

# Scientific integrity

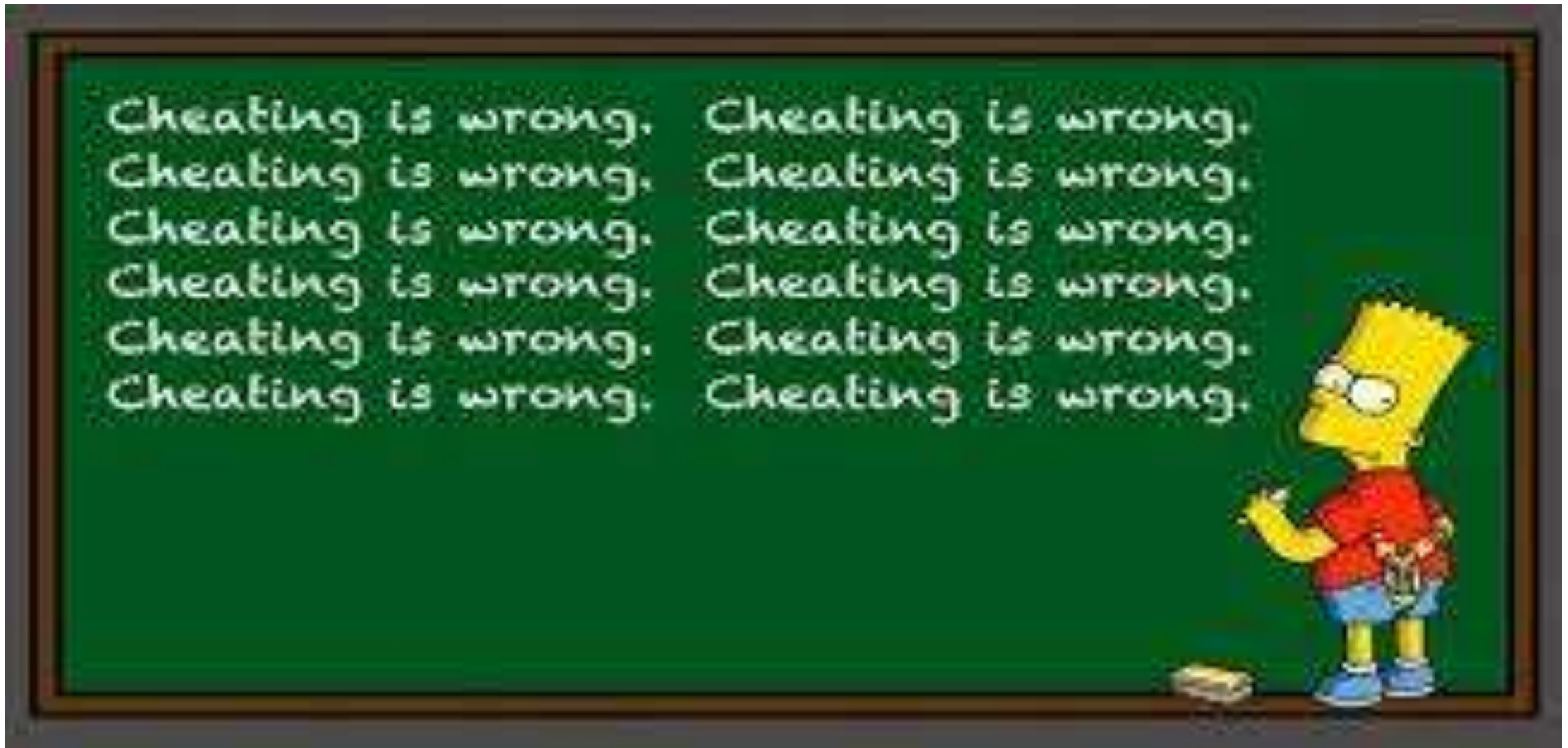
Andrea Saltelli

Barcelona, May 30 2023

Webinar at UPF Barcelona School of Management, in collaboration with UPF-BSM Cátedra Novo-Nordisk de Farmacoeconomía y Salud

<https://www.bsm.upf.edu/es/catedra-nn-farmacoeconomia-salud>





Source: The Simpsons, Twentieth Century  
Fox Film Corporation

# Going beyond Bart?

Based on



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# How to Teach Research Integrity?

16 Pages • Posted: 27 Feb 2023

**Andrea Saltelli**

UPF Barcelona School of Management

Date Written: February 21, 2023

## Paper statistics

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ABSTRACT VIEWS

101



## Definition of *integrity*

1 : firm adherence to a code of especially moral or artistic values : incorruptibility

As in 'a person of a remarkable integrity'

The ethos of open science:  
CUDOS, by R.K. Merton, a  
system of universal norms



Robert K. Merton

R. Merton, *The sociology of science: Theoretical and empirical investigations*, 1973.

**Communalism** – the common ownership of scientific discoveries, according to which scientists give up intellectual property rights in exchange for recognition and esteem (Merton actually used the term Communism, but had this notion of communalism in mind, not Marxism);

**Universalism** – according to which claims to truth are evaluated in terms of universal or impersonal criteria, and not on the basis of race, class, gender, religion, or nationality;

**Disinterestedness** – according to which scientists are rewarded for acting in ways that outwardly appear to be selfless;

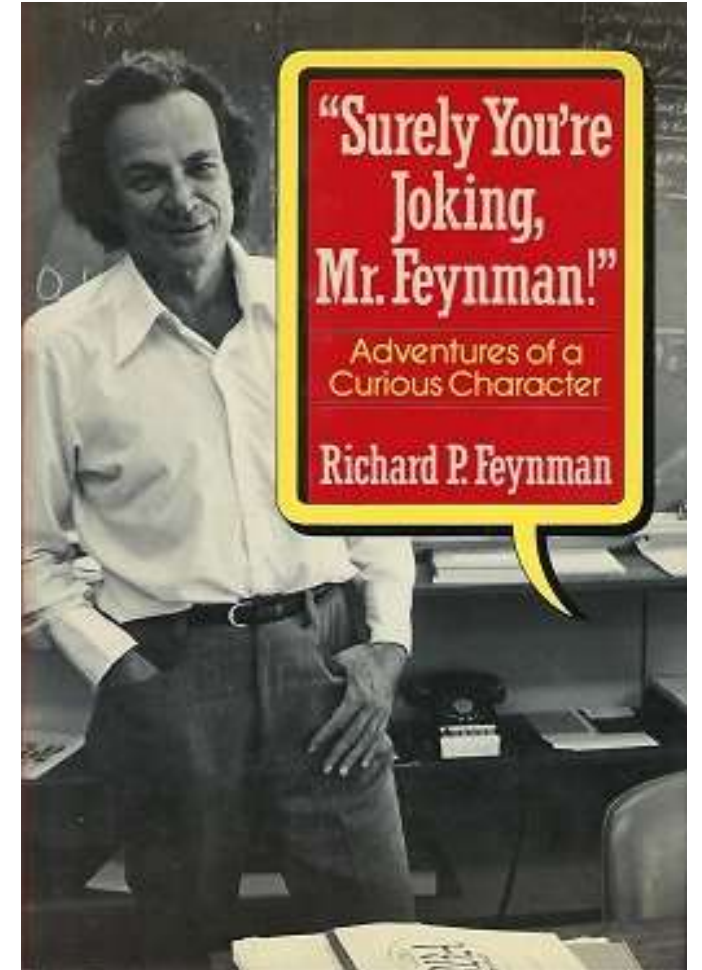
**Organized Skepticism** – all ideas must be tested and are subject to rigorous, structured community scrutiny.

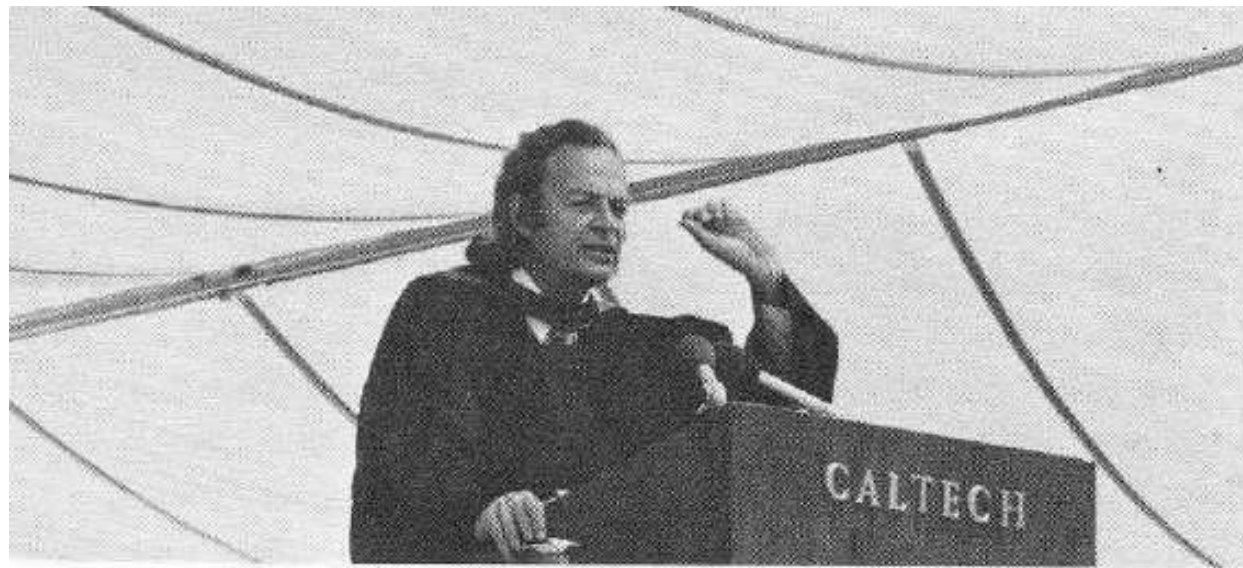


Caltech's speech  
(1974)

Richard Feynman  
on what organized  
scepticism is  
about

<https://calteches.library.caltech.edu/51/2/CargoCult.htm>





# Cargo Cult Science

by RICHARD P. FEYNMAN

**Some remarks on science, pseudoscience,  
and learning how to not fool yourself.  
Caltech's 1974 commencement address.**





Source:  
<https://www.zmescience.com/science/what-are-cargo-cults/>

What is a cargo cult?

“In the South Seas there is a cargo cult of people. During the war they saw airplanes land with lots of good materials, and they want the same thing to happen now ...

So they've arranged to imitate things like runways, ... they wait for the airplanes to land”



## Cargo Cult Science

by RICHARD P. FEYNMAN

Some remarks on science, pseudoscience, and learning how to not fool yourself. Caltech's 1974 commencement address.

...but they're missing something essential, because the planes don't land



## Cargo Cult Science

by RICHARD P. FEYNMAN

Some remarks on science, pseudoscience, and learning how to not fool yourself. Caltech's 1974 commencement address.



“[...] there is one feature I notice that is generally missing in cargo cult science. That is the idea that we all hope you have learned in studying science in school [...].



It's a kind of scientific integrity, a principle of scientific thought that corresponds to a kind of utter honesty—a kind of leaning over backwards. [...] Details that could throw doubt on your interpretation must be given, if you know them. [...] give all of the information to help others to judge the value of your contribution.”

