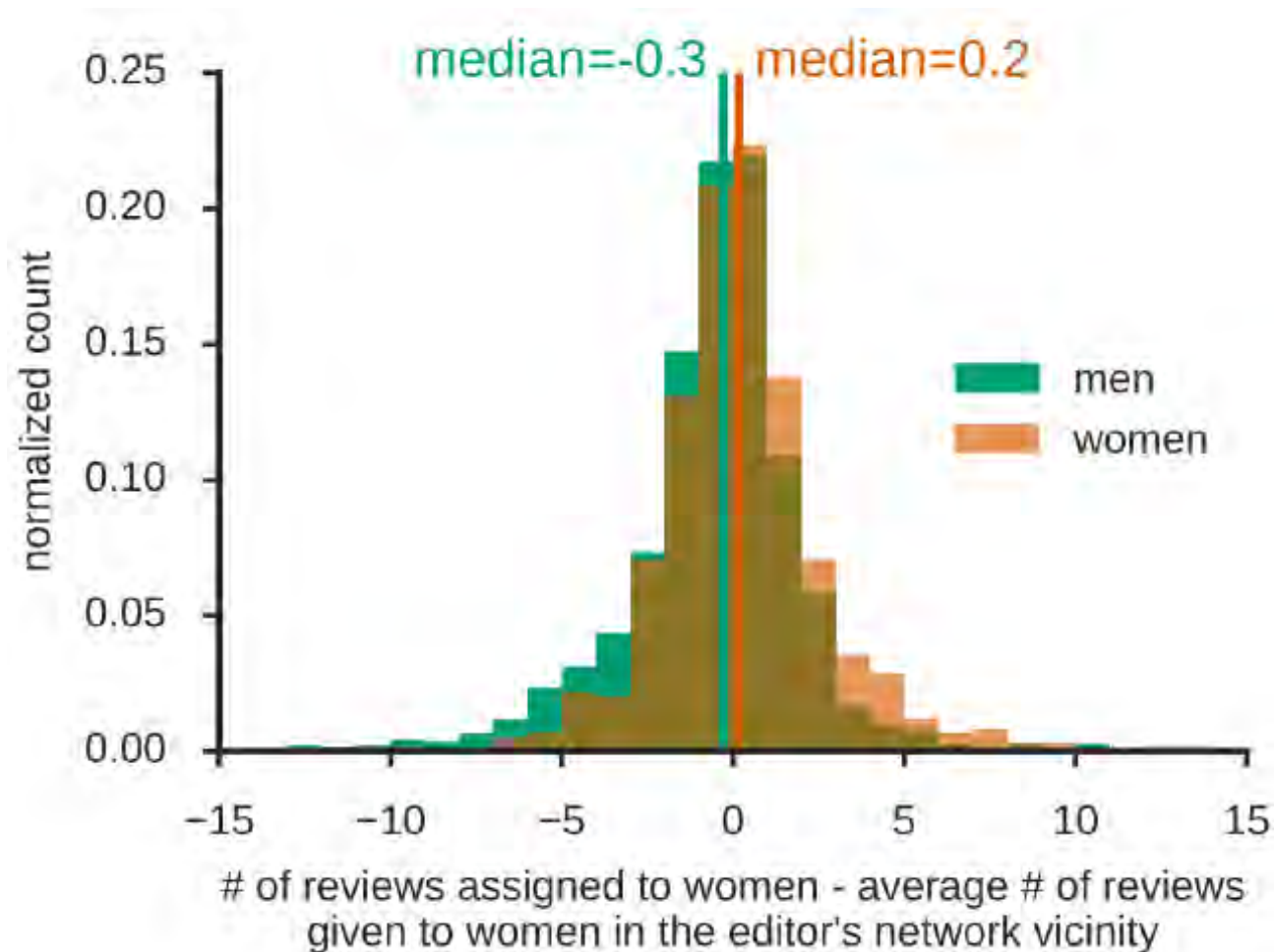
Compare editors choice with the *randomized* choice  
in the *neighbourhood*

