

# The future of scientific publishing

ideas for an open, transparent, independent system

**Nikolaus Kriegeskorte**

Medical Research Council

Cognition and Brain Sciences Unit

Cambridge, UK

# A publication system needs to provide two functions

**(1) access to papers**

**open access (OA)**

**(2) evaluation of papers**

**open evaluation (OE)**

# Open evaluation (OE)

post-publication, evaluative responses  
from peers

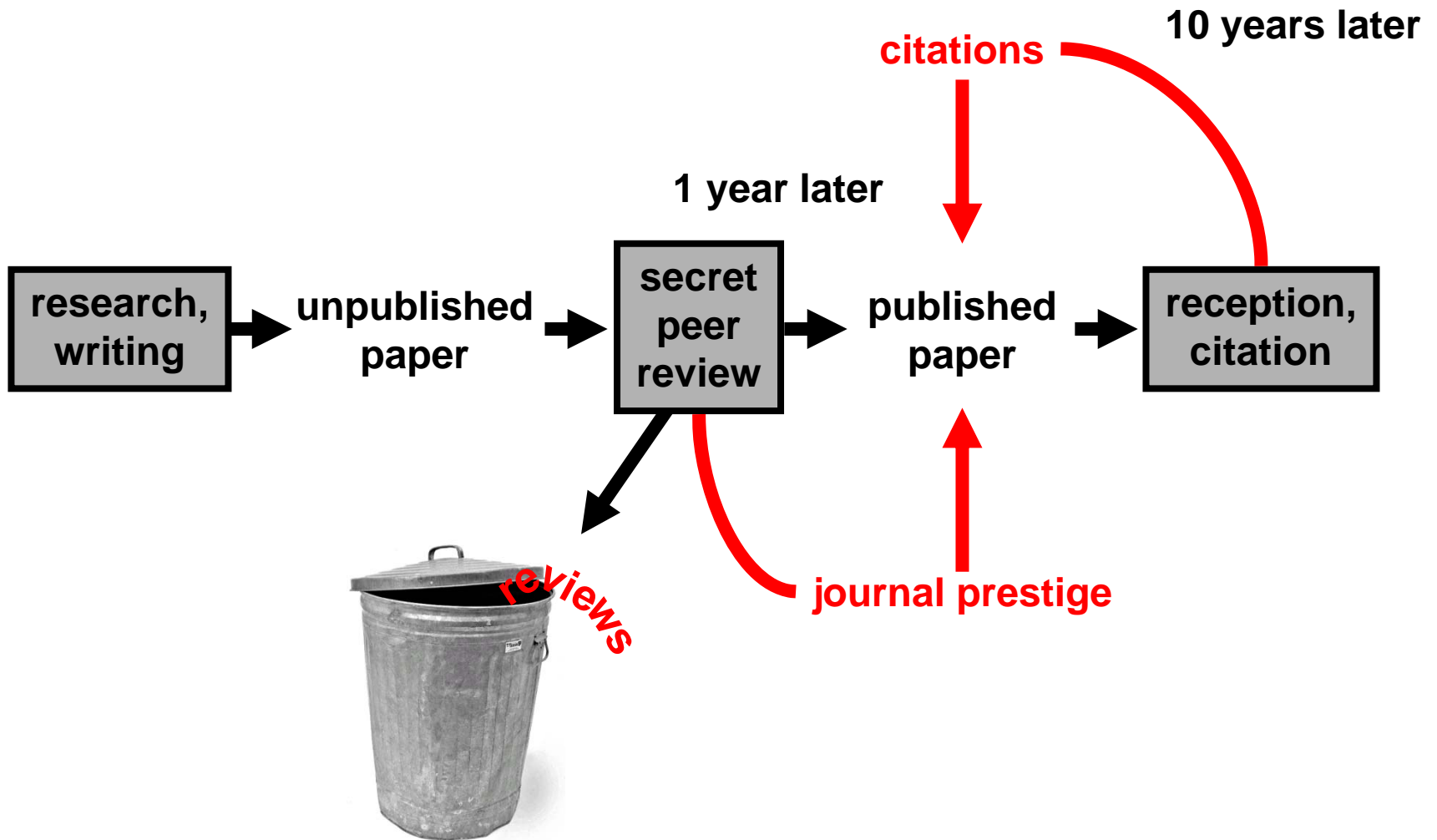
- peer **reviews**
- peer **ratings**

→ ***explicit judgments***

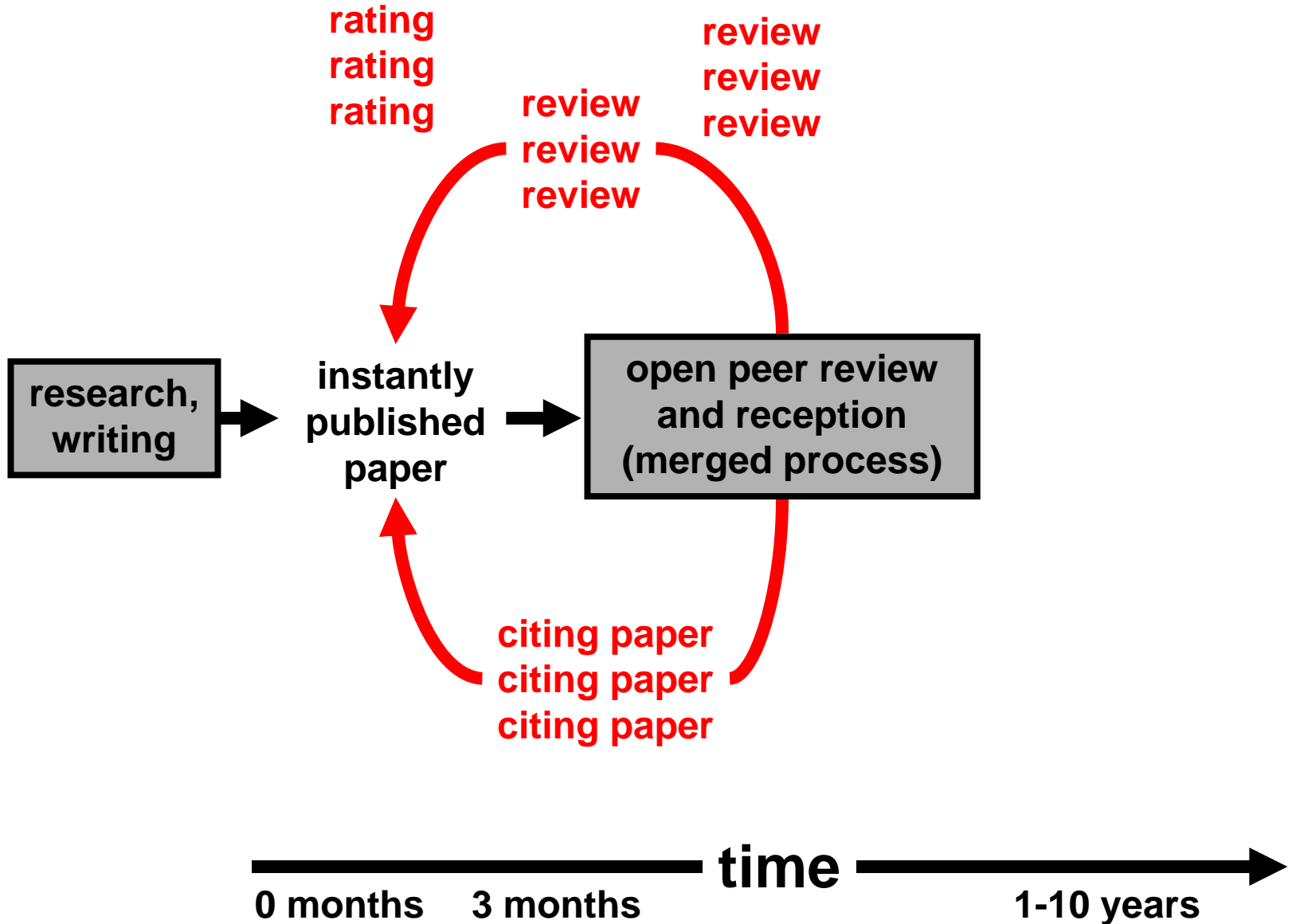
(in contrast to article metrics like views, downloads, etc.)

→ ***signed or anonymous***

# Current



# Future



# **Open post-publication peer review**

# Open post-publication peer review

- open to post: anyone can instantly post a review
- open to access: anyone can instantly access any review
- each review is permanently linked to the paper
- reviews are digitally authenticated at different levels
  - **signed** reviews  
(author authenticated and publicly identified)
  - **unsigned** reviews by authenticated group members  
(e.g. member of a scientific society)
  - **unauthenticated**

# Open **post-publication** peer review

- In order for reviewing to be open, it has to be post-publication.
- Review and reception are an integrated ongoing process after publication.
- Reviews do not decide about or delay publication.

# Open post-publication **peer review**

- Peer review is not perfect, but it is the best evaluation mechanism we have.
- The most serious drawbacks of peer review derive from the fact that it is currently a *secret* process.

# The nature of a review

## Current

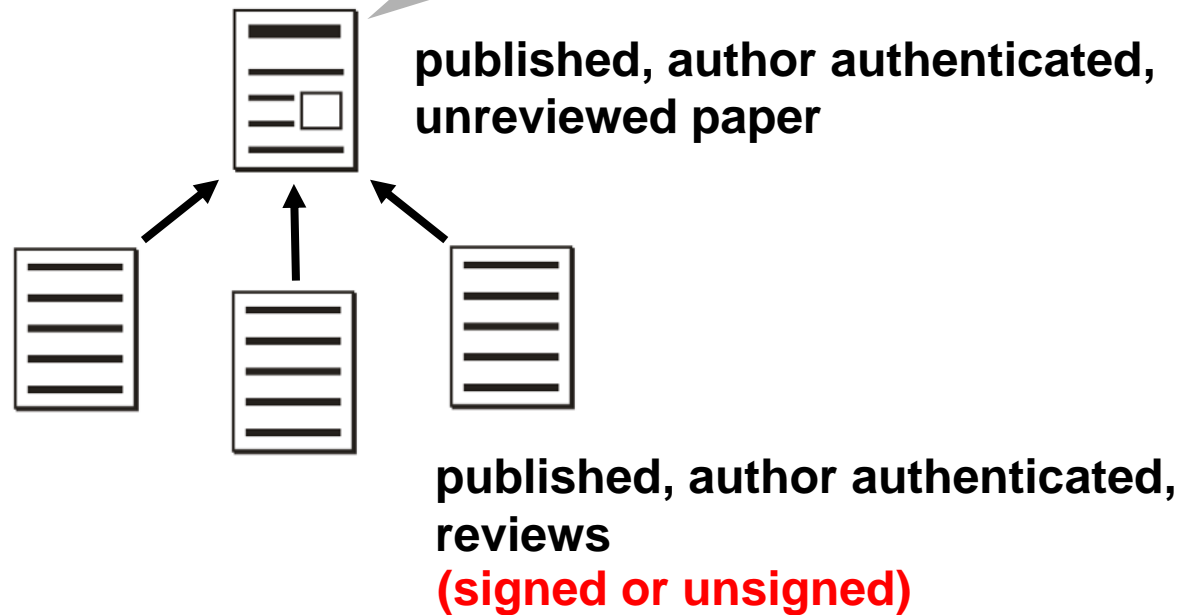
- secret communication to authors and editors
- decides about publication
- reviewer's motivation
  - selfless: scientific objectivity
  - selfish: science politics
- a weak argument can make or break a paper

## Future

- open letter to the community
- evaluates published work
- reviewer's motivation
  - selfless: scientific objectivity
  - selfish: looking smart and objective in public
- an argument is as powerful as it is compelling

## peer-to-peer editing

- authors ask a senior scientist to edit the paper
- editor chooses 3 reviewers and asks them to openly review the paper
- editor is named on the paper



## review

- text
- numerical ratings
  - justification of claims
  - importance
  - originality
  - ...