Contradictions in CUDOS?

The same R.K. Merton realized later in life that norms have corresponding counter norms

Mitroff, I. I. 1974, Norms and Counter-Norms in a Select Group of the Apollo Moon Scientists: A Case Study of the Ambivalence of Scientists, *American Sociological Review*, 39, 579–595.

# NORMS AND COUNTER-NORMS IN A SELECT GROUP OF THE APOLLO MOON SCIENTISTS: A CASE STUDY OF THE AMBIVALENCE OF SCIENTISTS\*

IAN I. MITROFF

American Sociological Review 1974, Vol. 39 (August): 579-595

*This paper describes a three and a half year study conducted over the course of the Apollo lunar missions with forty-two of the most prestigious scientists who studied the lunar rocks. The paper supports the Merton-E. Barber concept of sociological ambivalence, that social institutions reflect potentially conflicting sets of norms. The paper offers a set of counter-norms for science, arguing that if the norm of universalism is rooted in the impersonal character of science, an opposing counter-norm is rooted in the personal character of science. The paper also argues that not only is sociological ambivalence a characteristic of science, but it seems necessary for the existence and ultimate rationality of science.*



Three-and-a-half-year study conducted over the course of the Apollo lunar missions with forty-two of the most prestigious scientists who studied the lunar rocks

The concept of **sociological ambivalence:**  
**social institutions reflect potentially conflicting sets of norms**

- Solitariness (secrecy, miserism) is often used to keep findings secret in order to be able to claim patent rights...

Instead of Communalism

- Particularism [...] a real issue, particularly when you consider the ratio of researchers in rich countries compared with those in poor countries

Instead of Universalism

- Interestedness arises because scientists have genuine interests at stake in the reception of their research...  
Instead of Disinterestedness

- Dogmatism because careers are built upon a particular premise (theory) being true...

Instead of Organized  
Skepticism

# Journal of Empirical Research on Human Research Ethics

## **Normative Dissonance in Science: Results from a National Survey of U.S. Scientists**

Melissa S. Anderson, Brian C. Martinson, Raymond De Vries

First Published December 1, 2007 | Research Article | [Find in PubMed](#)

<https://doi.org/10.1525/jer.2007.2.4.3>

survey responses from 3,247 mid- and early-career scientists who had research funding from the U.S. National Institutes of Health

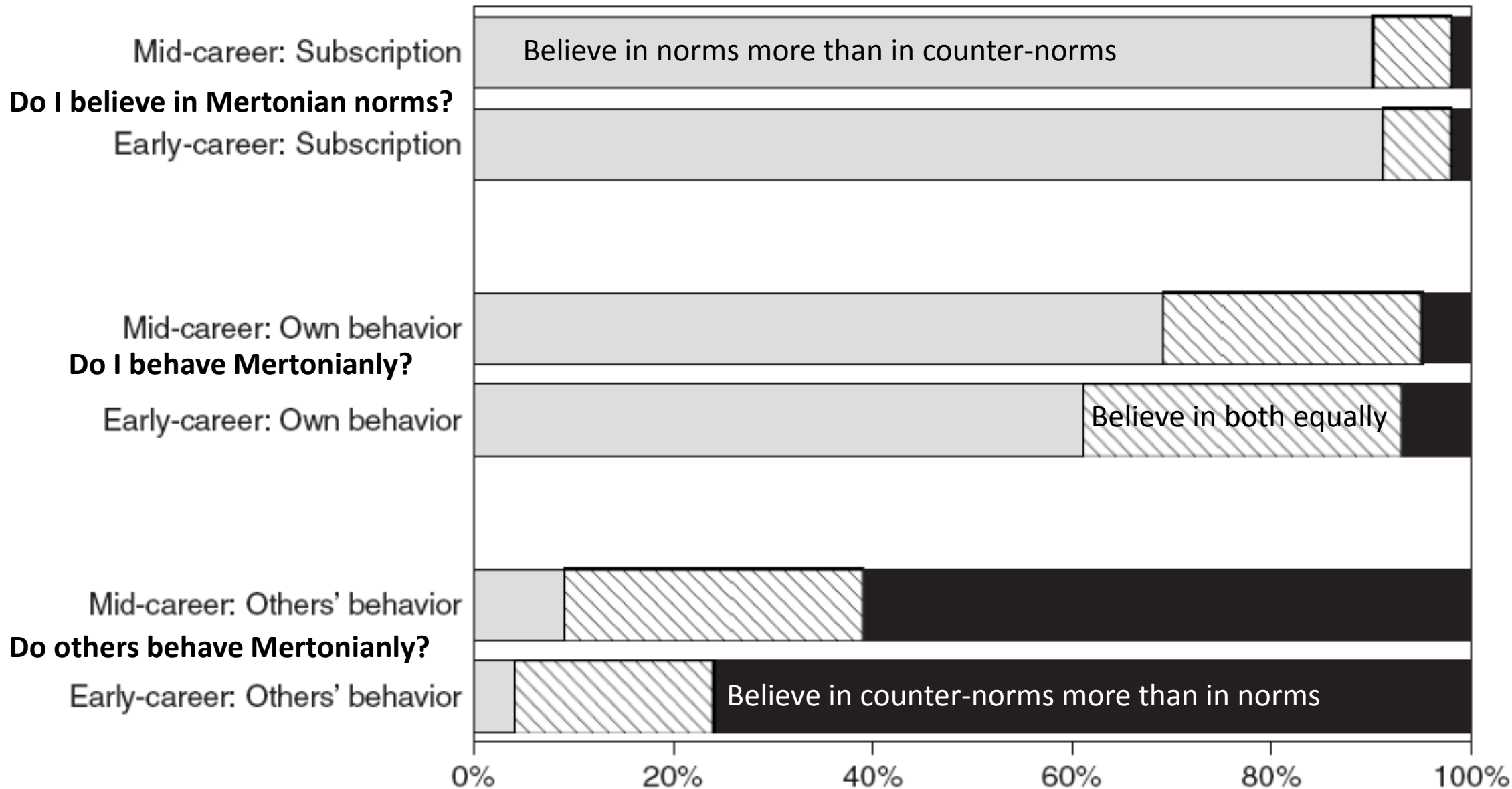


FIG. 3. Norm versus Counternorm Scores: Percent with Norm > Counternorm (dotted), Norm = Counternorm (striped), Norm < Counternorm (solid).



## Definition of *integrity*

1 : firm adherence to a code of especially moral or artistic values : incorruptibility

Do the various 'Open Science' initiative foster integrity (sense 1)?

# *Capitalism and Society*

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*Volume 3, Issue 2*

2008

*Article 5*

---

## The Historical Origins of 'Open Science': An Essay on Patronage, Reputation and Common Agency Contracting in the Scientific Revolution

**Paul A. David**, *Stanford University & The University of  
Oxford*

Open science was always a fragile social construction ...

... resulting from the movement away from secret knowledge and princely patronage toward state patronage, academies, and other modern institutions of science, taking place in the period between renaissance and the industrial revolution

The Historical Origins of 'Open Science': An Essay on Patronage, Reputation and Common Agency Contracting in the Scientific Revolution

**Paul A. David**, *Stanford University & The University of Oxford*



# What was before open science?

"Regarding the everyday duties, I shun only that type of prostitution consisting of having to expose my labor to the arbitrary prices set by every customer.

Instead, I will never look down on service a prince or a great lord or those who may depend on him, but, to the contrary, I will always desire such a position." (Galileo Galilei, 1564 – 1642)



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## *Capitalism and Society*

Volume 3, Issue 2

2008

Article 5

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The Historical Origins of 'Open Science': An  
Essay on Patronage, Reputation and Common  
Agency Contracting in the Scientific  
Revolution

**Paul A. David**, *Stanford University & The University of  
Oxford*

Open science exists already, funded by public and private actors, based on a distinctive ethos

It coexists with commercially oriented research

*Capitalism and Society*

---

*Volume 3, Issue 2*

2008

*Article 5*

---

The Historical Origins of 'Open Science': An  
Essay on Patronage, Reputation and Common  
Agency Contracting in the Scientific  
Revolution

**Paul A. David**, *Stanford University & The University of  
Oxford*

Open science lives a tension between:

Defending the existing ethos of the republic of science, Merton's CUDOS, "public knowledge"

Proprietary science, secrecy, visions of a knowledge economy

*Capitalism and Society*

---

*Volume 3, Issue 2*

2008

*Article 5*

---

The Historical Origins of 'Open Science': An  
Essay on Patronage, Reputation and Common  
Agency Contracting in the Scientific  
Revolution

**Paul A. David**, *Stanford University & The University of  
Oxford*

An acceleration toward 'Intellectual Capitalism'  
risks to move science back to the age of  
princely patronage ...

... from CUDOS back to the pre-renaissance  
ethos of secrecy in the pursuit of Nature's  
Secrets

*Capitalism and Society*

*Volume 3, Issue 2*

2008

*Article 5*

The Historical Origins of 'Open Science': An  
Essay on Patronage, Reputation and Common  
Agency Contracting in the Scientific  
Revolution

**Paul A. David**, *Stanford University & The University of  
Oxford*

# What Philip Mirowski has to say about the dangers of open science



S|S|S

*Article*

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## **The future(s) of open science**

Social Studies of Science  
2018, Vol. 48(2) 171–203

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**Philip Mirowski** 

John J. Reilly Center, University of Notre Dame, Notre Dame, IN, USA



We already struggle with  
“author–paid Article Publishing  
Charges (APCs) that range from  
\$500 to \$5,000 USD [Elsevier  
OA]”;

Corporate publishers have easily  
assimilated open access into their  
profit model.