# Inbreeding homophily across scientific fields



homophily also in fields  
with weaker gender bias

# Inbreeding homophily in neighbourhood

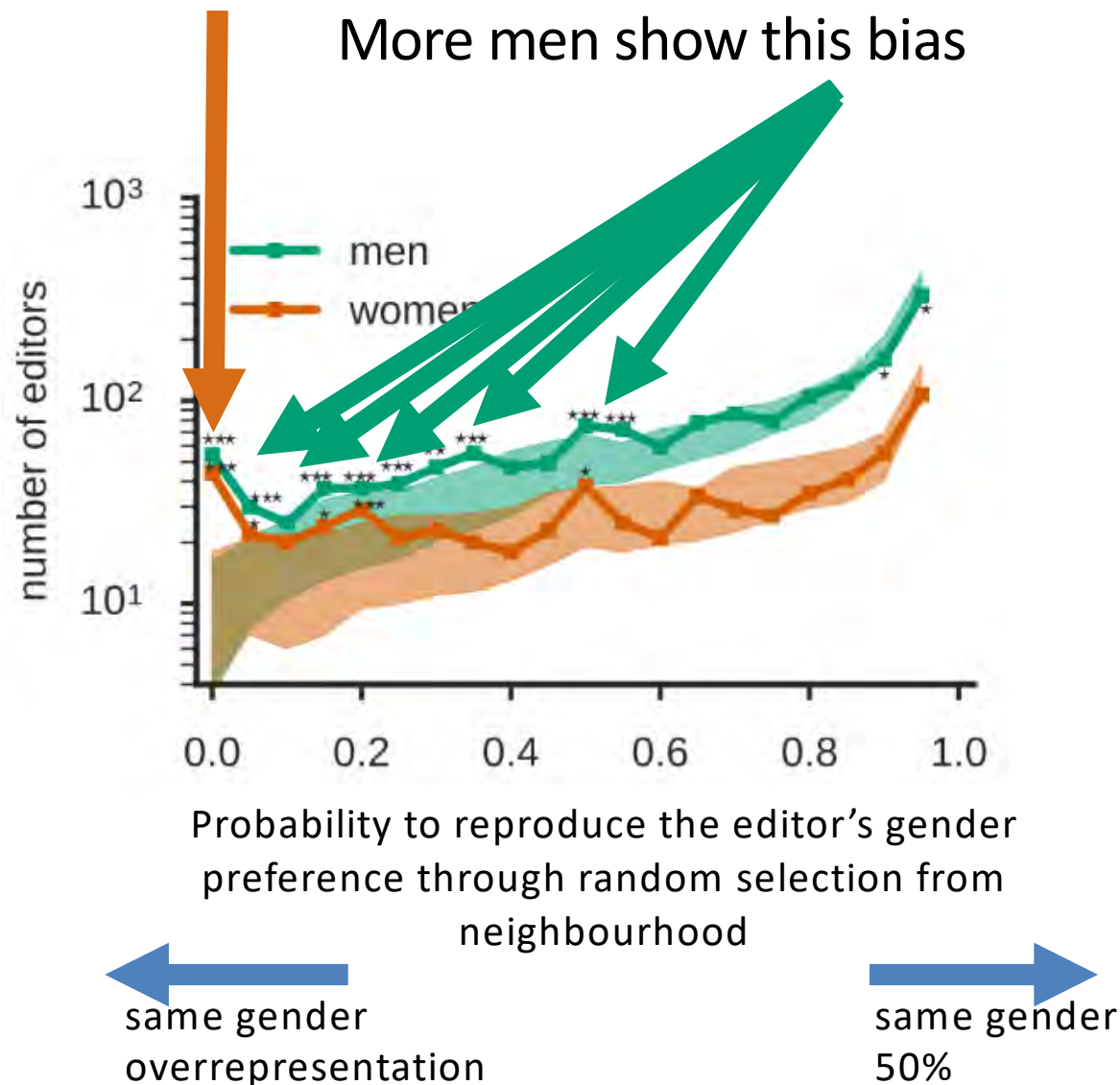


homophily also in fields with weaker gender bias

# Widespread homophily amongs men

Few women show pronounced same gender bias

More men show this bias



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

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