## peer-to-peer editing

- authors ask a senior scientist to edit the paper
- editor chooses 3 reviewers and asks them to openly review the paper
- editor is named on the paper



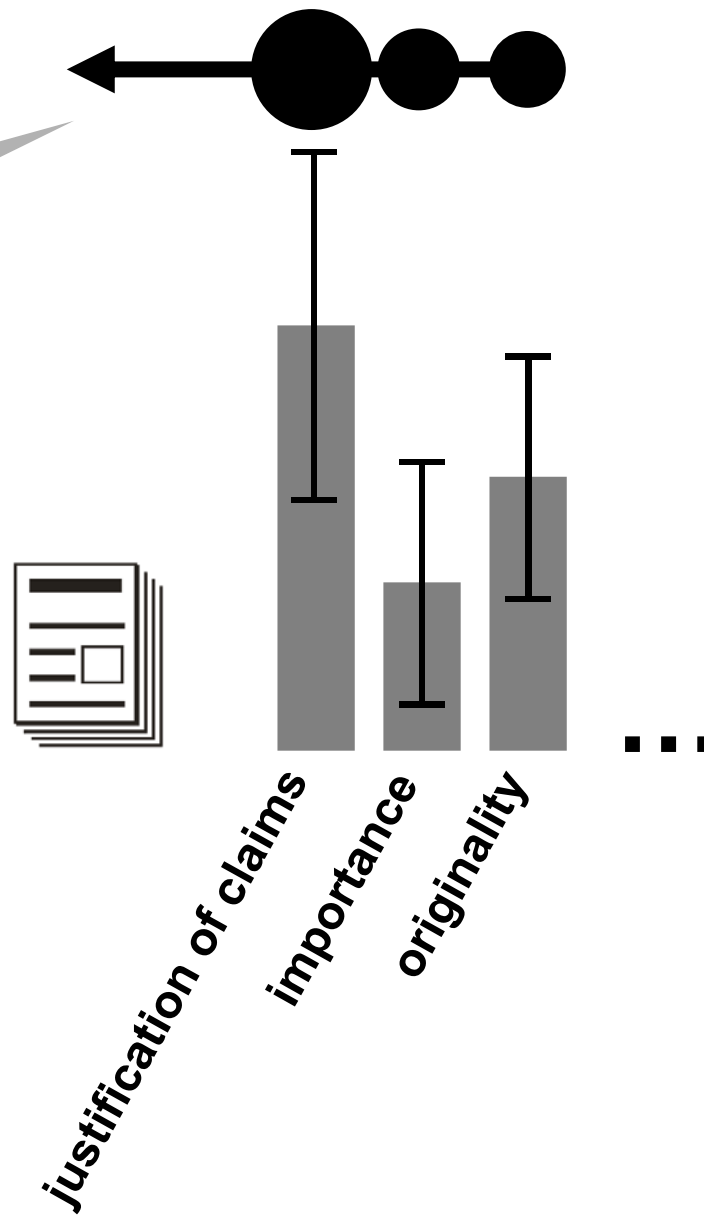
published, author authenticated,  
**reviewed** paper



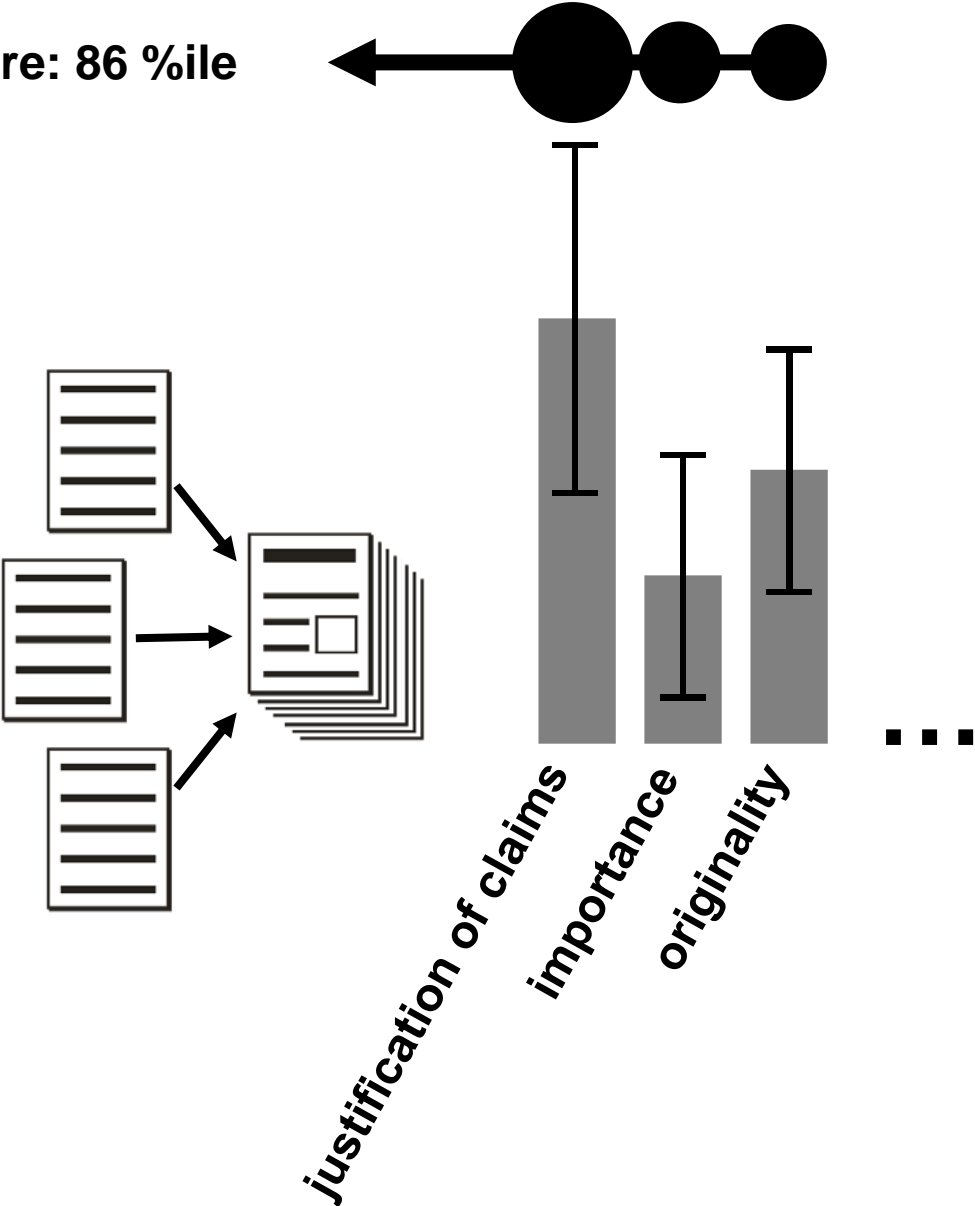
paper score: 86 %ile

### paper evaluation function (PEF)

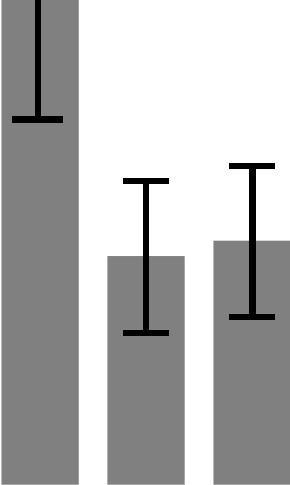
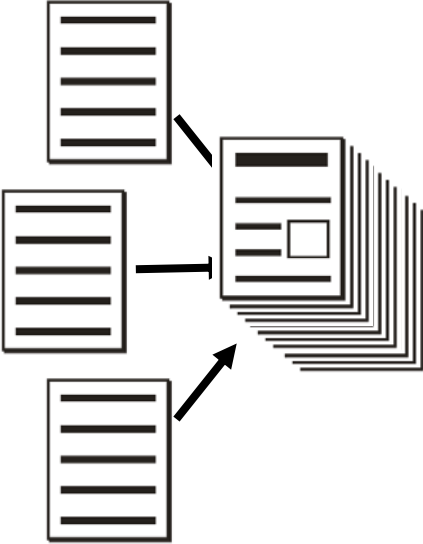
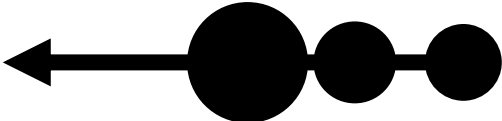
- arbitrary function that scores papers based on the available meta-information
- simplest case: weighted average of review ratings
- individuals or groups can define PEFs to prioritize the literature according to their needs