“the agenda [of open science] is effectively to re-engineer science along the lines of platform capitalism, under the misleading banner of opening up science to the masses”

Article

S|S|S

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## The future(s) of open science

**Philip Mirowski** 

John J. Reilly Center, University of Notre Dame, Notre Dame, IN, USA

Social Studies of Science  
2018, Vol. 48(2) 171–203

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“the open science movement is an artifact of the current neoliberal regime of science, [to] reconfigures both the institutions and the nature of knowledge to better conform to market imperatives”



Article

## The future(s) of open science

**Philip Mirowski** 

John J. Reilly Center, University of Notre Dame, Notre Dame, IN, USA

S|S|S

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# How a neoliberal agenda has damaged science

Article

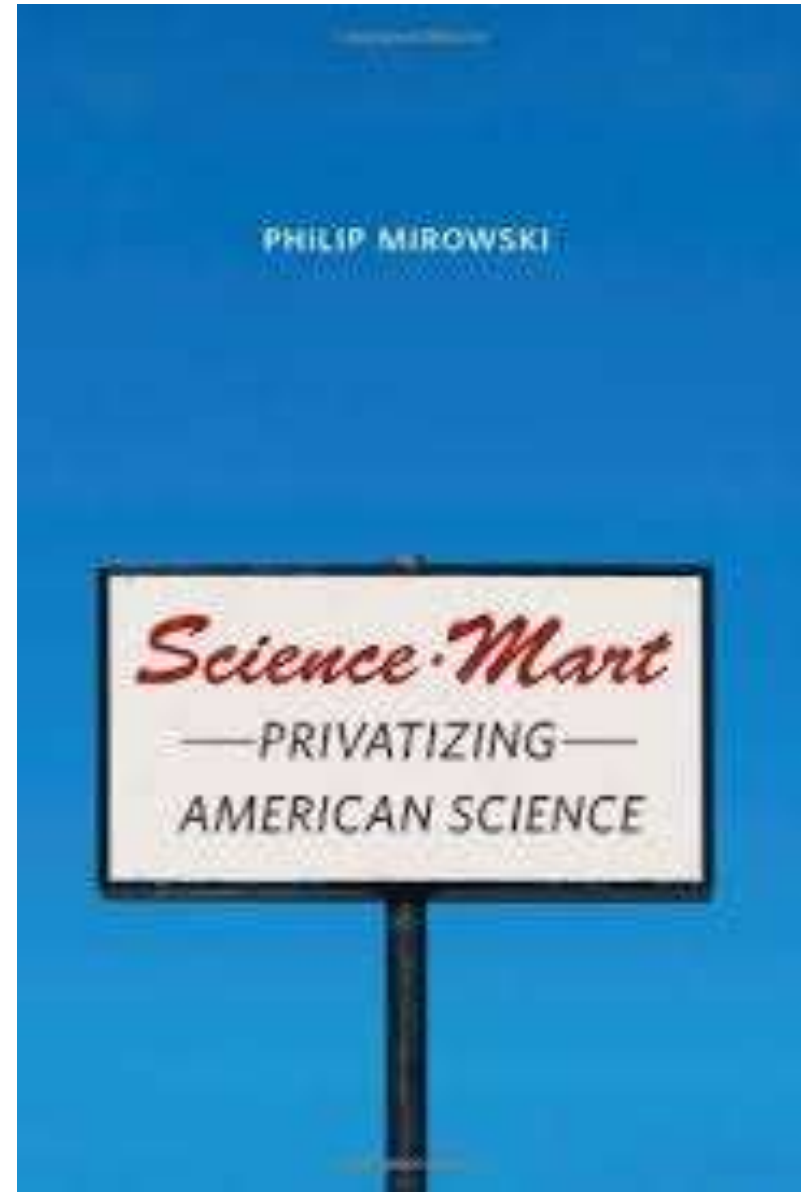
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## The future(s) of open science

**Philip Mirowski** 

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# What is hence the danger for Mirowski?

## Platform capitalism and the uberization of science

*Article*

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**The future(s) of open science**

**Philip Mirowski** 

John J. Reilly Center, University of Notre Dame, Notre Dame, IN, USA

Social Studies of Science

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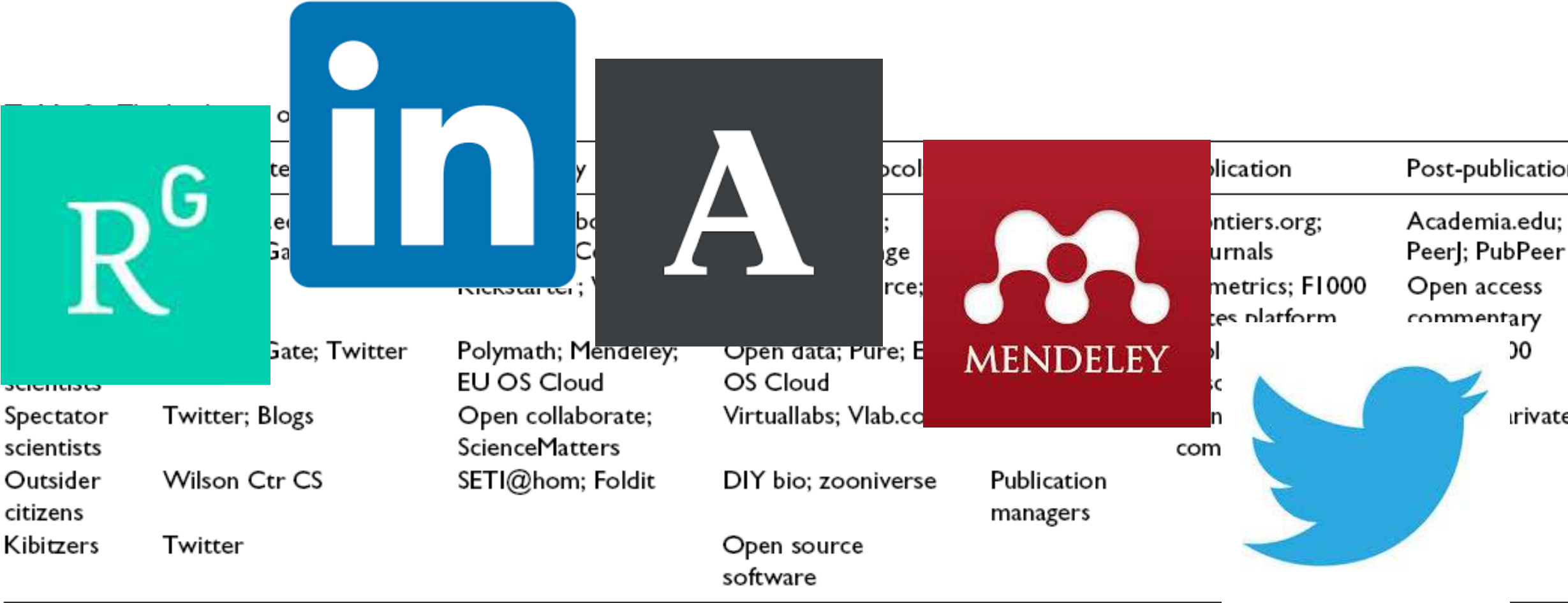


# Platforms competing to become the 'Facebook for Science'

## The future(s) of open science

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**Philip Mirowski**   
 John J. Reilly Center, University of Notre Dame, Notre Dame, IN, USA



# The future is with us already

we as scientists already live in “a quasi-market that constantly monitors [our] ‘net worth’ through a range of metrics, scores and indicators”

H-index, impact factors, peer contacts, network affiliations, and the like”

Article

S|S|S

## The future(s) of open science

Philip Mirowski 

John J. Reilly Center, University of Notre Dame, Notre Dame, IN, USA

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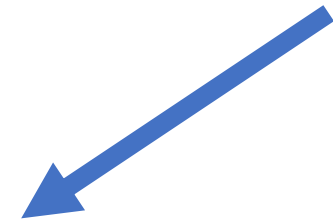
Open access  
movement  
(Plan S etc.)



Publishers multiply  
their titles by creating  
new OA journals



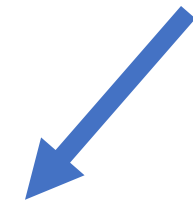
Which favours the  
mimetic chances of  
predatory publishers



Publishers increase  
their already  
incredible profits



OA titles (predatory  
and non) need to  
accept more articles  
to fund themselves



The abundance of  
OA titles plays into  
the publish or perish  
zeitgeist



## Definition of *integrity*

1 : firm adherence to a code of especially moral or artistic values : incorruptibility

To what sort of science do I pledge my integrity to?



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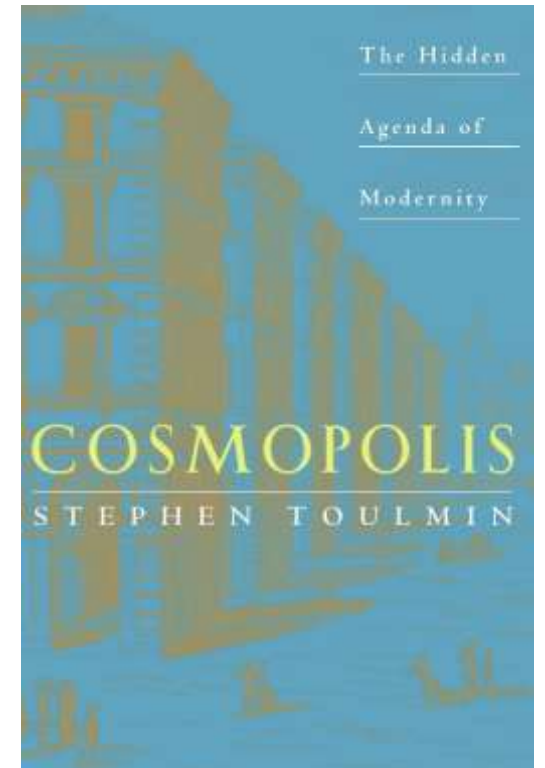
[https://commons.wikimedia.org/wiki/File:John,\\_king\\_of\\_Scotland,\\_being\\_brought\\_before\\_Edward\\_I.png](https://commons.wikimedia.org/wiki/File:John,_king_of_Scotland,_being_brought_before_Edward_I.png)

If you are a scientist you were  
nourished and trained in what Stephen  
Toulmin calls 'The hidden agenda of  
modernity'

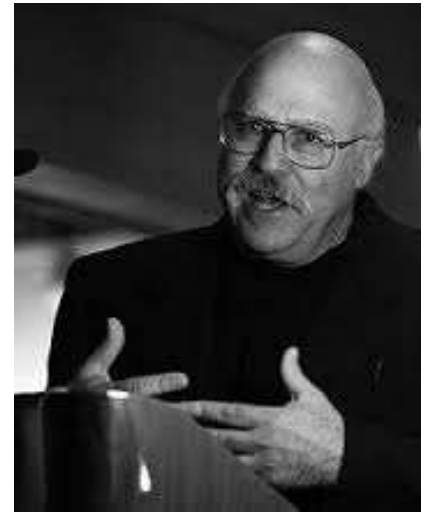
The vision of Cosmopolis, a society as  
rationally ordered as the Newtonian  
view of nature



Stephen Toulmin



The dream was spectacularly successful, in all fields of endeavor, leading to what Steven Shapin calls ‘invisible science’

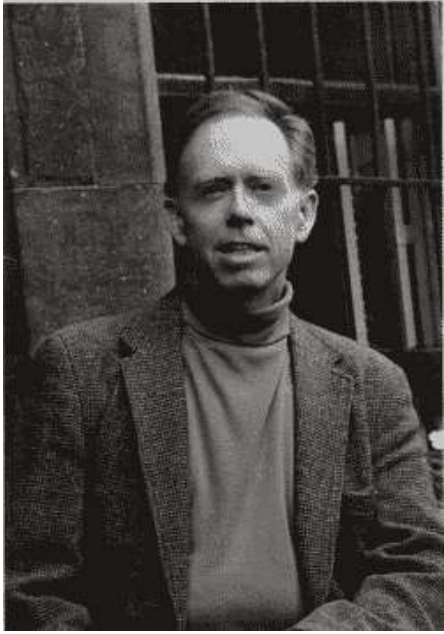


Steven Shapin

Steven Shapin, 2016, Invisible Science, The Hedgehog Review: Vol. 18 No. 3 (Fall 2016).



