

Smart Collaboration & Boundary Spanning for High Impact Climate Science

John McLevey, Alexander V. Graham, and Pierson Browne, University of Waterloo
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john.mclevey@uwaterloo.ca | johnmclevey.com | networkslab.org

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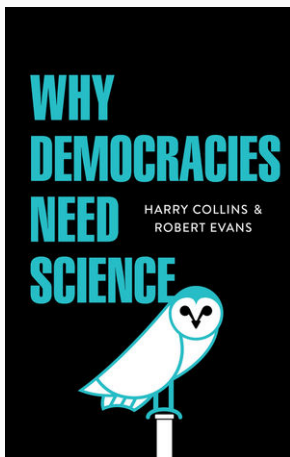
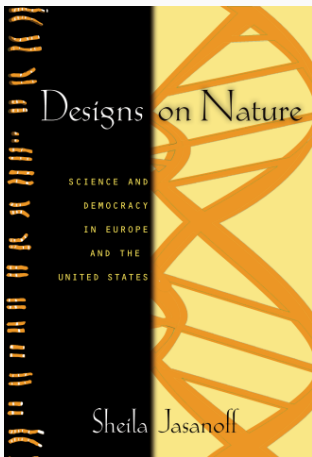
Context & Research Questions

A Gross Simplification of Trends in Science Policy Research

Policy → Science

Science → Policy

Science ↔ Democracy



Does [informational, intellectual,
institutional, country] diversity
help teams produce higher
impact science?



Theory & Hypotheses

Smart collaboration and the “diversity bonus”

Gardner, Page, science of team science, etc.

Net of other factors, increases in

H1 intellectual diversity

H2 collaboration with researchers from other sectors

H3 collaboration with researchers from other countries

will be associated with increases in scientific impact.

Weak ties, betweenness and brokerage, “vision advantages”

Granovetter, Burt, Uzzi, Evans, Foster, Stovel and Shaw, etc.

Net of other factors, increases in

H4 degree centrality (i.e. more co-authors)

H5 betweenness centrality

will be associated with increases in scientific impact.



Measures

How can we measure intellectual diversity?

Career Cited Reference Profiles (CCRP)

Coauthor Diversity Score (Individual Level)

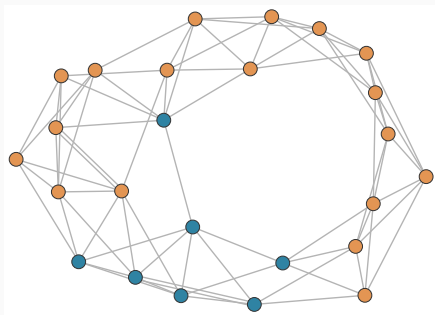
Group Intellectual Diversity (Group Level)

Career Cited References Profile (CCRP)

The set of references that a researcher has cited in her publishing career.



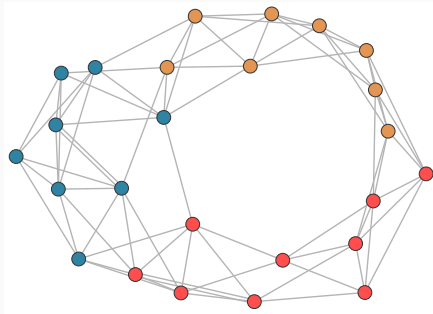
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Coauthor Diversity Score (CDS)

We compute Jaccard similarity for the CCRP's of every pair of authors. An author's CDS is an average of all her one-to-one scores. CDS is normalized for the number of pairwise comparisons, so scores range from 0 - 1.

0 = more diverse, 1 = more similar.



Group Intellectual Diversity (GID)

Like CDS but at the group level. We identify cohesive subgroups using Louvain community detection and compute the average CDS for every pair of researchers within the group regardless of whether they have collaborated directly. It is also normalized for the number of pairwise comparisons.

0 = more diverse, 1 = more similar.

Informational Diversity

Degree centrality and betweenness centrality

Institutional Diversity

From sector classifications of author addresses. Jaccard distances.

Country Diversity

From country classifications of author addresses. Jaccard distances.

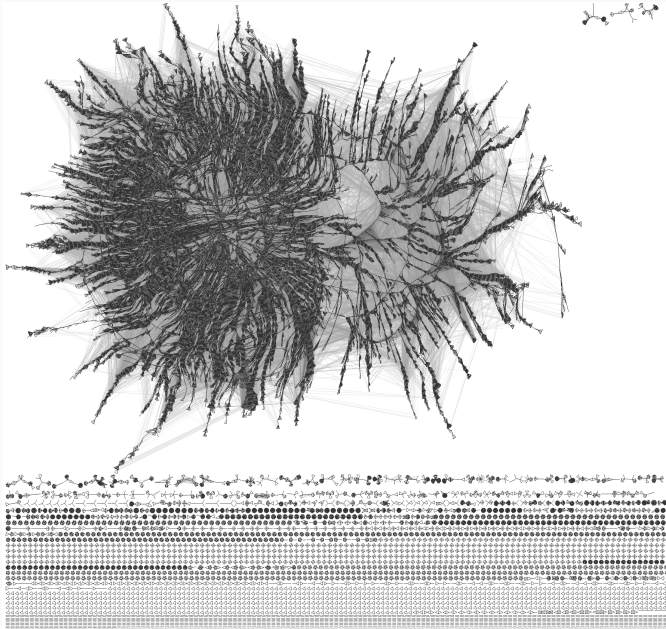
Impact

Total citations



Data & Methods

- Collected metadata on 36,333 climate science journals articles with authors from 5 countries, more coming soon.
- Constructed a record collection using **metaknowledge**
- Separated author addresses and used record linkage techniques to link them to institutions in the Global Research Institutions Database
- Extracted sectors and countries from GRID
- Constructed a co-authorship network of > 99,000 researchers
- Computed degree centrality, betweenness centrality, CCRPs, CDS, GID, institutional diversity, country diversity, number of papers, number of citations, and time since first publication
- Estimated a bootstrapped negative binomial model with total citations as the outcome variable



“It’s complicated.”



Preliminary Results

	Total Citations	
Intercept	-0.658***	(0.163)
Years Since First Publication	0.464***	(0.007)
Career Number of Papers	0.199***	(0.076)
Group Intellectual Diversity (GID)	0.020	(0.055)
Coauthor Diversity Score (CDS)	0.257**	(0.106)
Betweenness Centrality	1.298	(1.141)
Degree Centrality	17.321***	(0.371)
Sector Diversity	0.041	(0.107)
Country Diversity	5.080***	(0.223)

Estimates from a bootstrapped negative binomial regression model.



Implications & Future Research

❓ Rethinking the diversity bonus?

- The measures or the case?

❓ Rethinking centrality in (relatively) dense scientific networks

- Do researchers struggle to identify and connect with potential brokers?
Or are we failing to capture something important? Do structural holes close quickly?

❓ Why is country diversity so much more important than sector diversity?

- Some preliminary evidence to suggest that this effect is due to collaborating with researchers from the US and the UK.

Data Work

- Collect more data from more countries
- Improve linkages with GRID, drop linkages with weak matches for comparison
- Other measures of impact that go beyond science itself

Measures and Models

- Improve measures of sectoral and country diversity
- Shift emphasis from individuals to teams

☕ *thanks!*

✉ john.mclevey@uwaterloo.ca

🌐 johnmclevey.com

🌐 networkslab.org