paper score: 86 %ile

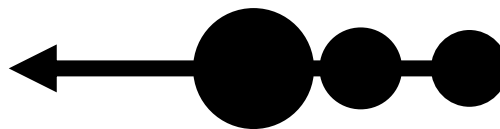


paper score: 94 %ile

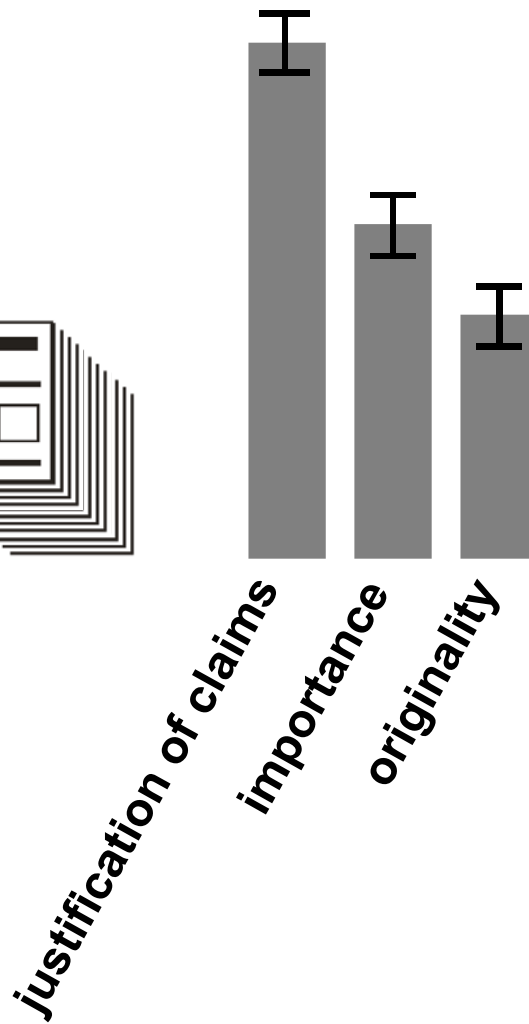


*Justification of claims*  
*importance*  
*originality*

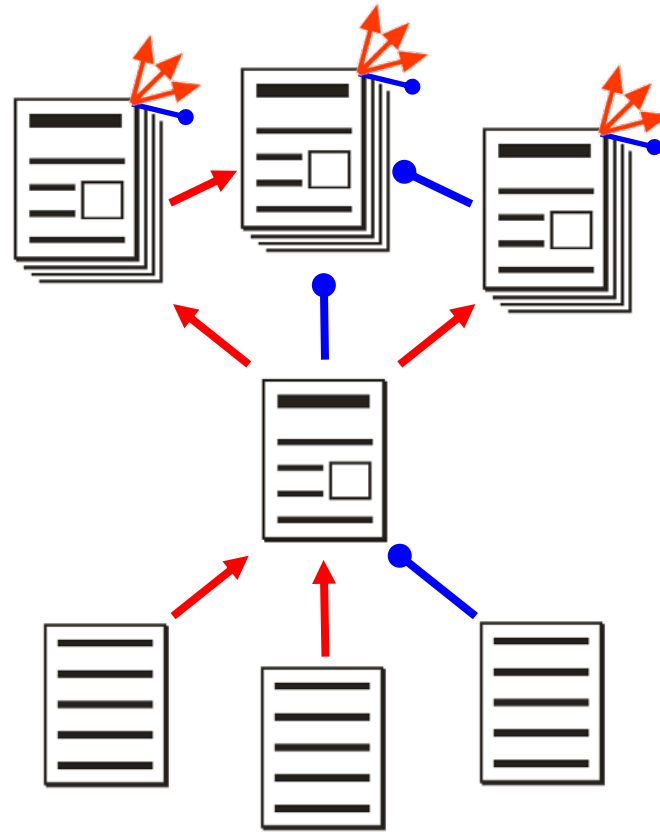
paper score: 98 %ile



ready to be  
showcased in  
*Science or Nature*

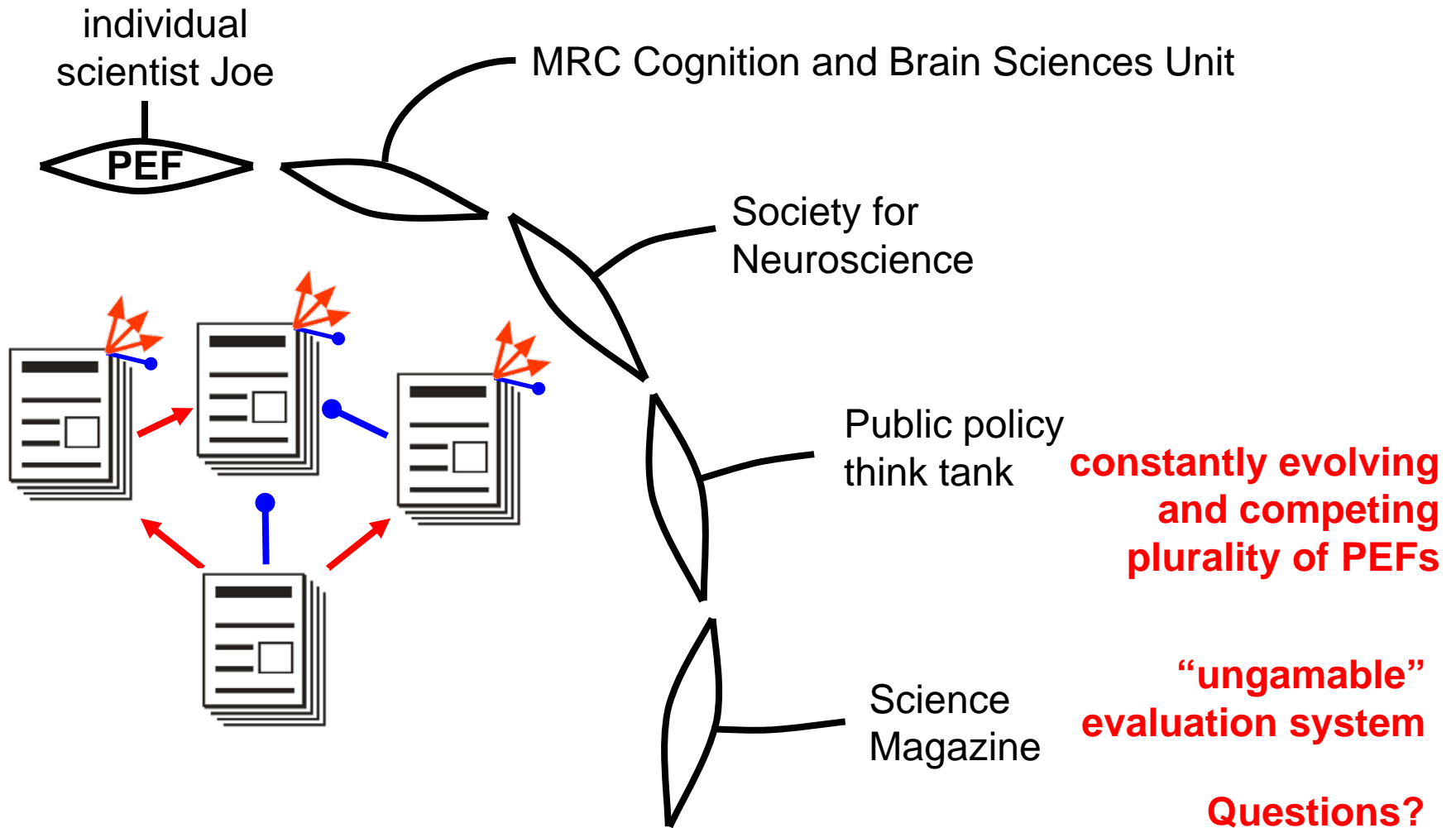


# “Papernet”



**Bayesian belief  
propagation**

# Paper evaluation functions provide multiple “lenses onto the literature”



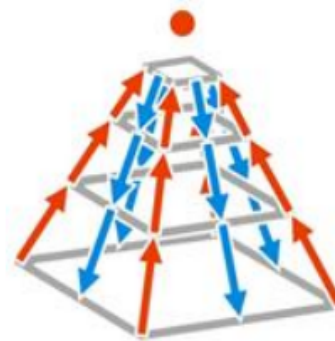
# Designing open evaluation

- Part of scientific methods development
- The future system will derive its authority from a scientific literature on open evaluation.



**frontiers**  
IN COMPUTATIONAL NEUROSCIENCE

Special Topic

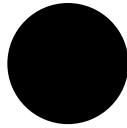


Beyond open access:  
visions for open  
evaluation of scientific  
papers by  
post-publication peer  
review

Hosted By:

Diana Deca, University of Amsterdam, Netherlands  
Nikolaus Kriegeskorte, Medical Research Council  
Cognition and Brain Sciences Unit, UK

[Submit Article](#)



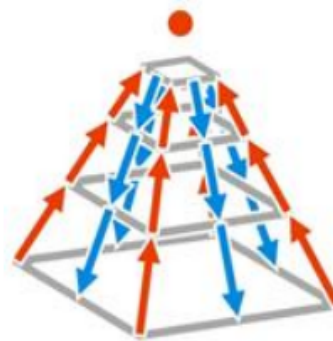
# Designing open evaluation

- Part of scientific methods development
- Scientists should envision, design, justify, and test the system.
- The future system will derive its authority from a scientific literature on open evaluation.



**frontiers**  
IN COMPUTATIONAL NEUROSCIENCE

Special Topic



Beyond open access:  
visions for open  
evaluation of scientific  
papers by  
post-publication peer  
review

Hosted By:

Diana Deca, University of Amsterdam, Netherlands  
Nikolaus Kriegeskorte, Medical Research Council  
Cognition and Brain Sciences Unit, UK

[Submit Article](#)

**How can we transition to the  
future system?**

# Transitioning

## Public website for open posting of digitally authenticated post-publication reviews

- Pubmed-scale investment to develop collaborative software and install the system (Public funding. Involve Google?)
- Papers published in the current system can be reviewed using the new system
- Original reviewers can publish the reviews they wrote for a traditional journal
- This provides a platform for continual online evaluation of the scientific literature
- Tipping point reached when the evaluative signal becomes more reliable than journal prestige
- Papers can then be published instantly without journals – as authenticated digital documents (like the reviews)

# What can we do now?

- Publish the reviews we write and receive online  
**Useful activism, not the solution.**

- View the problem as a grand challenge to cognitive and brain science  
**How to organize the collective cognition of the scientific community?**

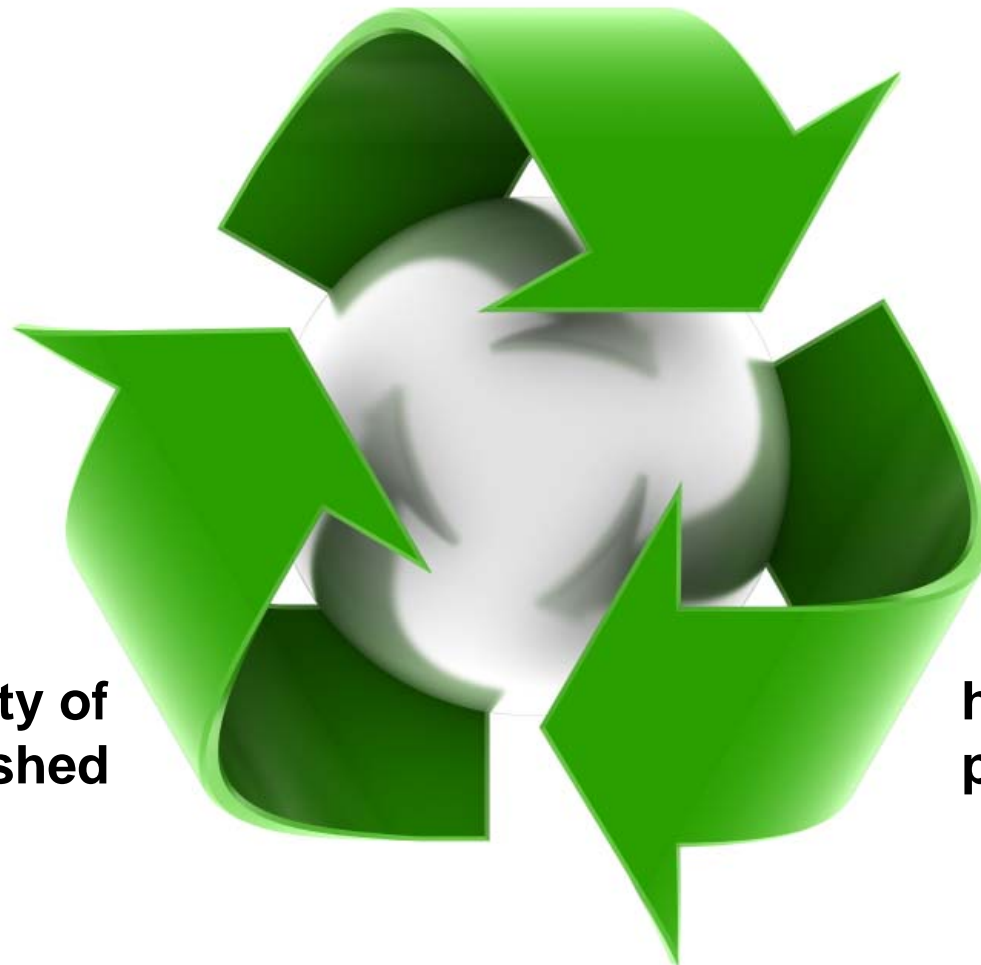
- Imagine how we want it to work, then talk and write about it...  
**[futureofscipub.wordpress.com](http://futureofscipub.wordpress.com)**