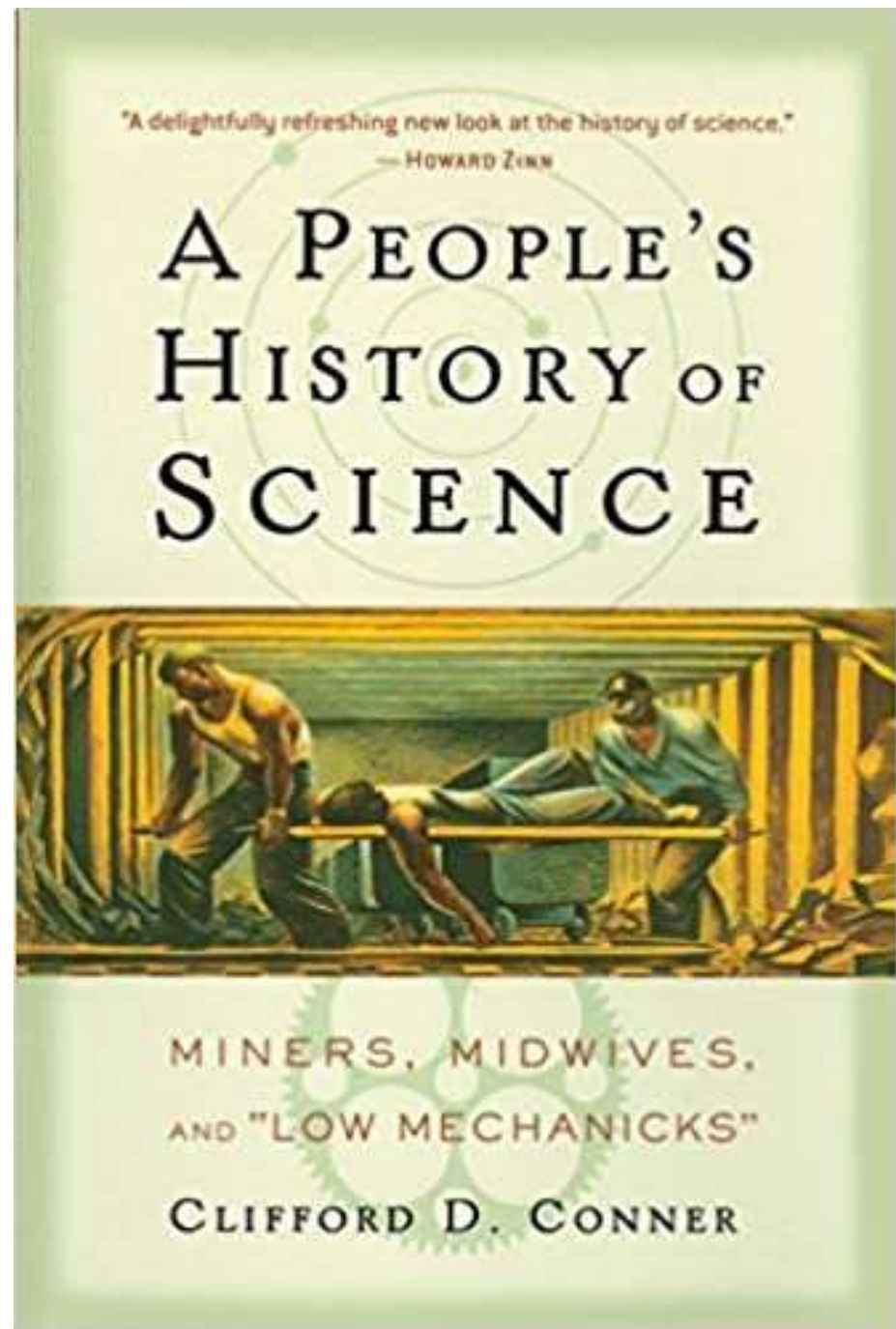
# What is science?

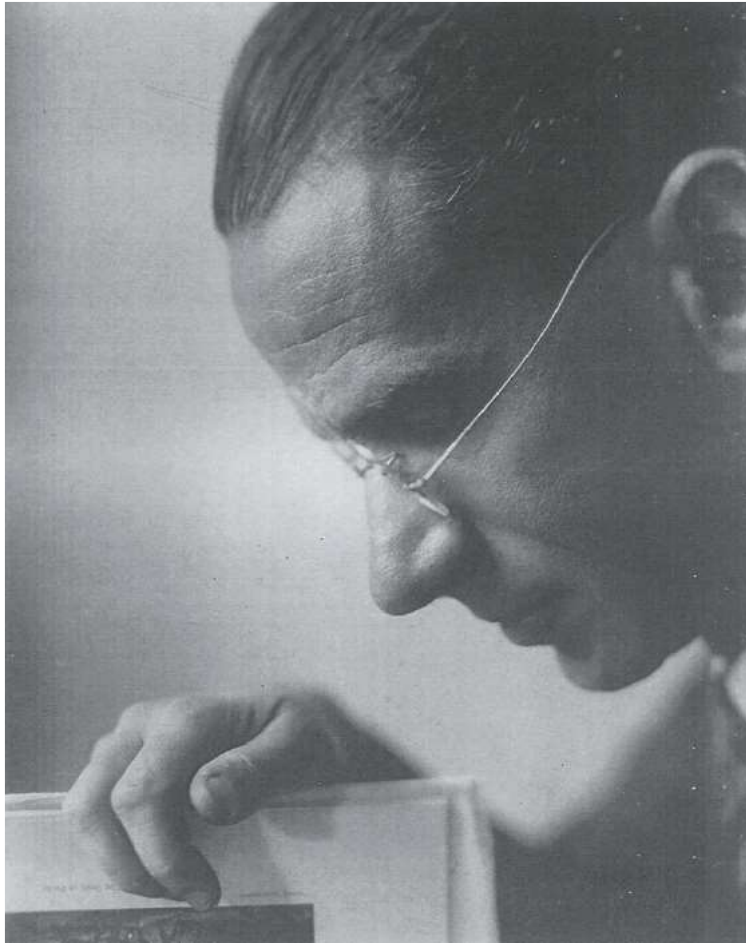


Clifford D. Conner

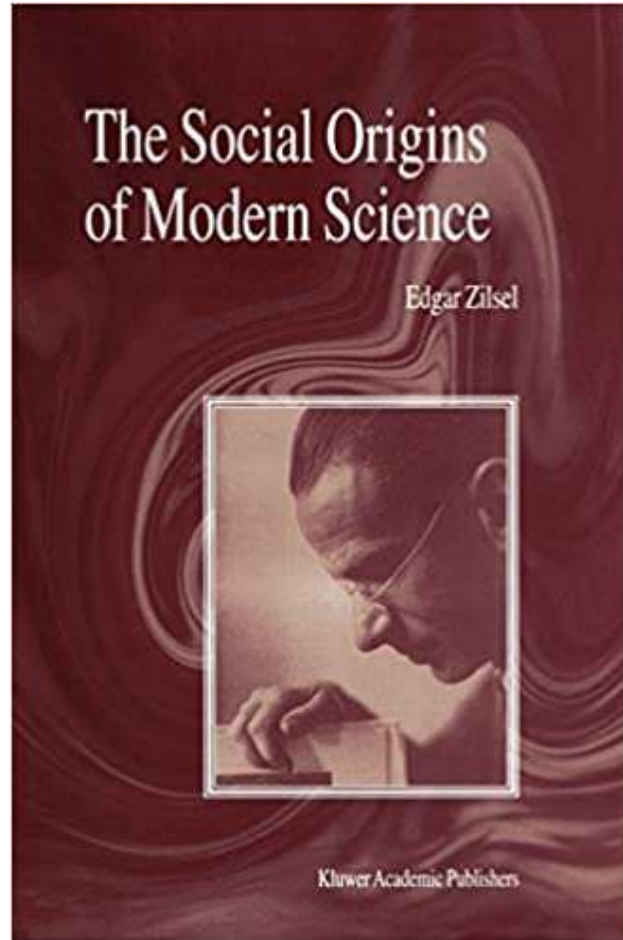
An antidote to a vision of the history of science as the fruit of the intuition of great (mostly) men

‘Knowing what’ was often only possible after ‘knowing how’ had been discovered





Edgar Zilsel  
(1891–1944)



The Zilsel thesis:

- Superior artisans,
- Secular humanists,
- University scholars

“Science originates in urban cultures, money economy, market economy...”

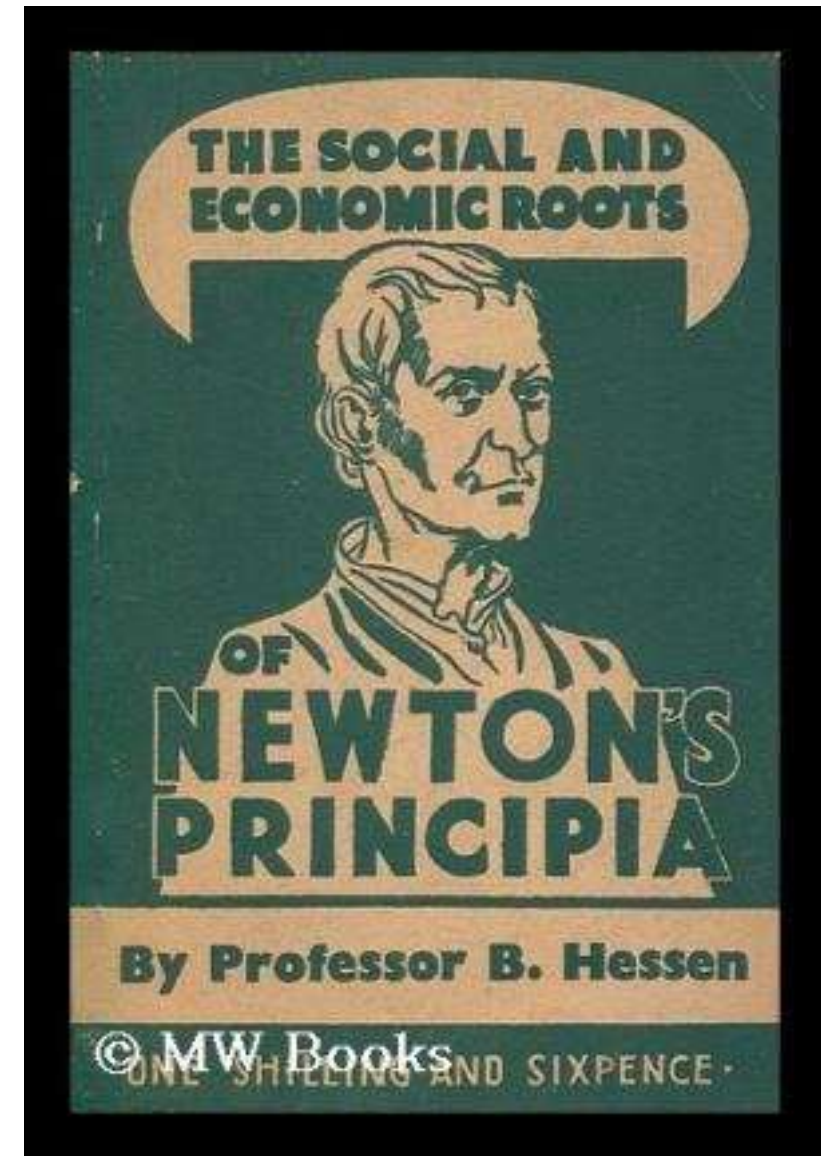


Boris Hessen  
(1893–1936)

The Hessen thesis:

Science originates from the commercial and capitalistic needs of the XVII century nascent bourgeoisie ...

... not just from the work of 'great minds'



How about the way we  
are taught our science?

