

# Measuring Science Your Way

*Sabine Hossenfelder*

In collaboration with Michael Harney, Tobias Mistele, and Tom Price.  
This research was supported by the Foundational Questions Institute.



# The trouble with measures

Scientists don't like them.



I'm not just  
a number!

# The real trouble with measures

We can't do without them.

Researchers as well as those in administration and policy making need a fast, reliable way to quantify scientific relevance.

So they use quantifiers that are readily available.



# Which leads to more trouble with measures

They create perverse incentives:

- Write several shorter papers rather than one long one.
- Try to publish similar results repeatedly.
- Work on trendy and productive topics.
- Trade co-authorships and citations.
- Exaggerate relevance of findings.
- ...

# Which leads to even more trouble

- Optimizing for a specific measure makes this measure less and less useful as an indicator for scientific research. Instead it becomes an indicator for successfully optimizing said measure.
- The dominance of few measures streamlines research practices and research interests by devaluing non-conforming practices and interests.

# What can we do about it?

The cause of the problem is not the use of measures per se.

The cause is the use of bad measures:

Scientists presently use few and over-simplified measures: the h-index, total number of citations, the journal impact factor – and little else.

This is what creates perverse incentives, invites gaming, and streamlines research.

# We know that's not good but do it anyway...

Because even the computation of simple measures is **prohibitively time-consuming** for individual scientists or university personnel.

They therefore have to rely on publishers, abstract-servers, digital libraries, or subscription services (like dimensions.ai).



# But this problem is solvable

There are lots and lots of citation indices: The *h*-index, *g*-index, *hg*-index, the *h-b*-index, the *M*-index, the *R*-index, and so on.

There are further entirely different measures for academic productivity, eg those that work similar to Google's PageRank.

Idea: Make a larger variety of measures accessible to scientists.

# If you measure, measure right

SciMeter.org: A non-profit web-interface for research evaluation that is:

- **Customizable and adaptive**  
Define your own measure for research impact
- **Transparent and reproducible**  
Both data and algorithms are documented
- **For Scientists, not against them**  
Designed to help scientists make fast assessments

# How customizable measures help

Large variety: Prevents streamlining

Fast adaptation plus anonymity: Prevents Gaming

Both together: Weaken perverse incentives

Bonus: Objective measures counteract bias that comes from personal connections or in-group behavior.

Of course measures can not replace a qualitative, in-depth assessment. But they are necessary and will not go away.

We need them for fast filtering and sorting before the in-depth analysis.

We presently only use data from the arXiv  
(But are working on an extension).

# Welcome to Scimeter

## Custom metrics

Create your own custom metric and apply it to a list of authors.

E.g. to rank a list of applicants.

Create your custom metric

# DIY Metrics

Metrics	Author lists	Results
<div>Default metric of author list</div> <div><div><div></div>Add metric</div></div>	<div><div><div></div>Add author list</div></div>	<div>Please select a metric and an author list.</div>

---

Choose a metric



The Classics

# papers

★★★★☆

normalized h-index (simple)

★★★★☆

Sum of journal impact factor

★★★★☆

h-index

★★★★☆

normalized h-index (neural net)

★★★★☆

broadness

★★★★☆

Average word count

★★★★☆

10-year h-index prediction

★★★★☆

Please select a metric from the list.

## Choose a metric

The Classics

The Classics

Citation metrics

Productivity metrics

Collaboration metrics

Topic metrics

External

Other

All

normalized h-index (neural net)

★★★★☆

broadness

★★★★☆

Average word count

★★★★☆

10-year h-index prediction

★★★★☆

Please select a metric from the list.



## Add custom metric



Name

Formula

Blending mode

Description (optional)

You can use the following **per-paper metrics** in the formula field by using their **alias** (left column):

<b>date</b>	publication date in years since 1990 <a href="#">more</a>
<b>ncit</b>	# citations <a href="#">more</a>
<b>naut</b>	# authors <a href="#">more</a>
<b>jif</b>	Journal impact factor <a href="#">more</a>
<b>pagerank</b>	citation graph pagerank <a href="#">more</a>
<b>nwords</b>	# words <a href="#">more</a>

The formula is evaluated for each paper and can contain the following **operations**:

<b>a + b</b>	sum of a and b
<b>a - b</b>	difference of a and b
<b>a * b</b>	product of a and b
<b>a / b</b>	quotient of a and b
<b>ge(a, b)</b>	1 if a >= b, 0 otherwise
<b>le(a, b)</b>	1 if a <= b, 0 otherwise
<b>gt(a, b)</b>	1 if a > b, 0 otherwise
<b>lt(a, b)</b>	1 if a < b, 0 otherwise
<b>max(a, b)</b>	maximum of a and b

## Add author list

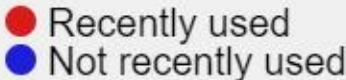


List name

Categories

acc-phys  
adap-org  
alg-geom  
ao-sci  
astro-ph  
astro-ph.CO  
astro-ph.EP  
astro-ph.GA  
astro-ph.HE  
astro-ph.IM

Restrict to gender (optional)



# Topic matches

Find authors similar to a (set of) keyword(s).

Keyword

Weight

dark matter

1

X

galaxies

1

X

Add keyword

Advanced settings

Submit

---

# Similar authors

Find authors similar to a (set of) author(s).

Author

Weight

Stacy McGaugh

1.0

X

Add author

Submit

## Results

1. [Stacy McGaugh](#)
  2. [Aaron A Dutton](#)
  3. [Andrea V Macciò](#)
  4. [Paolo Salucci](#)
  5. [Michael Boylan-Kolchin](#)
  6. [Xi Kang](#)
  7. [Matthieu Schaller](#)
-

I have great difficulty getting funding for this project.  
Any advice greatly appreciated.

SCIMETER.ORG

---

Measuring science the right way. Your way.