# **Supplementary material**

**Problem: Journal prestige is the sole immediate indicator of paper quality**

# High-value virtuous cycle

**high  
journal prestige**

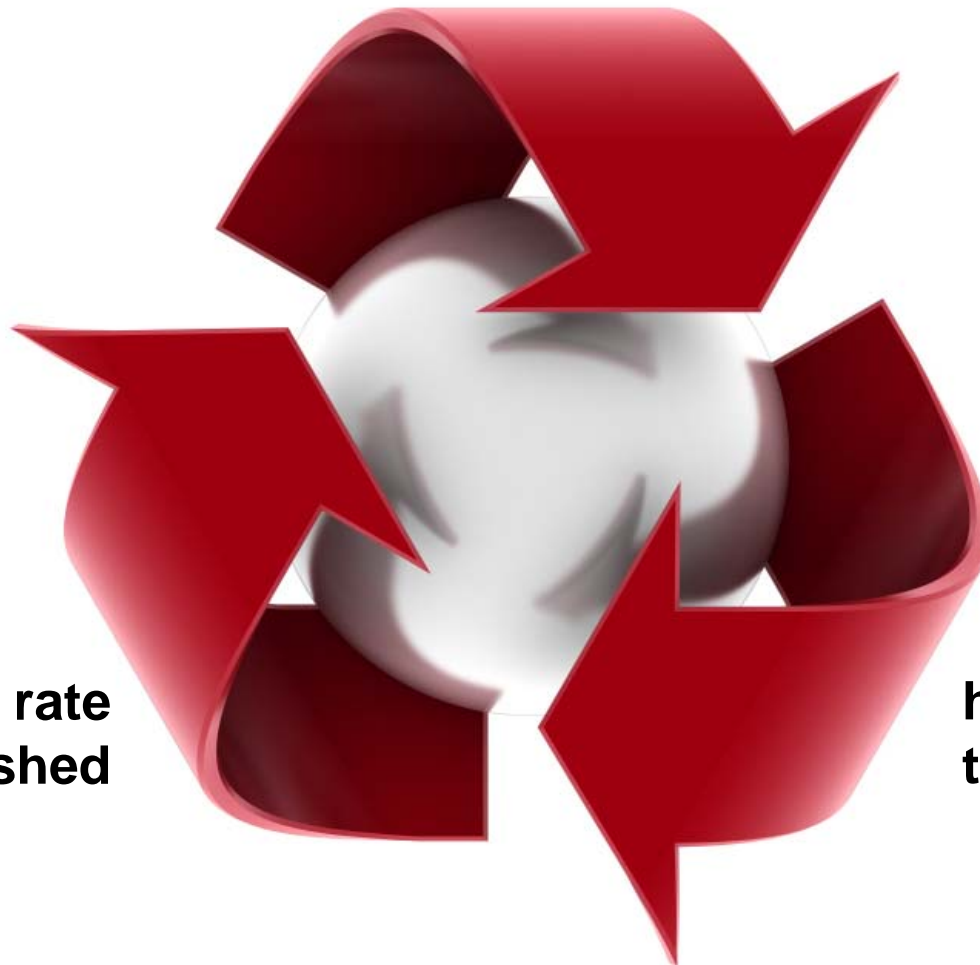


**high quality of  
papers published**

**high quality of  
papers submitted**

# Hype-value vicious cycle

**high  
journal prestige**



**high citation rate  
of papers published**

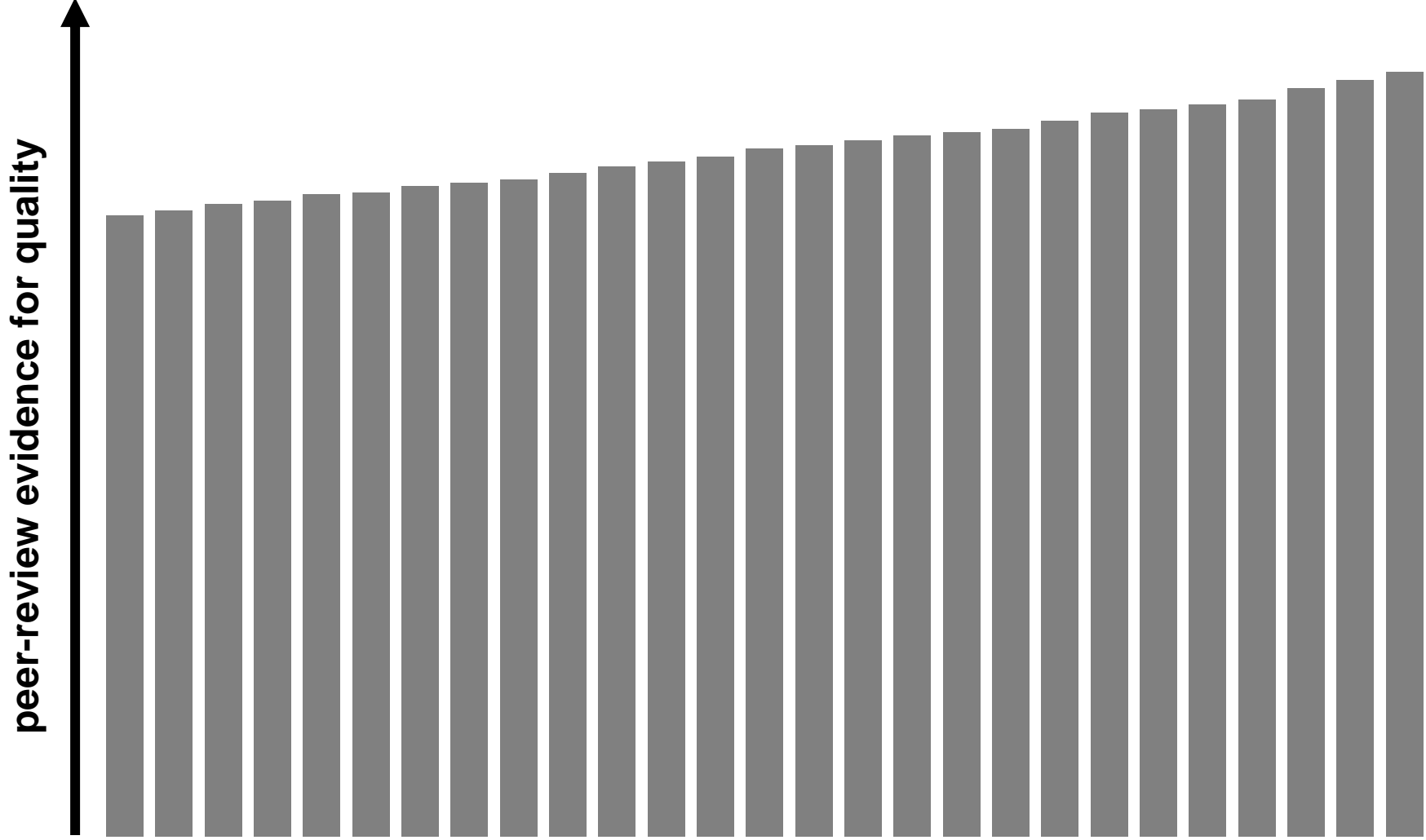
**high attention  
to papers published**

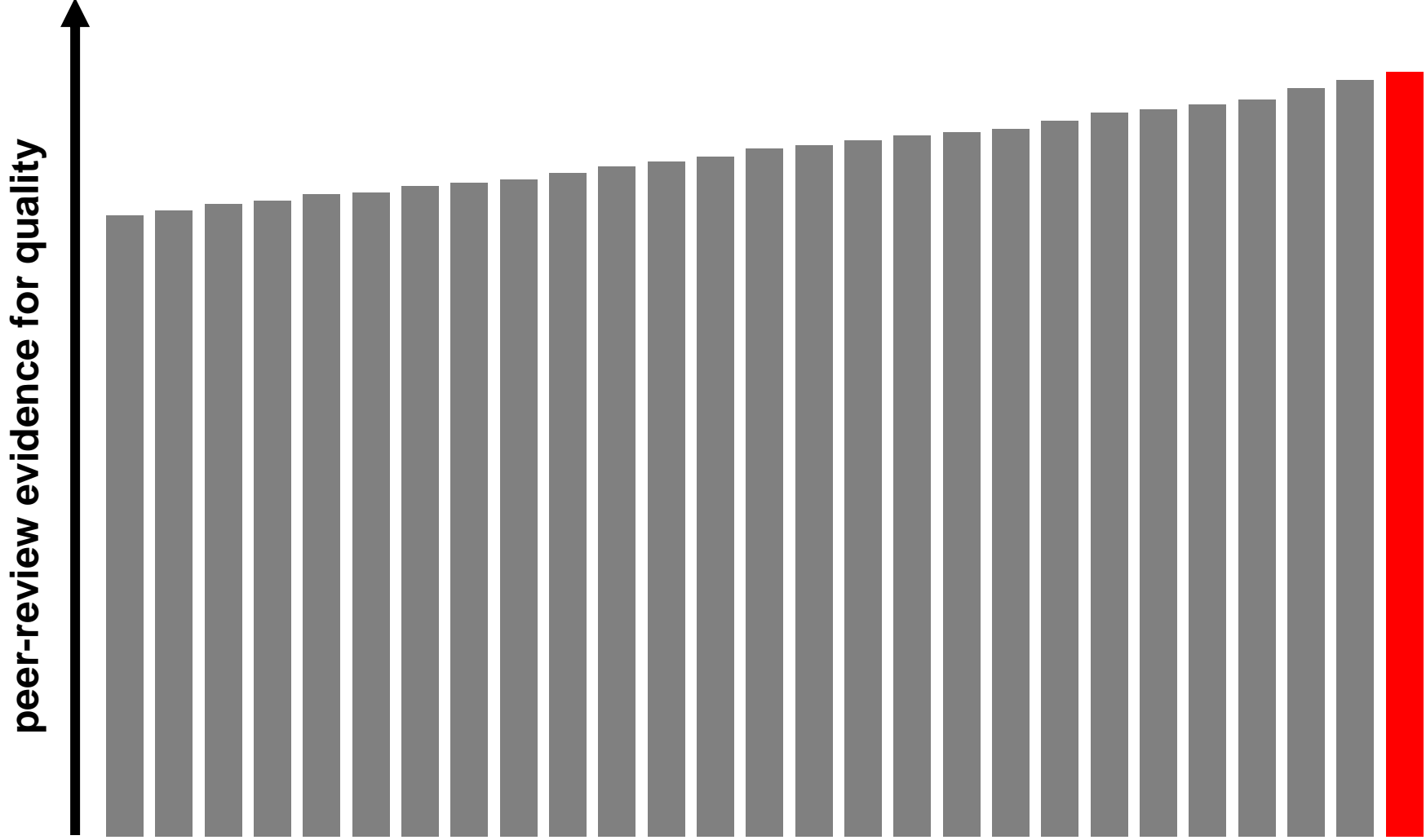
# Journal prestige: simultaneously real and fake