Kuhn said that the “educational initiation that prepares and licenses the student for professional practice… is both rigorous and rigid”

and “It is a narrow and rigid education [in physics/science], probably more so than any other except perhaps in orthodox theology”



Thomas Kuhn, *The structure of scientific revolution*, 192, Chapters I and XIII

and “the member of a mature scientific community is, like the typical character of Orwell’s 1984, the victim of a history rewritten by the powers that be.”



Thomas Kuhn, *The structure of scientific revolution*, 192, Chapter XIII

# What is science?

- The legacy of Enlightenment
- The way to emancipation and Bildung
- ...
- ...
- A tool of corporate power?

# Sylvain Laurens

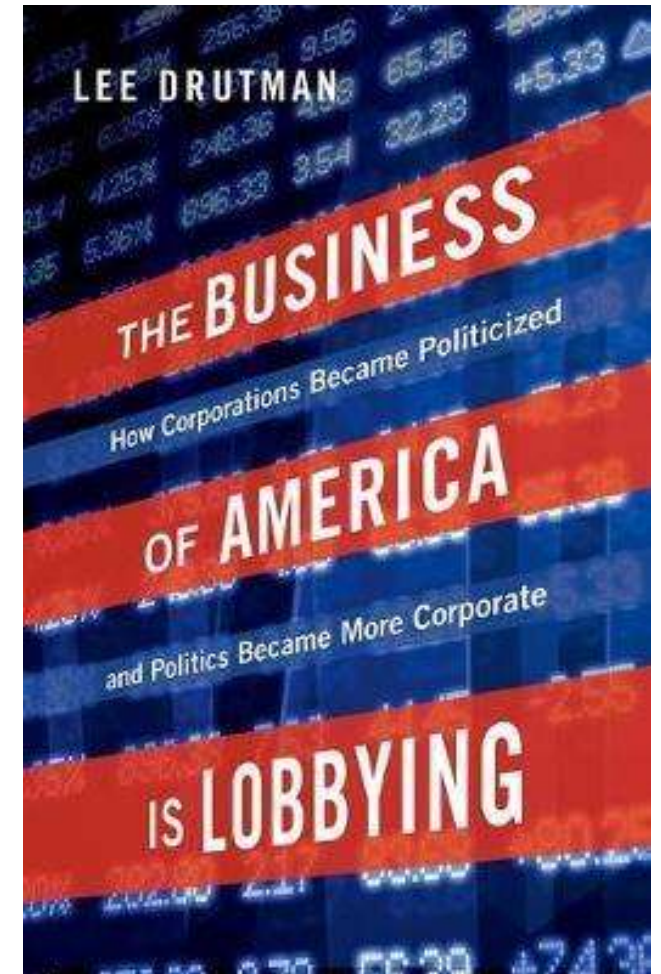


**LOBBYISTS AND  
BUREAUCRATS IN BRUSSELS**  
CAPITALISM'S BROKERS

Sylvain Laurens



Lee Drutman







ELSEVIER

# Futures

Volume 135, January 2022, 102860



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## Science, the endless frontier of regulatory capture

Andrea Saltelli <sup>a</sup>  , Dorothy J. Dankel <sup>b, c</sup>, Monica Di Fiore <sup>d</sup>, Nina Holland <sup>e</sup>,  
Martin Pigeon <sup>e</sup>



**MENOS  
MEDICINA** | **MAS  
SALUD**

Organización Civil Internacional por la transparencia, la integridad, la participación y la equidad en las políticas de salud, la asistencia sanitaria y la investigación biomédica.

[Inicio](#) [Atención Primaria](#) [Medicalizaciones](#) [Regulación e Industria](#) [Salud Materno Infantil](#) [Saber Crítico](#) [Salud Mental](#) [Covid-19](#)  
[Salud, Ciencia y Políticas](#) [Terapéutica y Fármacos](#) [Vacunas](#) [Mas](#)

## Los guardianes de la razón: Fact check, captura cultural e imaginario sociotécnico. Por Abel Nova

por nmurcia | Jun 9, 2021 | Regulación e Industria | 0 Comentarios



Abel Nova

<http://www.nogracias.org/2021/06/09/los-guardianes-de-la-razon-fact-check-captura-cultural-e-imaginario-sociotecnico-por-abel-nova/>

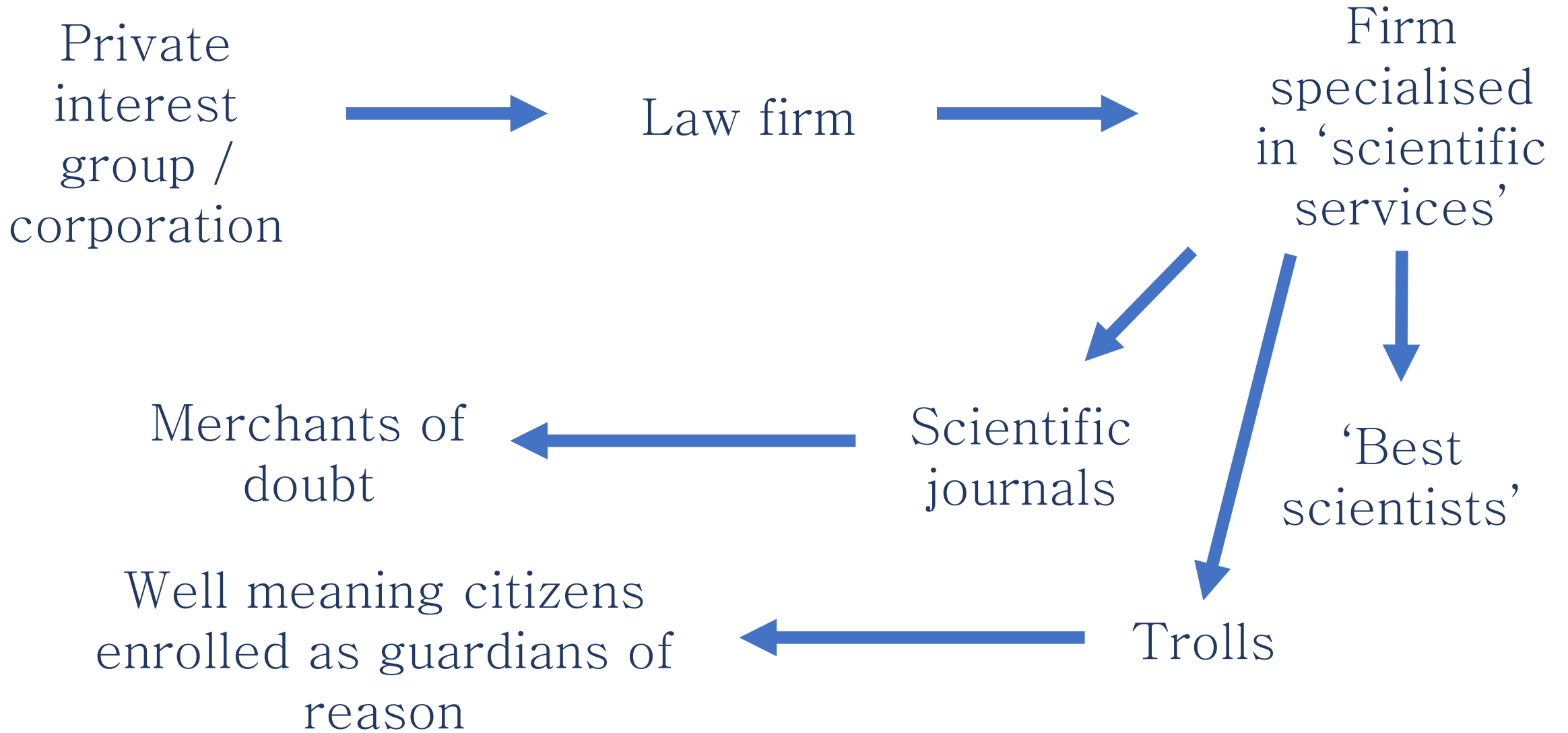
# From the abstract:

... a form of corporate penetration which is based on a strategic use of the image and legitimacy of science

...cases where lobbyists present themselves as upholders of the values of the evidence-based policy, and interested in the methodological and ethical aspect of science for policy

# From the abstract:

Epistemic ladder: lobbyists move from **questioning** the evidence to **questioning** its legitimacy, all the way to **creating** a worldview where not only the evidence, but the very idea of regulation, become irrelevant or undesirable





## Definition of *integrity*

1 : firm adherence to a code of especially moral or artistic values : incorruptibility

Wrapping up: what sort of science and what sort of integrity we embrace are related, non trivial questions



## Definition of *integrity*

2 : an unimpaired condition : soundness

As in 'the reactor vessel has not lost its integrity'

# Predatory publishing?



Credit: David Parkins, Nature,  
<https://www.nature.com/articles/d41586-019-03759-y>



**NEWS** • 08 FEBRUARY 2021

# Hundreds of ‘predatory’ journals indexed on leading scholarly database

Scopus has stopped adding content from most of the flagged titles, but the analysis highlights how poor-quality science is infiltrating literature.

[Dalmeet Singh Chawla](#)

---

# Predatory: cloning existing journals



Recent cases:

- Talent Development and Excellence,
- Transylvanian Review
- Test Engineering and Management

<https://retractionwatch.com/2021/05/26/how-hijacked-journals-keep-fooling-one-of-the-worlds-leading-databases/>

Predatory publishers (the Achilles heel of the APC model)

Predatory open access publishers

<https://beallslist.net>

Beall was threatened by Omics International with a \$1billion lawsuit



Jeffrey Beall,  
librarian,  
University  
of Colorado,  
Denver

Dear Andrea Saltelli,

I hope everything is going well.