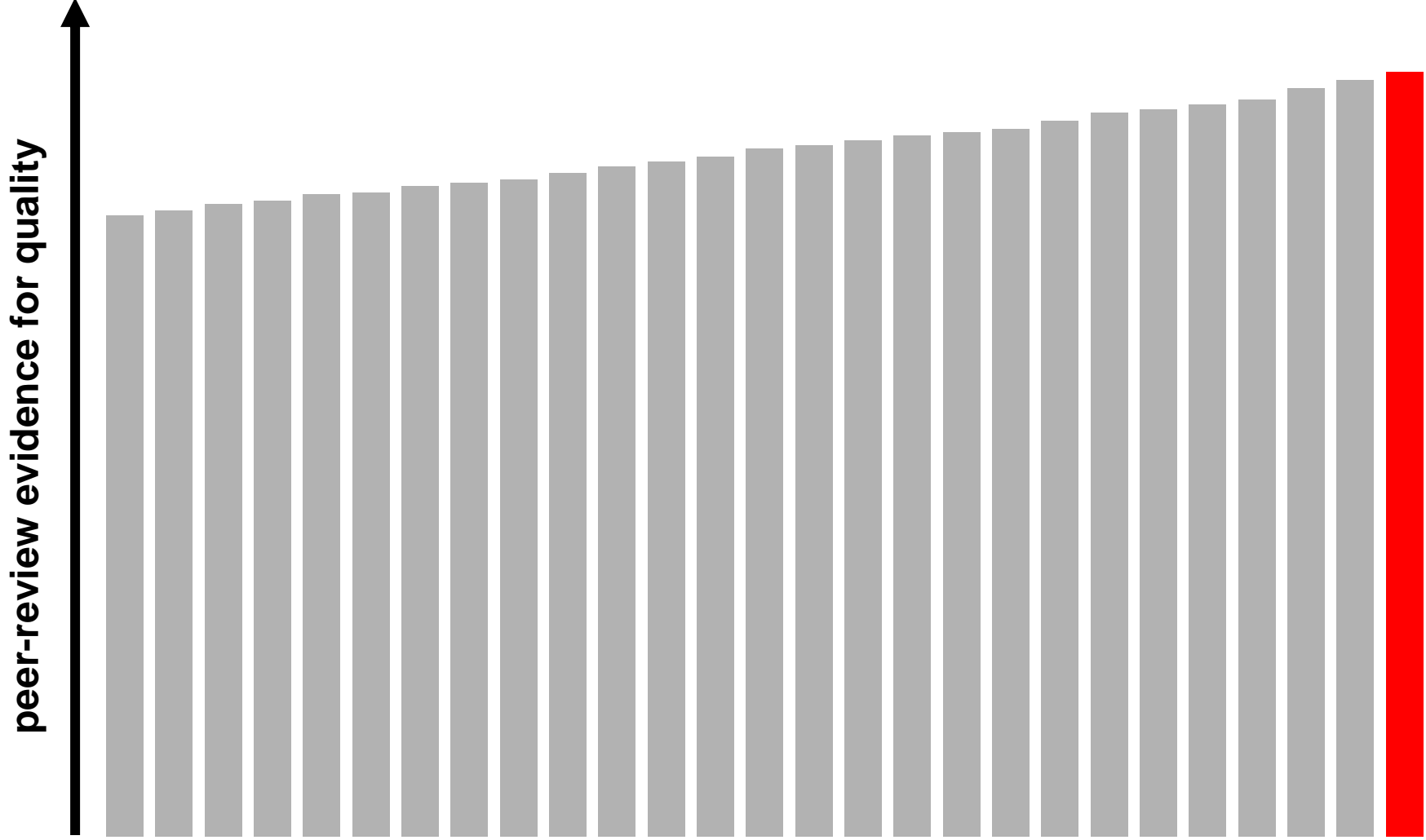
- Journal prestige truly is somewhat correlated with paper quality.
- However, the correlation is much lower than implicitly claimed.
- Nature and Science claim to give us the very best papers.
- In fact they give us an essentially random tiny selection among a much larger set of equally worthy papers.
- “Equally worthy” means not significantly different, given the noise in the review process.
- Since journal prestige is the only immediate indication of quality we have, it need not be good to dominate our reading choices.

# Journal prestige: simultaneously real and fake

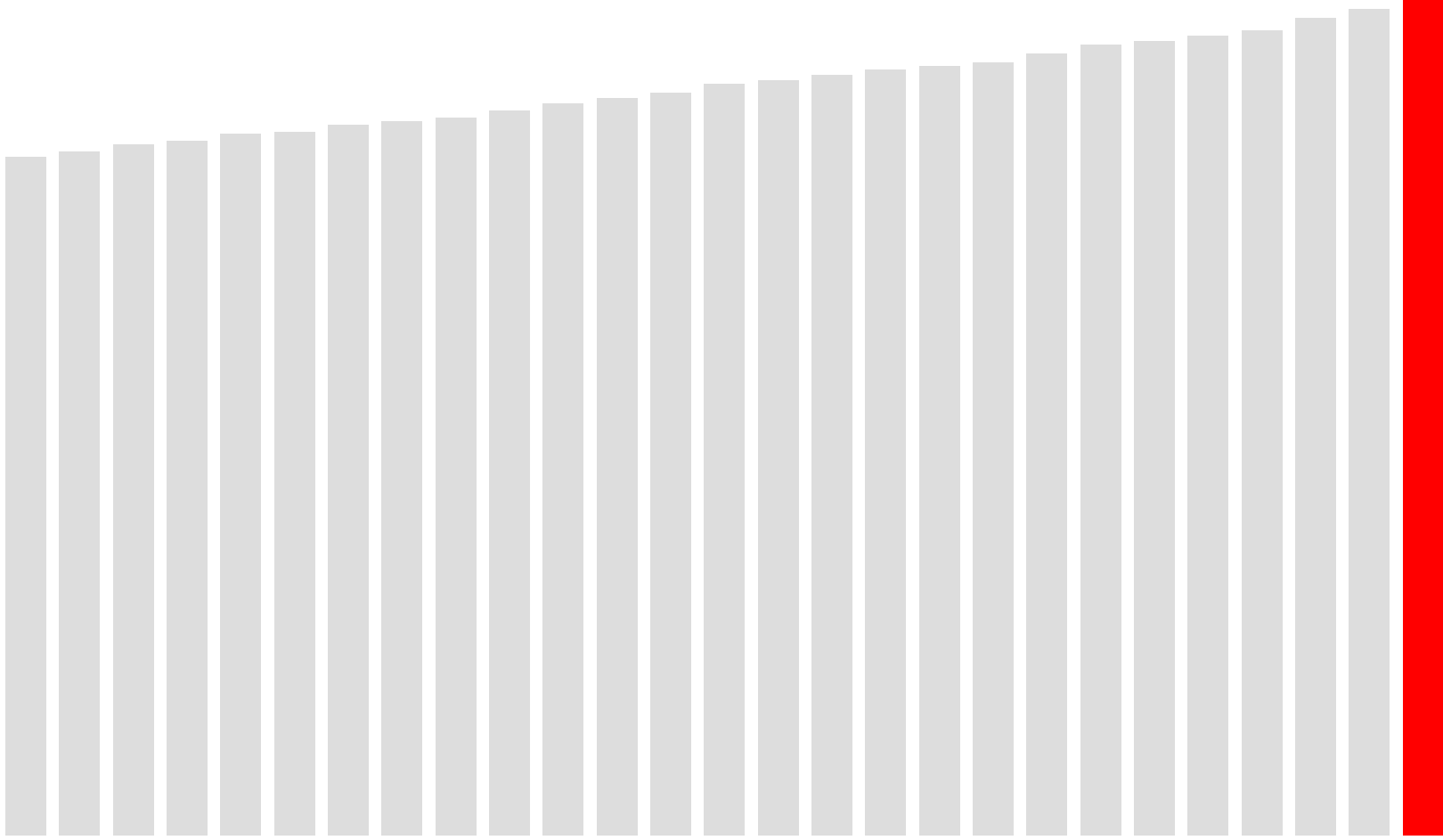
- *Nature* and *Science* have great influence on
  - science funding decisions
  - public attention and policies
  - scientists' careers
- Editors and reviewers are talented and well-meaning people.
- However, 3-4 reviews are simply insufficient to make a decision of such weight to the community.
- High-impact journals confuse the scientific community and the general public with an essentially random signal (i.e. selection among the much larger proportion of equally worthy papers) that is too strong to be ignored.
- This wastes very large amounts of public funds.



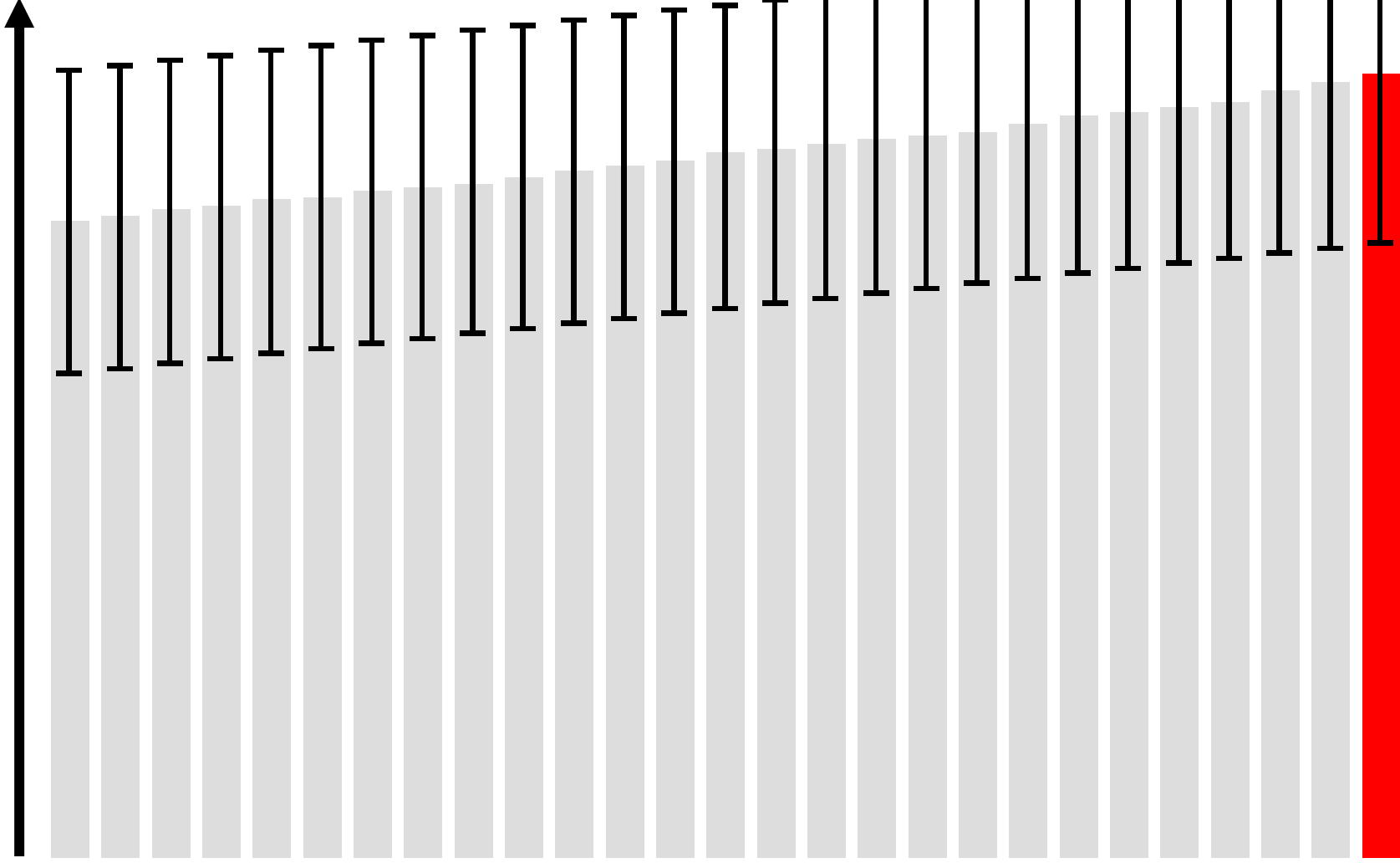


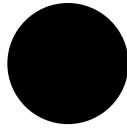


peer-review evidence for quality



peer-review evidence for quality

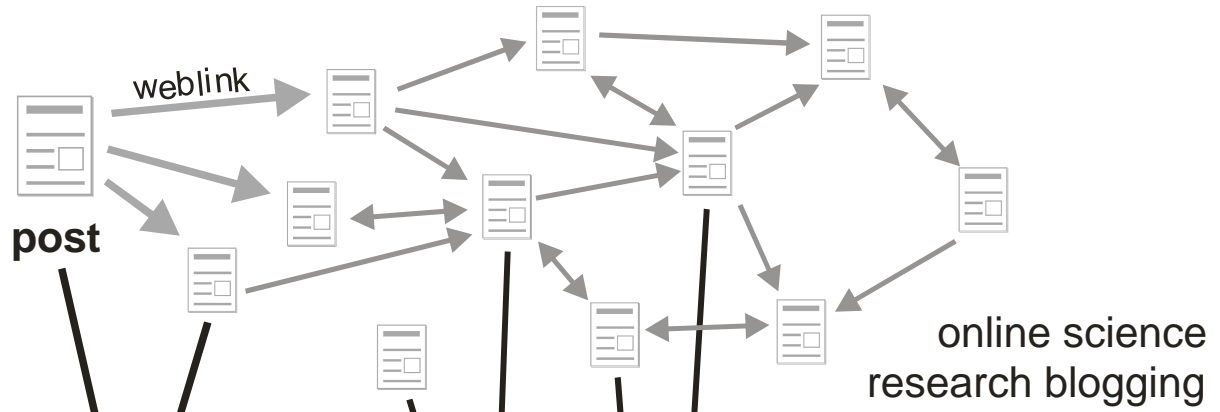




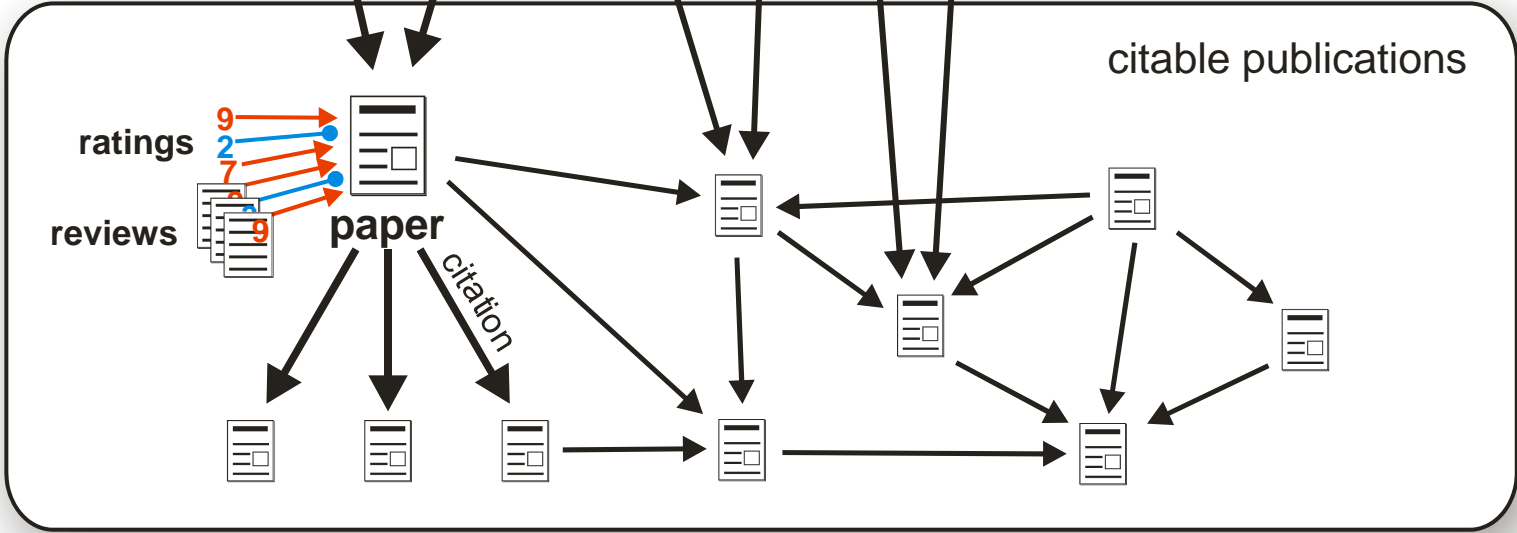
# Paper evaluation functions (PEFs)

- weighted average of reviewer ratings
  - weighted by dimension (e.g. justification of claims, importance)
  - weighted by reviewer information
    - expertise factor (e.g. h-factor)
    - independence of authors (citation and social network analysis)
    - time investment (e.g. self-report)
- could include alternative metrics (views, downloads, etc.)
- constant competition of alternative PEF “lenses” onto the literature
- arbitrary algorithms possible

**fleeting**  
short-term  
memory



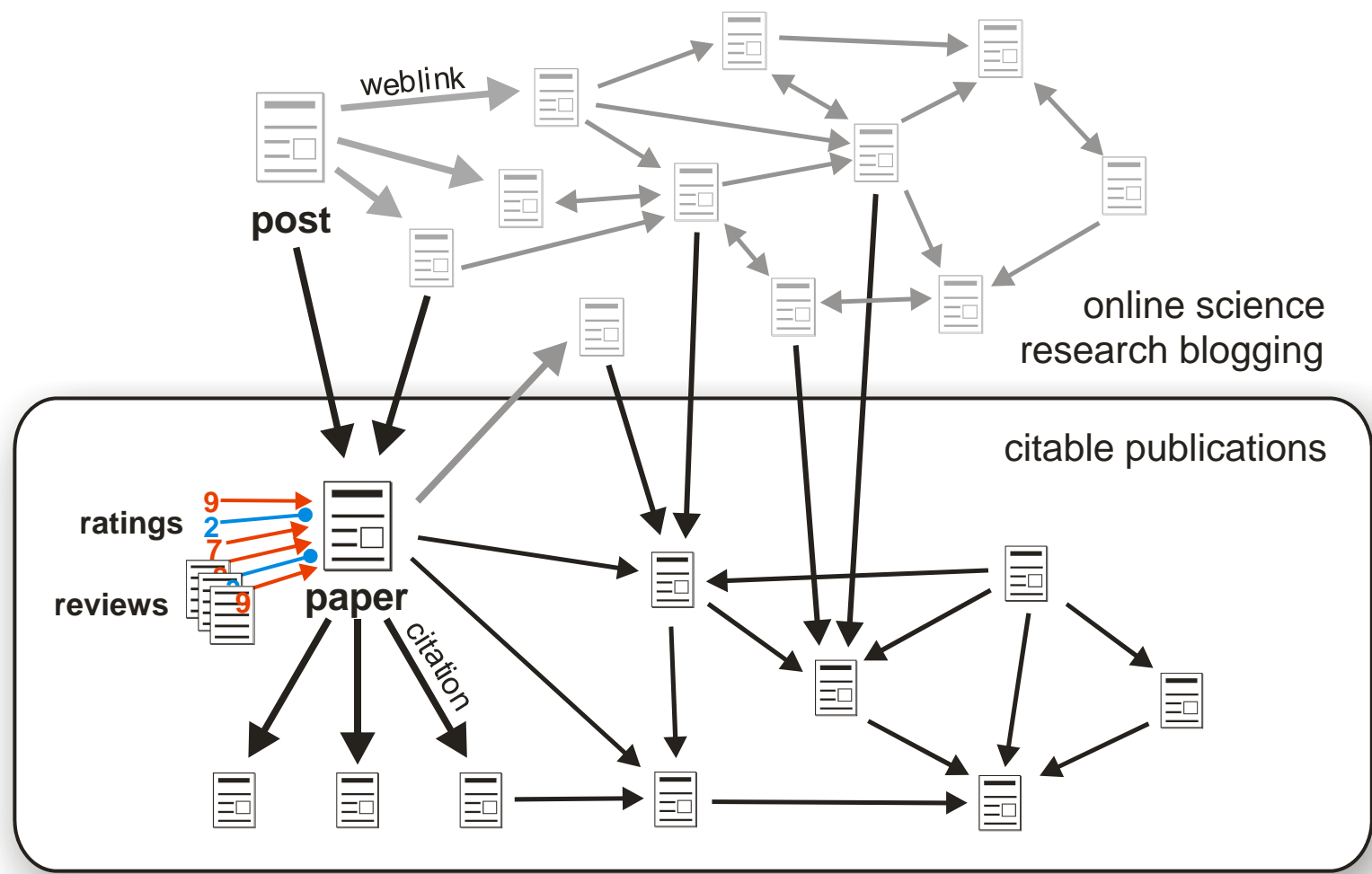
online science  
research blogging



citable publications

**crystallized**  
long-term  
memory

**fleeting**  
short-term  
memory



**crystallized**  
long-term  
memory

online science  
research blogging

citable publications

ratings  
9  
2  
7  
4

reviews  
9

paper

citation

post

weblink

# Some current developments that point in the right direction

- **arXiv**  
open-access paper repository
- **PLoS, PLoS ONE**  
open-access, traditional journals, inviting postpublication commentary
- **Faculty of 1000**  
commercial source for alternative paper evaluations from selected experts
- **ResearchBlogging.org**  
collects blog responses to peer-reviewed papers
- **Frontiers journal family**  
combine open access and democratic postpublication selection for greater visibility

# Overview

- What's right and wrong with the current system?
- What features define the future system of scientific publishing?
- How can we transition to the future system?