GAVIN PUBLISHERS

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We cordial

As you bei

If you have

Hoping

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▶ ISSN: 2575-7091

Food & Nutrition Jou

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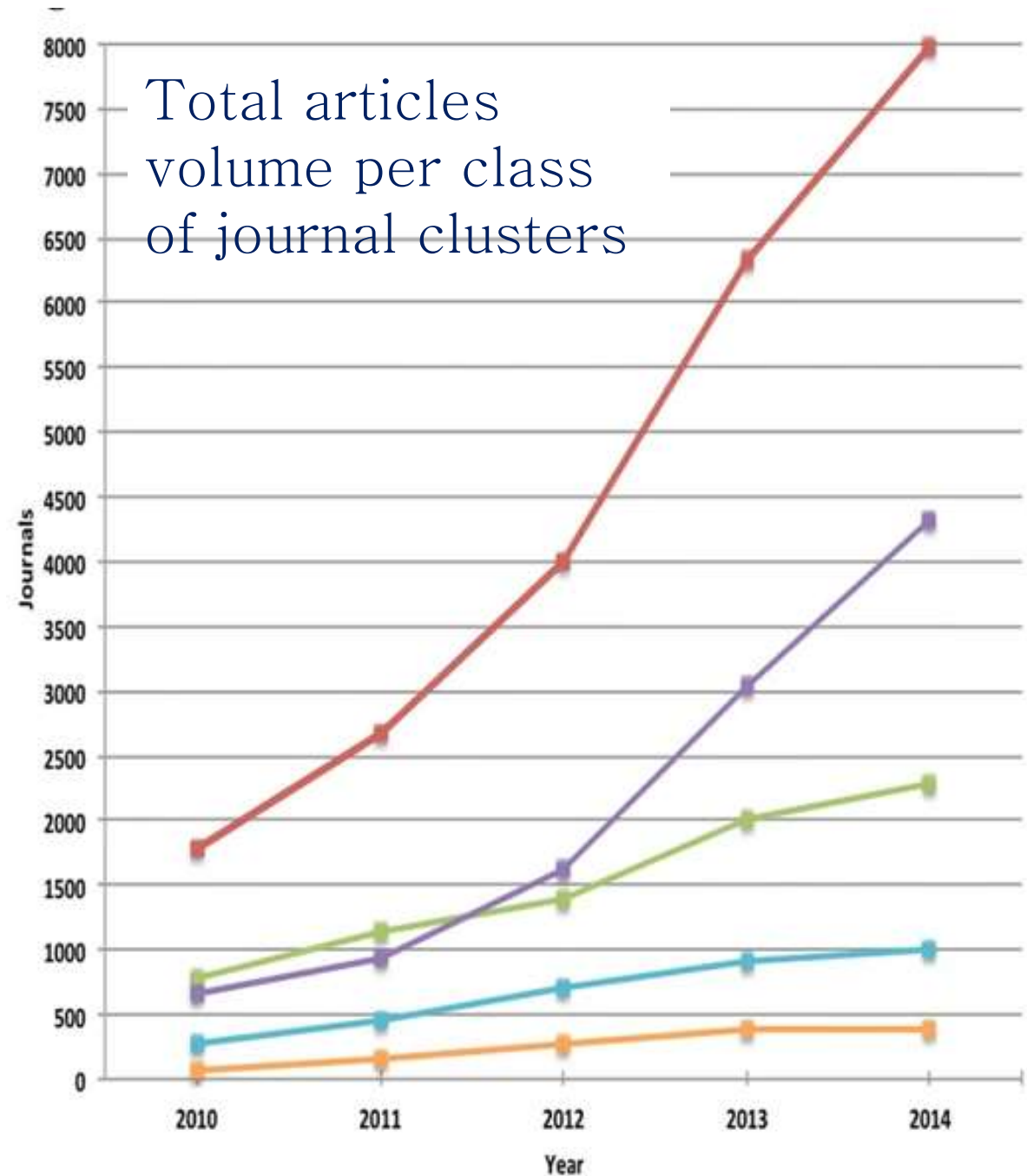
\* Directory of Journals indexing

About the Journal

Journal Impact Factor 1.2\*

Is on Beall's list ←

C. Shen and B.-C. Björk, “‘Predatory’ open access: a longitudinal study of article volumes and market characteristics,” BMC Med., vol. 13, no. 1, p. 230, Dec. 2015.



Crisis of reproducibility

Failed replications, entire subfields going bad,  
fraudulent peer reviews, predatory publishers,  
perverse metrics, statistics on trial ...




Brow

 OPEN ACCESS

ESSAY

June 21, 2017

Why Most Clinical Research Is Not Useful

John P. A. Ioannidis 

Published: June 21, 2016 • <https://doi.org/10.1371/journal.pmed.1002049>

THE  
ECONOMIC  
JOURNAL



*The Economic Journal*, 127 (October), F236–F265. Doi: 10.1111/eoj.12461 © 2017 Royal Economic Society. Published by John Wiley & Sons, 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA.

THE POWER OF BIAS IN ECONOMICS RESEARCH\*

*John P. A. Ioannidis, T. D. Stanley and Hristos Doucouliagos*

October 27, 2017



## Futures

Volume 91, August 2017, Pages 5-11



# What is science's crisis really about?

Andrea Saltelli <sup>a, b</sup>  , Silvio Funtowicz <sup>a</sup>



## Futures

Volume 104, December 2018, Pages 85-90



# Why science's crisis should not become a political battling ground

Andrea, Saltelli 



## THE RIGHTFUL PLACE OF SCIENCE: **SCIENCE ON THE VERGE**

### CONTRIBUTORS

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Ângela Guimarães Pereira	Jeroen P. van der Sluijs





# Darwinian fitness of malpractices

Downloaded from <http://rsos.royalsocietypublishing.org/> on September 23, 2016

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Research



**Cite this article:** Smaldino PE, McElreath R.

2016 The natural selection of bad science.

*R. Soc. open sci.* **3**: 160384.

<http://dx.doi.org/10.1098/rsos.160384>

Received: 1 June 2016


Accepted: 17 August 2016

## The natural selection of bad science

Paul E. Smaldino<sup>1</sup> and Richard McElreath<sup>2</sup>

<sup>1</sup>Cognitive and Information Sciences, University of California, Merced, CA 95343, USA

<sup>2</sup>Department of Human Behavior, Ecology, and Culture, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany

 PES, 0000-0002-7133-5620; RME, 0000-0002-0387-5377

Poor research design and data analysis encourage false-positive findings. Such poor methods persist despite perennial calls for improvement, suggesting that they result from something more than just misunderstanding. The persistence of poor methods results partly from incentives that favour them, leading to the natural selection of bad science. This dynamic requires no conscious strategizing—no deliberate cheating nor loafing—by scientists, only that publication is a principal factor for

[redacted] As in the real world, successful labs produce more 'progeny,' such that their methods are more often copied and their students are more likely to start labs of their own. Selection for high output leads to poorer methods and increasingly high false discovery rates. [redacted]

[redacted] Improving the quality of research requires change at the institutional level.

Smaldino PE, McElreath R., 2016 The natural selection of bad science. R. Soc. open sci. 3: 160384. <http://dx.doi.org/10.1098/rsos.160384>

Is the present publishing  
system sound?

## Opinion

Peer review and scientific publishing

Thu 13 Sep 2018

Scientific publishing is a rip-off. We fund the research - it should be free

*George Monbiot*



Those who take on the global industry that traps research behind paywalls are heroes, not thieves





I. Graber-Stiehl, “Science’s pirate queen,” *Verge*, Feb-2018.



Kazakhstani scientist  
Alexandra Elbakyan



The long read

## Is the staggeringly profitable business of scientific publishing bad for science?

Elsevier profits 2010 = £724m on £2bn revenue: a 36% margin – higher than Apple, Google, or Amazon

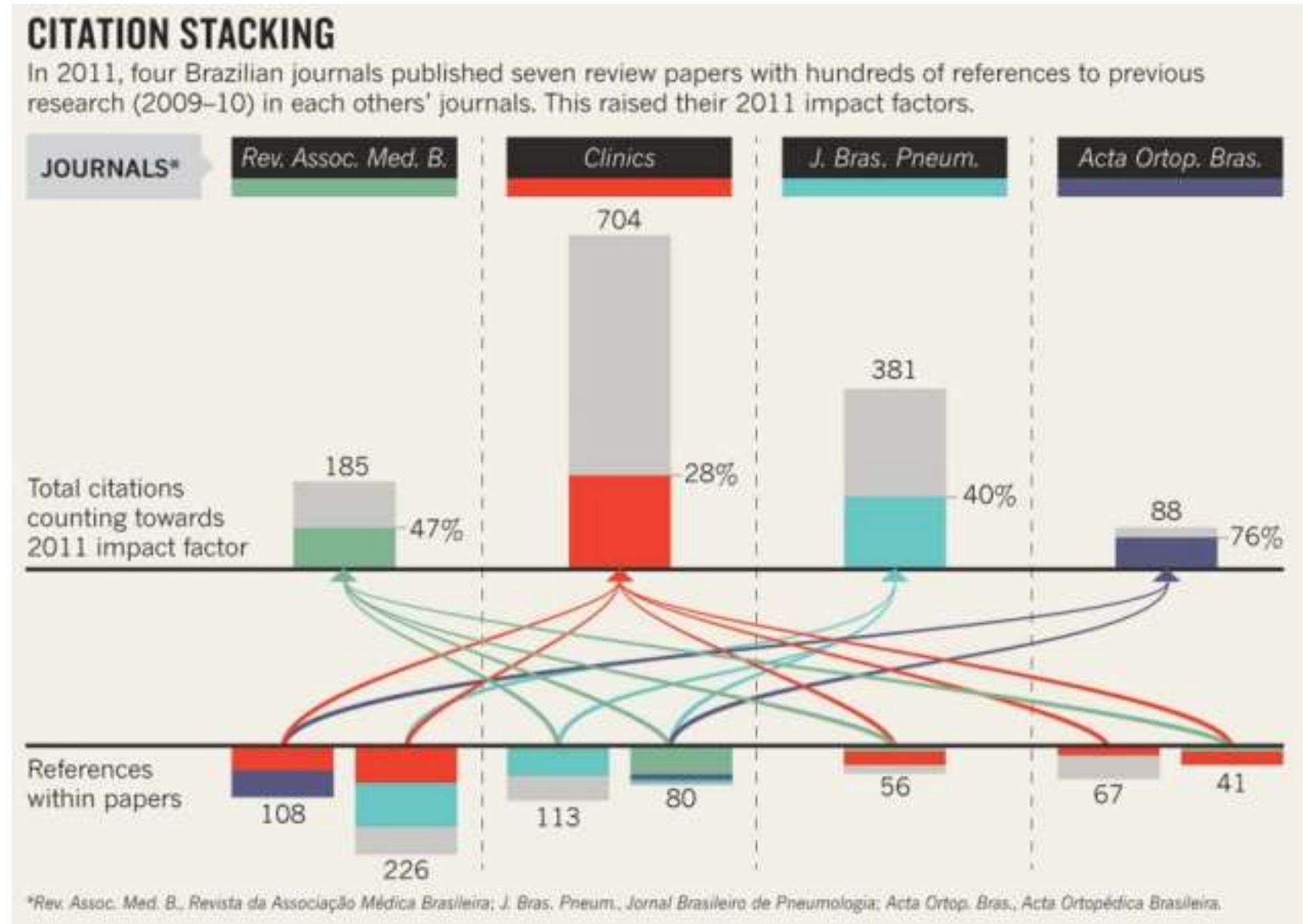
Stephen Buranyi, The Guardian, 27 Jun 2017.



A 2005 Deutsche Bank report referred to it as a “bizarre” “triple-pay” system, in which “the state funds most research, pays the salaries of most of those checking the quality of research, and then buys most of the published product”

Stephen Buranyi, The Guardian, 27 Jun 2017.

Use and abuse of metrics: from self-citation to citation cartels to citation stacking



Richard Van Noorden, 2017, Brazilian citation scheme outed. Thomson Reuters suspends journals from its rankings for 'citation stacking'. Nature, 27 August 2013



Is the grant  
system sound?

- … researchers spend much of their research time writing research proposals
- … the costs of peer review and non-granted project applications are often higher than the total budget of a call
- … grants are preferentially allocated to well endowed labs and teams …
- … strategic behavior of evaluators
- … a system based on lotteries would be way more efficient



nature

NEWS • 20 NOVEMBER 2019

David Adam

## Science funders gamble on grant lotteries

A growing number of research agencies are assigning money randomly.



What can one learn from the Health Research Council of New Zealand?