**What's right and wrong  
with the current system?**

# Positive functions of the current system

- Journal prestige as an evaluative signal that helps select papers to read

doi:10.1038/nature04982

nature



ELSEVIER

---

NeuroImage

---

[www.elsevier.com/locate/ynimg](http://www.elsevier.com/locate/ynimg)  
NeuroImage 32 (2006) 892 – 905

## Dynamics of visual recognition revealed by fMRI

Thomas Carlson,<sup>a,b,\*</sup> Meike J. Grol,<sup>b,c</sup> and Frans A.J. Verstraten<sup>b,c</sup>

<sup>a</sup>Department of Psychology, Vision Sciences Laboratory, Harvard University, Cambridge, MA 02118, USA

<sup>b</sup>Helmholtz Institute, Psychonomics Division, Universiteit Utrecht, The Netherlands

<sup>c</sup>F.C. Donders Centre for Cognitive Neuroimaging, Radboud Universiteit Nijmegen, The Netherlands

RS

guishable  
t' values

umber of  
ioned in  
vity was

# Positive functions of the current system

- Journal prestige as an evaluative signal that helps select papers to read
- Beautiful professional layout for papers

2.  
1.

**Figure 1 | Periodic fixation t**  
**signals even in the dark. a,**  
illumination sources (light-c  
absorbance spectra for deox  
 $10^4 \text{ mol}^{-1} \text{ M}^{-1}$ ) b.  $6 \times 10^4 \text{ mol}^{-1} \text{ M}^{-1}$

# Problems with the current system

- Not generally open access ————— **open access (OA)**
  - Long publication delays
  - Excessive costs
  - Journal prestige is the only immediate evaluative signal for choosing papers
  - Intransparent and unsatisfactory paper evaluation process
- 
- open access (OA)**
- open evaluation (OE)**

# What's wrong with journal prestige as an evaluative signal?

- reflects journals, not individual papers
- too weakly correlated with paper quality
- 3-4 reviews provide too noisy an evaluative signal to justify the de-facto influence of high-impact publications on
  - the attention of the scientific community
  - public policy
  - science funding
  - individual scientists' careers
- no continuous quality ratings on multiple scales

**What features define the future system of scientific publishing?**

# An open peer review

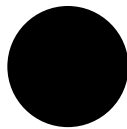
- **text document** that evaluates a paper
- includes **numerical ratings** along multiple scales
  - justification of claims
  - importance
  - originality
  - any review can define **arbitrary new scales**
- typically **author authenticated**
- **signed or unsigned**
- could include **reviewer time investment** (e.g. “90 min”)
- could include statement about **relationship to author** (e.g. “friend”, “acquaintance”, “never personally communicated”)

# Reviewer-specific rating normalization

- **same distribution of ratings for each reviewer:** each reviewer's ratings (in percentile quality within field) are interpreted relative to his or her other ratings, i.e. the ratings are rescaled to have a uniform distribution
  - corrects reviewer niceness bias
  - encourages reviewing low-quality papers as well
- For digitally authenticated signed and unsigned reviews, coarse summary measures of each reviewer's ratings and time investments are publicly available.

# Reviewer-specific rating normalization

- **same weight for each minute spent on the review:** each review is weighted by the time the reviewer reported to have invested in it
- **same influence for each reviewer:** each review is weighted by the reported time investment divided by the total time the reviewer spend on reviews in the preceding 12 months



# Publication process

- Public funds science
- Scientists conduct research
- Scientists write papers
- Scientists submit papers to journals (journal sometimes charges a fee)
- Journal administers peer review
- Scientists perform review (for free)
- Scientists hand over copyright (for free)
- Journal charges scientists for publication
- Journal charges scientists for reading their own paper

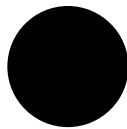
# Current roles of public/ scientists and journals

## Public/scientists

- fund research
- conduct research
- write papers
- review papers
- edit journals (!)
- read papers

## Journals

- administer review
- provide layout
- publish papers



# Overprice tags mako.cc/fun/overpricetags

\$6,288

\$6,200

\$5,995

\$5,915

\$5,914

\$5,793

\$5,650

\$5,615

\$5,566

\$5,485

\$5,395

\$5,383

\$5,375

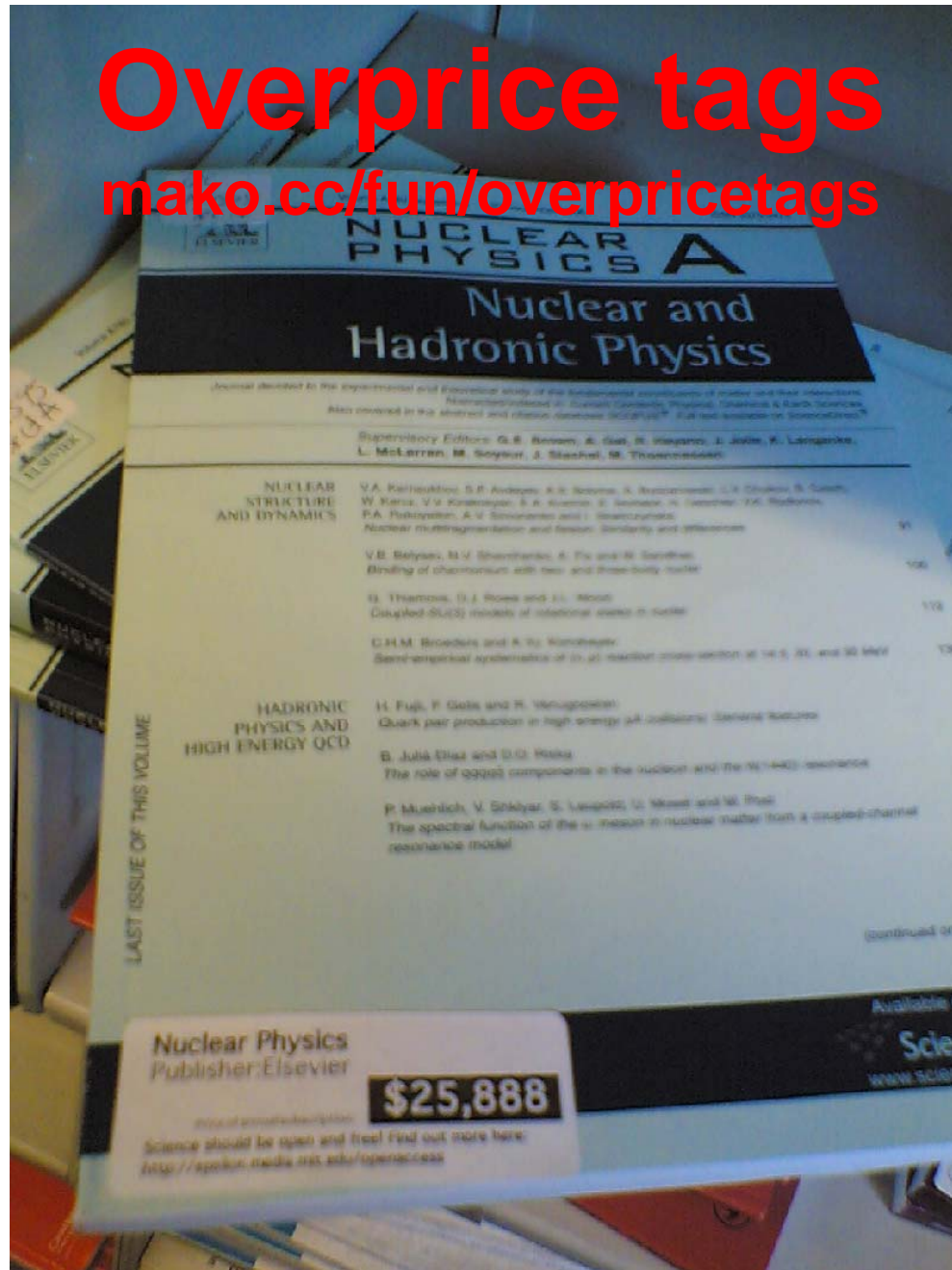
\$5,355

\$5,189

\$5,153

\$5,133

Overprice tags  
mako.cc/fun/overpricetags



LAST ISSUE OF THIS VOLUME

NUCLEAR  
STRUCTURE  
AND DYNAMICS

V.A. Kartalov, S.P. Avdeyev, A.S. Babitskiy, S. Buzdakov, G.R. Chudakov, B. Gurev, W. Kienzle, V.V. Kiselev, S.A. Kuznetsov, S. Lomonosov, N. Mankin, P.A. Moshchakov, P.A. Pukhov, A.V. Suvorov and I. Tsvetkov: Nuclear multifragmentation and fusion: Similarity and differences 91

V.E. Belyaev, N.V. Zhuravskiy, A. Tk and M. Gorenberg: Binding of charmonium with two- and three-body nuclei 106

G. Theodorou, D.J. Rowe and J.L. Wood: Coupled SU(2) models of rotational states in nuclei 113

C.H.M. Broeders and A. de Wit: Nonrelativistic semi-empirical systematics of  $\alpha$ ,  $\beta$  and  $\beta^+$  transition cross-sections at 14.5, 20, and 30 MeV 131

HADRONIC  
PHYSICS AND  
HIGH ENERGY QCD

H. Fujii, F. Gotsis and R. Venugopalan: Quark pair production in high energy  $pA$  collisions: General features 141

B. Julia-Espey and D.G. Haka: The role of odd-parity components in the nucleon and  $\Delta(1232)$  resonance 151

P. Muehlich, V. Sridhar, S. Leupold, G. Meiser and M. Prutz: The spectral function of the  $\omega$ -meson in nuclear matter from a coupled-channel resonance model 161

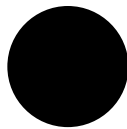
(continued on

Nuclear Physics  
Publisher: Elsevier

**\$25,888**

Science should be open and free! Find out more here:  
<http://openaccess.elsevier.com>