## Research Policy

Volume 49, Issue 1, February 2020, 103831



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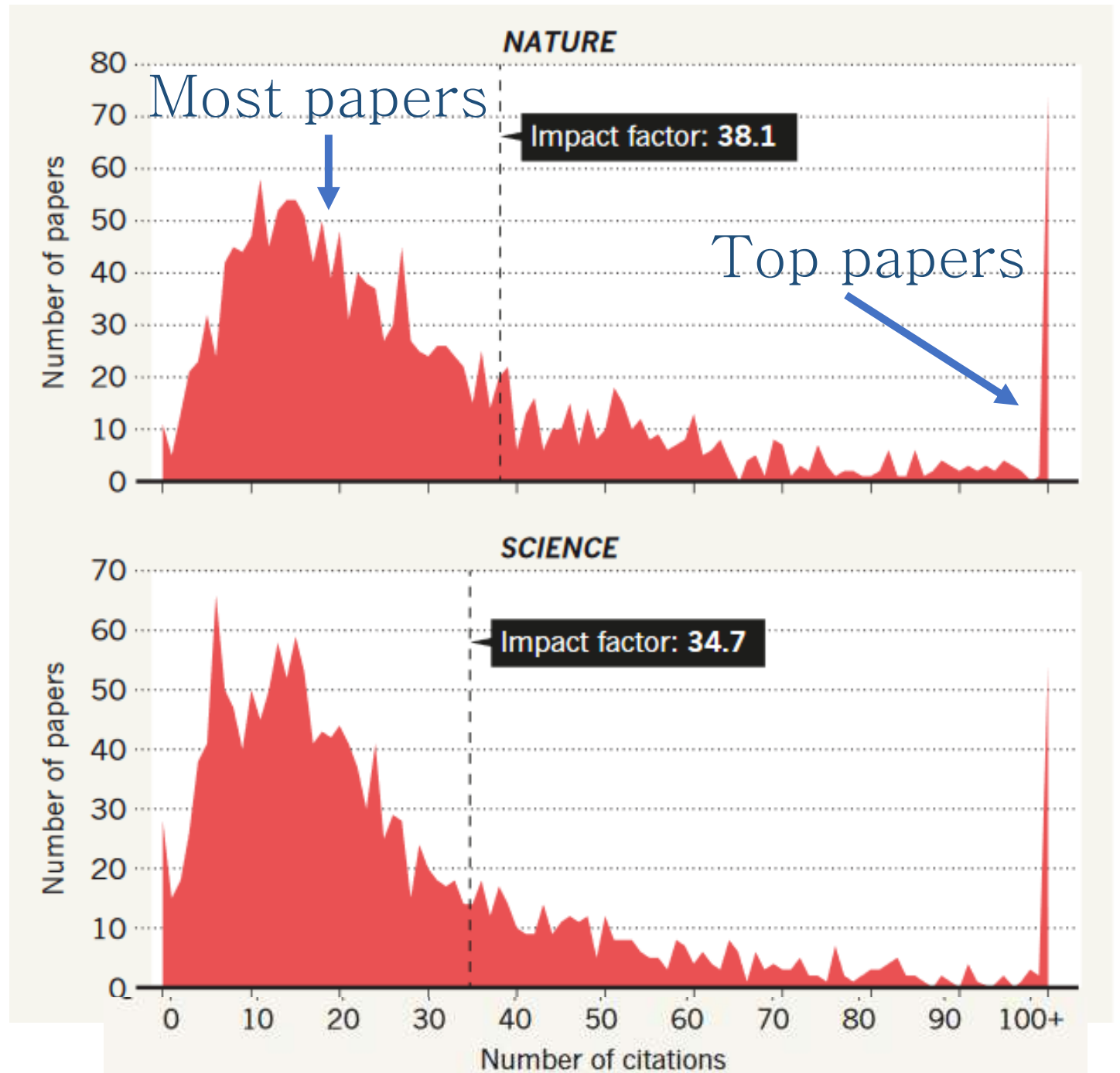
### How to avoid borrowed plumes in academia

Margit Osterloh  , Bruno S. Frey 

The impact factor is a misleading measure  
of the importance of an individual article.

The average paper is cited much less than the journal's impact factor

Source: E. Callaway, 2014  
Publishing elite turns against impact factor, Nature, 535, 210–211.



Cutting corners or not?

## Cargo-cult statistics and scientific crisis

Written by Philip B. Stark and Andrea Saltelli on 05 July 2018. Posted in [Science](#)



P-hacking,  
HARKing, salami  
slicing, ...

**nature materials**

Published: January 2005

**The cost of salami slicing**


Nature Materials 4, 1(2005) | [Cite this article](#)



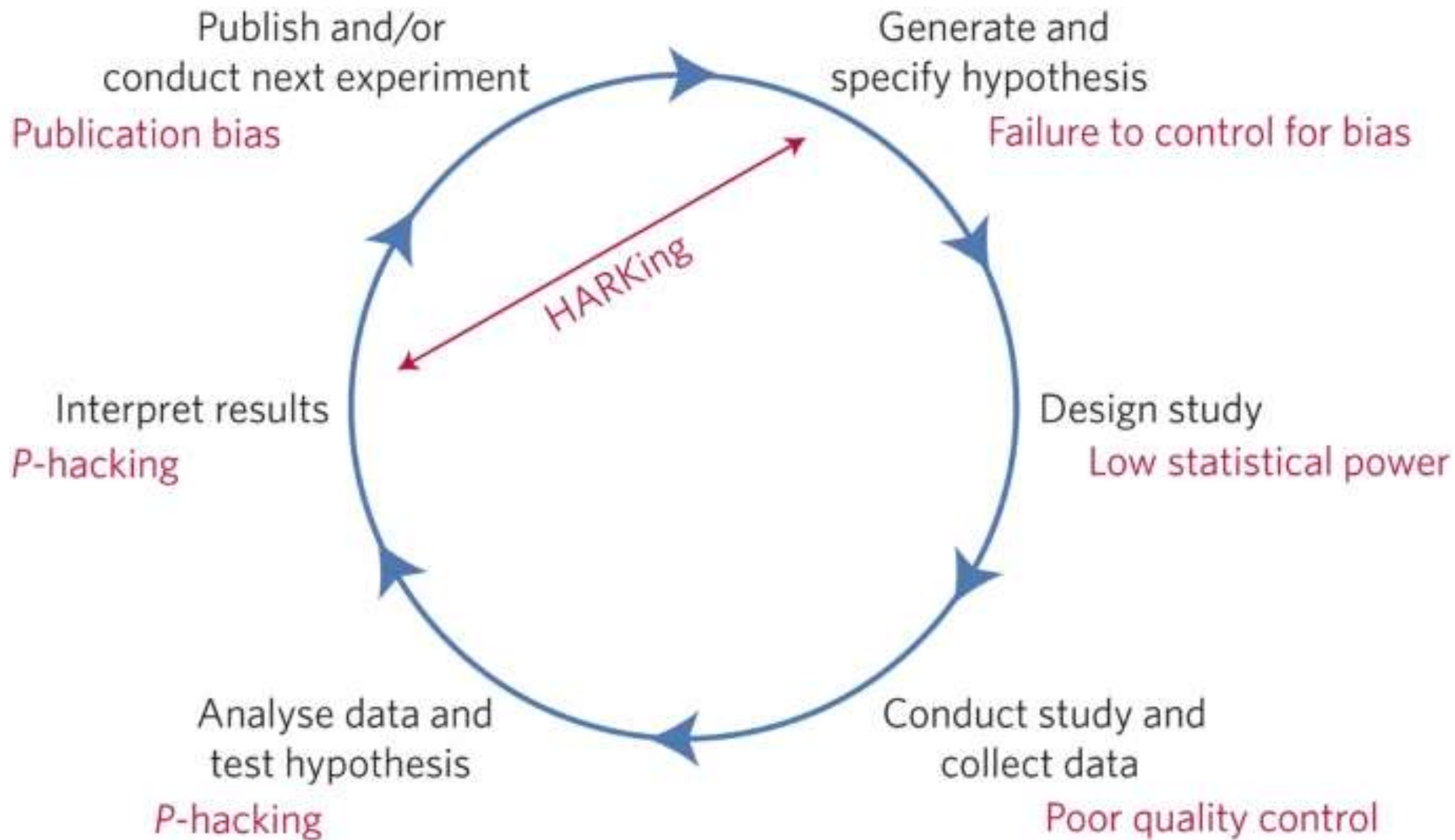
**nature human behaviour**

Open Access | Published: 10 January 2017

# **A manifesto for reproducible science**

Marcus R. Munafò , Brian A. Nosek, Dorothy V. M. Bishop, Katherine S. Button, Christopher D. Chambers, Nathalie Percie du Sert, Uri Simonsohn, Eric-Jan Wagenmakers, Jennifer J. Ware & John P. A. Ioannidis







## Definition of *integrity*

2 : an unimpaired condition : soundness

Wrapping up: The science we receive in heritage from our fathers has aspects which are unsound



## Definition of *integrity*

3 : the quality or state of being complete or undivided : completeness

As in ‘the manuscript has arrived to us in its integrity’

Has the 'manuscript' of science arrived in its integrity?

If not, what has gone lost?

- 1) Science as (small) communities of peers
- 2) Science as a self ruled republic

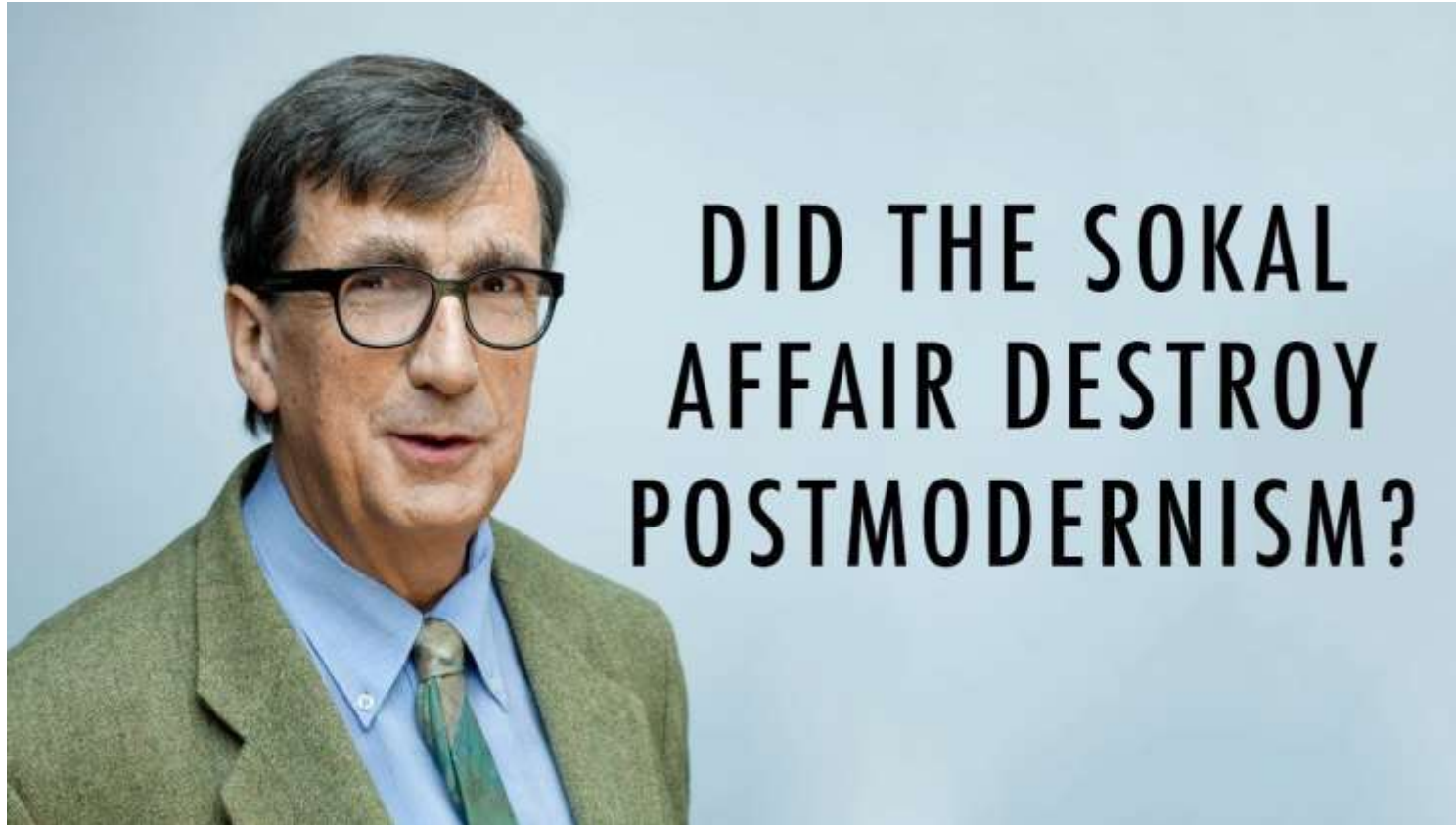
# Science is divided: the Sokal affair (1996)