Available at  
ScienceDirect  
www.sciencedirect.com



# Crystallised scientific communication

informal conversation

discussion at lab meeting

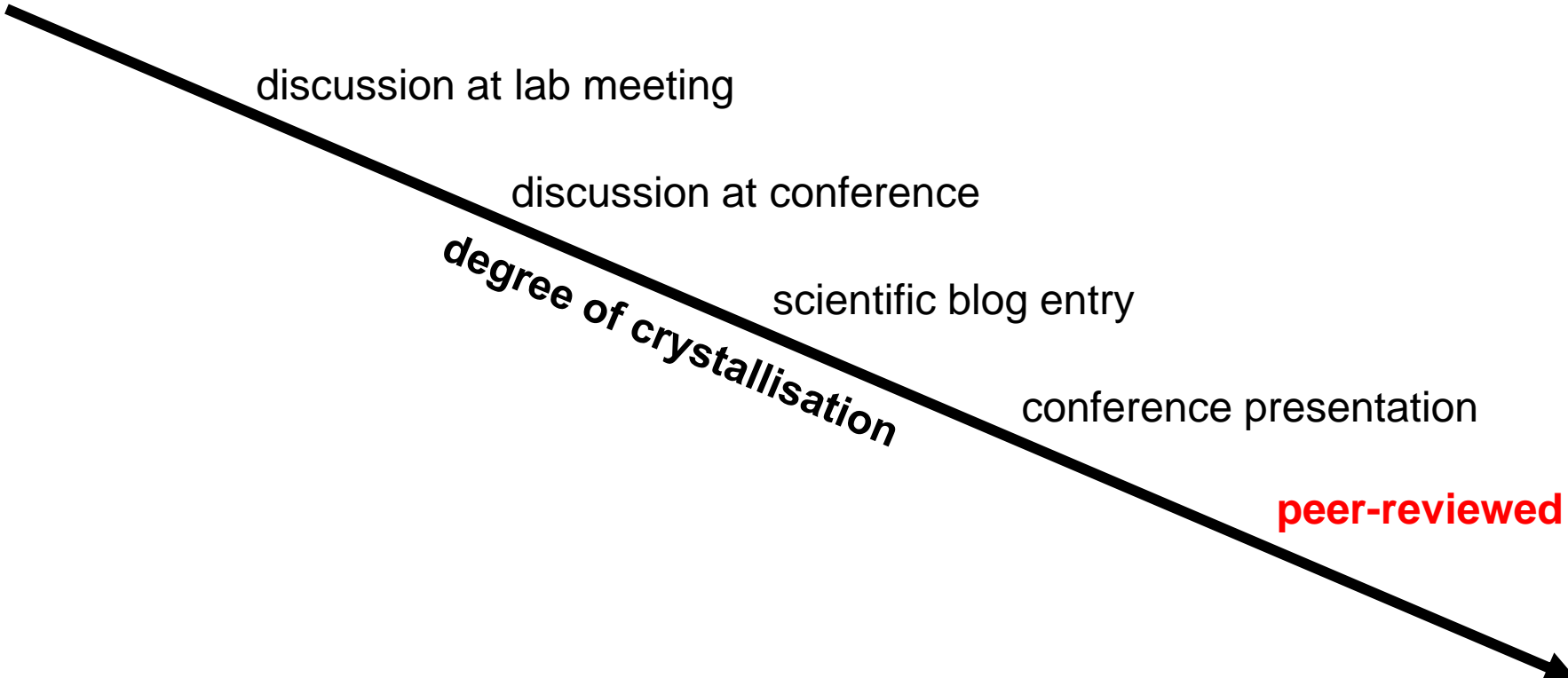
discussion at conference

scientific blog entry

conference presentation

**peer-reviewed paper**

*degree of crystallisation*



# Scholarly crystallization

level of crystallization

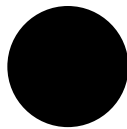


- informal conversation between two people **remembered by participants only**
- scientific group discussion at a conference or in a lab meeting **remembered by speakers and expert audience**
- research blogging **published durably, but subject to changes**
- scientific publication **published permanently, though revisions may be added**

# Why is scholarly crystallization required?

- citability
- historical record

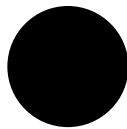
More fluid forms of publication like research blogging and Wikipedia build on the separate bedrock of crystallized scientific publication.



- Open access (OA) is one of two required elements. The other element is open post-publication peer review (OPR). Frontiers is taking big steps toward providing both elements. However, we will need a completely general (not journal-linked) system eventually. Together OA and OPR will solve the problems of the current system: Publication will be instant, because review follows publication. Reviews will be public letters to the community, thus less political, better motivated, and higher in quality. Journal prestige will no longer be the sole immediate evaluative signal provided to readers to prioritize their reading. Paper evaluation functions can be defined by individuals and organizations to rank and select papers for greater visibility, thus eventually obviating the need to publish in prestigious journals.

- Journal impact factors (IFs) are somewhat correlated with paper quality.
- However, their power in selling us high-impact journals derives partly from a self-fulfilling prophesy: a paper in a high-IF journal will get more attention and will thus be cited more than an equally good paper in a low-IF journal. Thus, the high-IF-journal paper will contribute more to its journal's future IF, than the low-IF-journal paper of equal quality. In this way, IFs create their own partially spurious reality.
- Nevertheless, the correlation between journal IF and actual paper quality, though it is small, is not zero. As long as IFs (or journal prestige) are \*the only\* immediately available evaluative signal on new papers, it is rational to rely on them -- despite their low correlation with paper quality. This is why almost all of us find IFs hard to ignore when prioritizing our reading and selecting journals to submit our work to.
- In addition to open access, we therefore need open post-publication peer review (OPR), to provide us with an immediate evaluative signal about paper quality, so we can prioritize our reading by a criterion that is more accurate than journal IF or journal prestige.

- i agree that the correlation will depend on one's definition of quality. however, by most definitions, i suspect, there would be a small but significant positive correlation.
- however, discussing whether there is a correlation or not only serves the agenda of those who would like to keep the current system of scientific publication: this discussion leads to the conclusion that there may be a correlation, however small. so in the absence of a more substantial evaluative signal for new papers, people will revert to IFs or journal prestige. i do.
- open post-publication peer review (OPR) will provide a continually updated, paper-specific evaluation signal \*with error bars\*. it will thus provide a truly substantive alternative criterion, by which we can prioritize our reading.
- we will not need to write more reviews. we only need to publish the reviews we are already writing for the journals – including numerical quality ratings on multiple scales. a review becomes an open letter to the community – potentially boosting our reputation if we sign it and it is of high quality. once reviews are publicly available, anyone can write paper evaluation functions (PEFs) that will provide alternative perspectives on the literature and allow us to choose what to read.
- 
- i'm exploring these ideas here: [futureofscipub.wordpress.com](http://futureofscipub.wordpress.com).



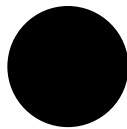
# Reviews contain numerical judgments on multiple scales

## Basic scales

- overall quality
- originality
- potential importance
- justification of claims
- tutorial/didactic value

**Openly extensible:** Any reviewer can invent additional scales, naming and immediately using them.

**Time-investment record:** Reviewers also specify the time invested in reviewing the paper in minutes.

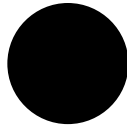


# Papernet

● paper (unreviewed, uncited)

●  
↑  
○ review (excitatory)

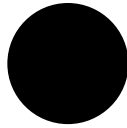
●  
●  
|  
○ review (inhibitory)



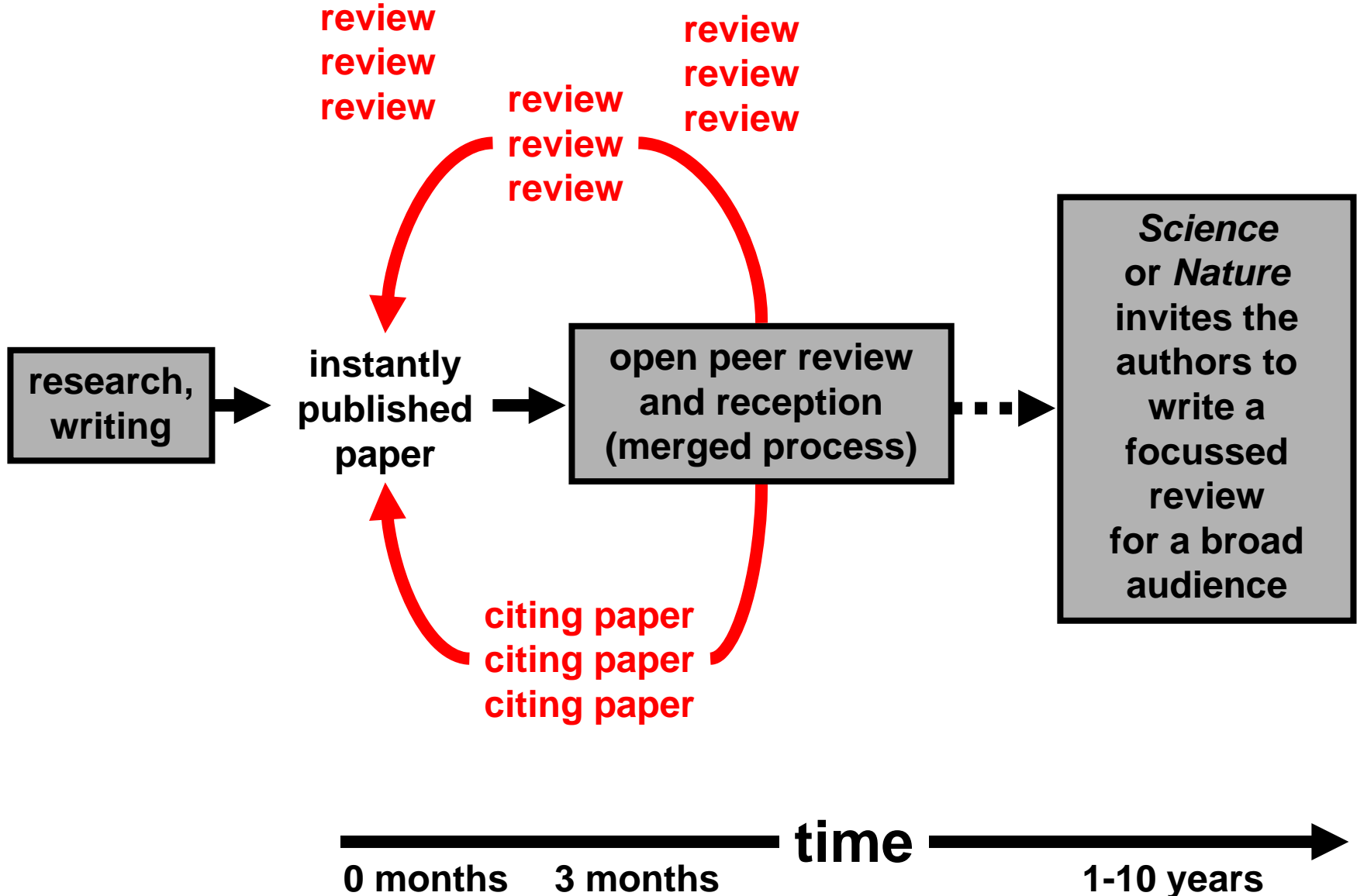
**What do we expect of an ideal scientific publishing system?**

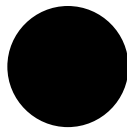
**access**

**evaluation**



# Future





# What is a scientific publication?

- a paper
- a review (publication serving mainly to evaluate one or several papers)