The birth of 'scholarly hoax'

"Transgressing the  
Boundaries: Towards a  
Transformative Hermeneutics  
of Quantum Gravity"

The hoax generated soul searching in the community of science and technology studies



Bruno Latour, source <https://medium.com/the-humanities-in-transition/part-1-sokals-hoax-371af59bde3f>

# The Conceptual Penis as a Social Construct: A Sokal-Style Hoax on Gender Studies

BY PETER BOGHOSSIAN, ED.D. (AKA PETER BOYLE, ED.D.)

AND JAMES LINDSAY, PH.D. (AKA, JAMIE LINDSAY, PH.D.)

Source: [https://www.skeptic.com/reading\\_room/conceptual-penis-social-construct-sokal-style-hoax-on-gender-studies/](https://www.skeptic.com/reading_room/conceptual-penis-social-construct-sokal-style-hoax-on-gender-studies/)

Another hoax  
in 2018  
(aka: Sokal-squared)

HOME \ CULTURE

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## Grievance Studies exposes college corruption with hoax papers

# The Washington Times

*America's Newspaper*

Source: <https://www.washingtontimes.com/news/2018/oct/3/grievance-studies-exposes-college-corruption-hoax-/>

Beryl L. Crowe: “two insular scientific communities – the natural and the social-between which there is very little communication and a great deal of envy, suspicion, disdain, and competition for scarce resources”

**The Tragedy of the  
Commons Revisited**

28 November 1969, Volume 166, Number 3909

**SCIENCE**



Beryl L. Crowe: “Perhaps the major problems of modern society have, in large part, been allowed to develop and intensify through this structure of insularity and specialization”

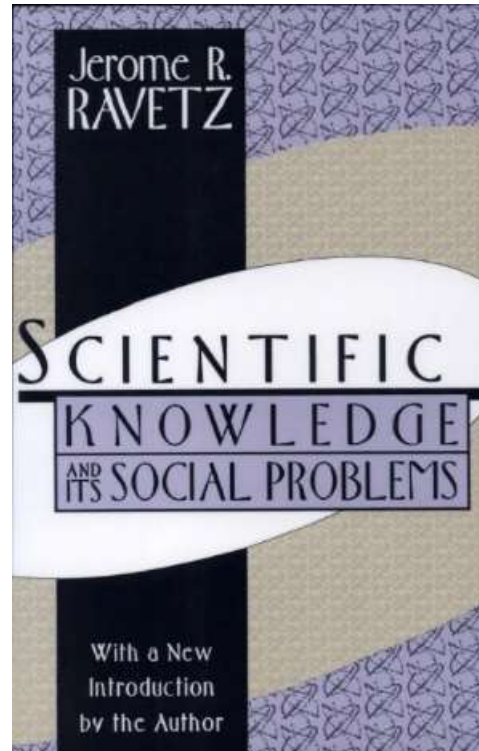
**The Tragedy of the  
Commons Revisited**

28 November 1969, Volume 166, Number 3909

**SCIENCE**

p.22: “[...] The problem of quality control in science is at the centre of the social problems of the industrialized science of the present period.”

Ravetz, J., 1971, *Scientific Knowledge and its Social Problems*, Oxford University Press.



Jerome R.  
Ravetz



## Definition of *integrity*

3 : the quality or state of being complete or undivided : completeness

Wrapping up: science is not in 'one piece'

# Epilogue

Science's integrity has implications for society

Those implications are unfolding at an unprecedented rate: the case of COVID-19

COMMENT · 24 JUNE 2020

## Five ways to ensure that models serve society: a manifesto

Pandemic politics highlight how predictions need to be transparent and humble to invite insight, not blame.

COVID-19 and its models

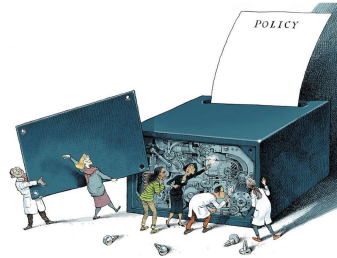


Illustration by David Parkins



**nature**

COVID-19 policies dictated by  
'science' with several digits  
precision in the presence of  
fundamental uncertainties



Undocumented research code used  
as a policy tool (chameleon models)



Pfleiderer, P. Chameleons: The Misuse of Theoretical Models in Finance and  
Economics. *Economica* 87, 81–107 (2020).

Forthcoming: “What did COVID-19 really teach us about science, evidence and society?”

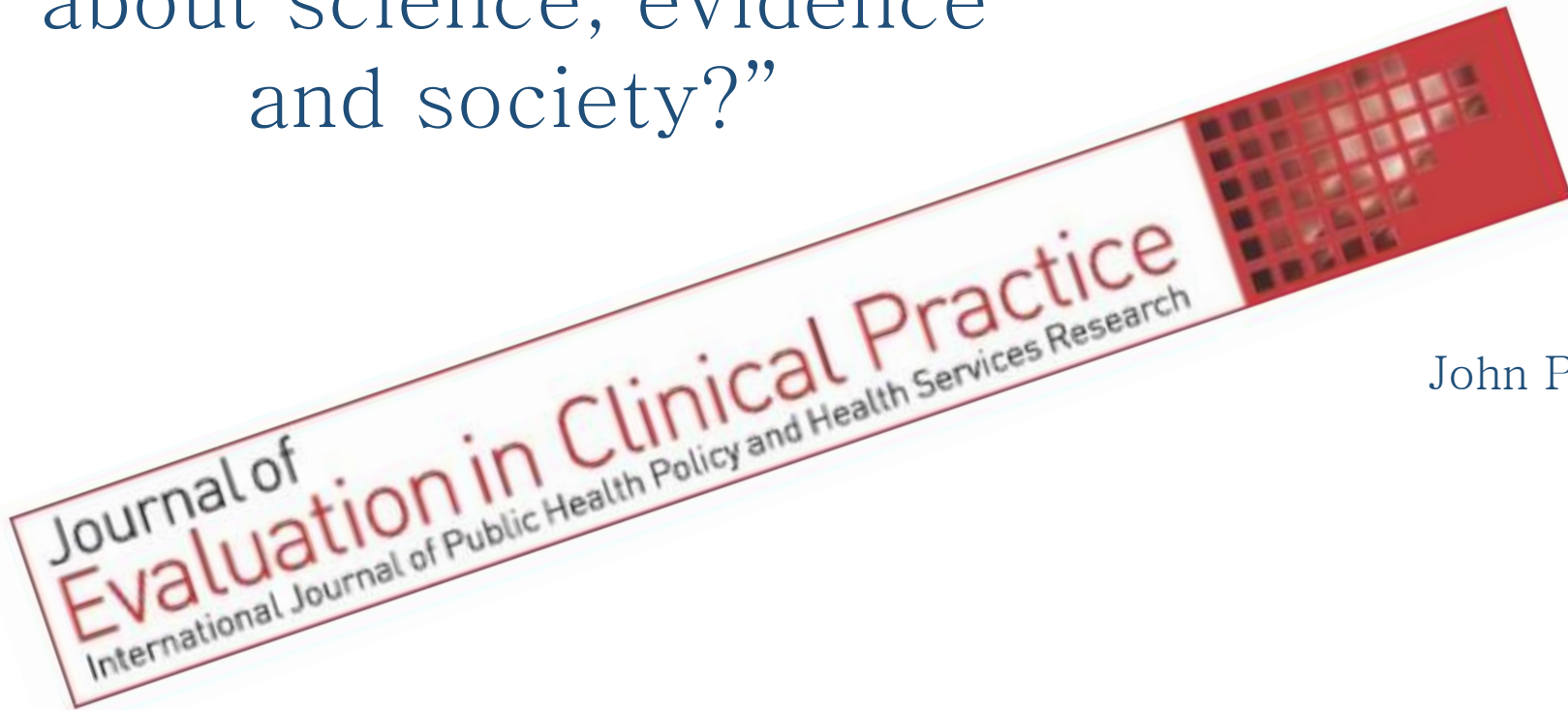
Daniel Sarewitz



John P.A. Ioannidis



Joachim P. Sturmborg



Did we follow the science?

With what results?

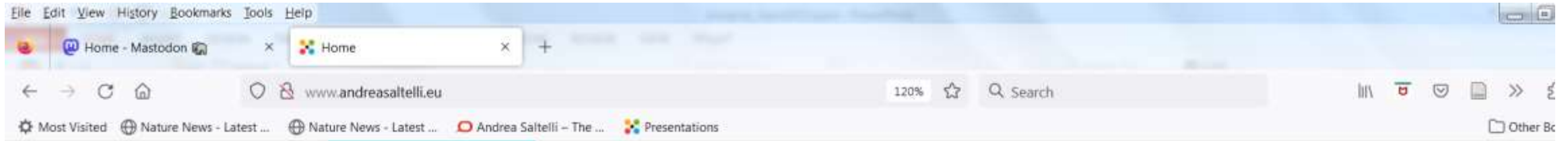
What if science was the problem to start with?

How about trust in the long term?





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## Coming Out Soon: The politics of modelling



### Praise for the volume

*"A long awaited examination of the role —and obligation —of modeling."*

**Nassim Nicholas Taleb**, Distinguished Professor of Risk Engineering, NYU Tandon School of Engineering. Author, of the 5 -volume series *Incerto*.

\*\*\*

*"A breath of fresh air and a much needed*

### Mastodon Toots by

@AndreaSaltelli



AndreaSaltelli

2023/4/18 17:24

"Kaufman, who was until recently a senior climate economist in the White House, questioned the need for the government to set a single price. Regulators should stop "pretending we