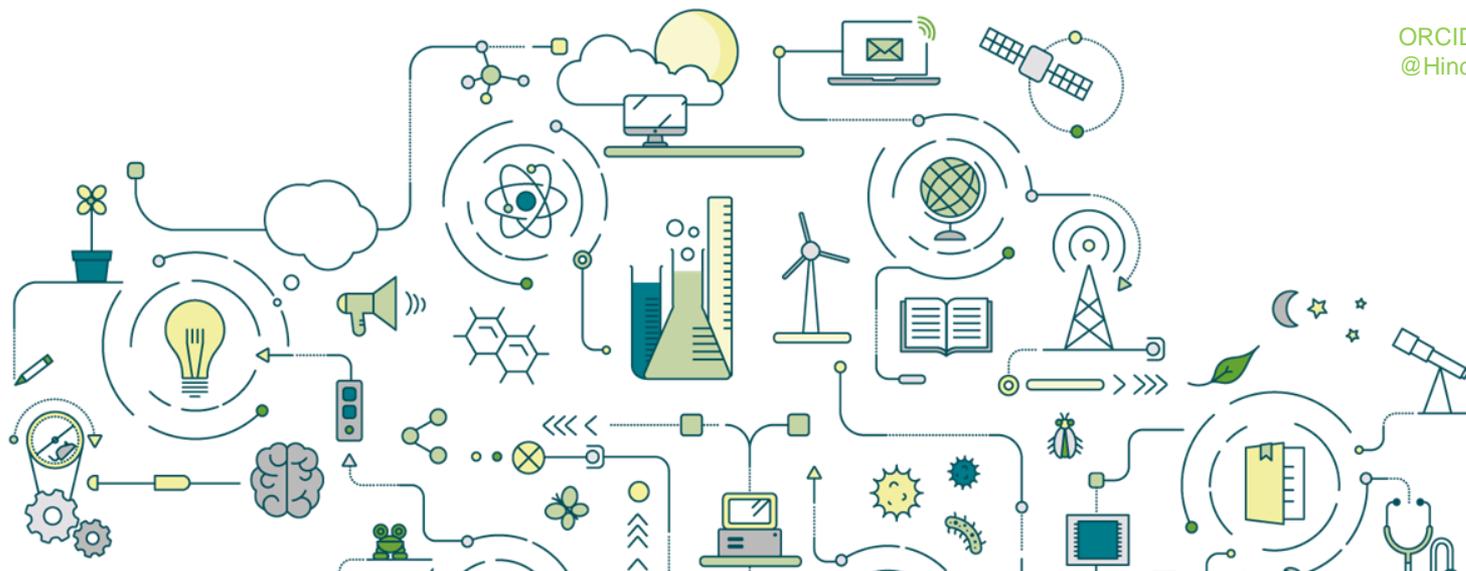


# A social and technical infrastructure for cultural change

Catriona J. MacCallum  
Director of Open Science, Hindawi Ltd

*OAI 11 – The CERN-UNIGE Workshop  
Innovations in Scholarly Communication  
University of Geneva, 20 Jun 2019*

ORCID 0000-0001-9623-2225  
@Hindawi @catmacOA



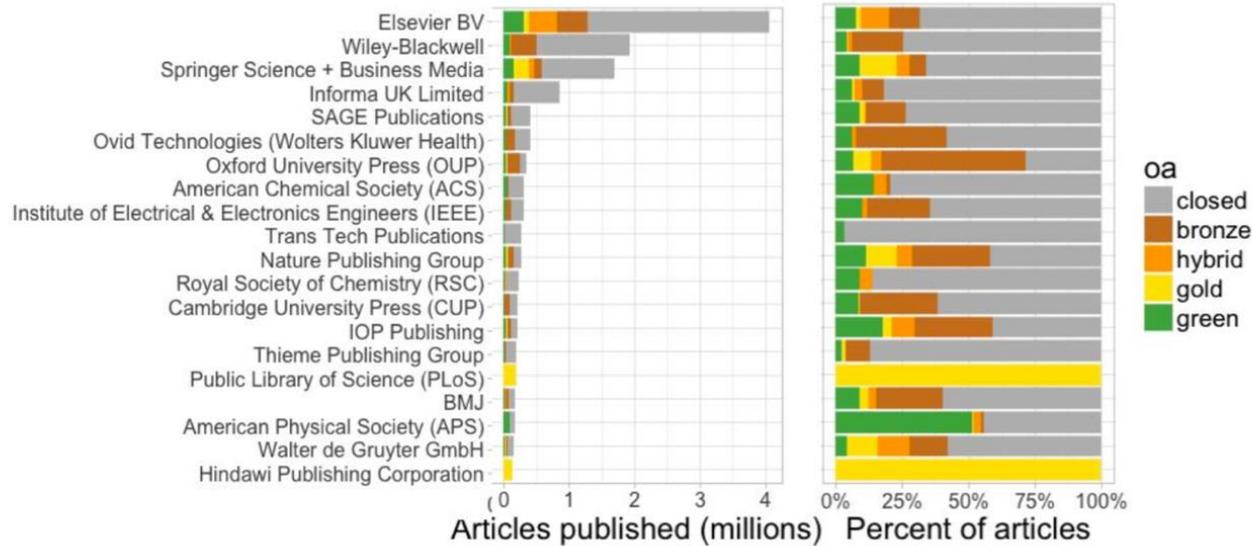
Open Access  
is just the  
tip of the  
iceberg



Foubister, Murray. English: Spectacular Christmas Morning Cruise through the Remnants of Giant Tabular Iceberg B15Y, Which Is Now Grounded Just off Bransfield Island at the N Tip of the Antarctic Peninsula... 25 December 2015. <https://www.flickr.com/photos/mfoubister/2587923332/>. [https://commons.wikimedia.org/wiki/File:Spectacular\\_Christmas\\_morning\\_cruise\\_through\\_the\\_remnants\\_of\\_giant\\_Tabular\\_iceberg\\_B15Y,\\_which\\_is\\_now\\_grounded\\_just\\_off\\_Bransfield\\_Island\\_at\\_the\\_N\\_tip\\_of\\_the\\_Antarctic\\_Peninsula.\\_\(25879233322\).jpg](https://commons.wikimedia.org/wiki/File:Spectacular_Christmas_morning_cruise_through_the_remnants_of_giant_Tabular_iceberg_B15Y,_which_is_now_grounded_just_off_Bransfield_Island_at_the_N_tip_of_the_Antarctic_Peninsula._(25879233322).jpg). CC BY SA



# Open Access by publisher



**Figure 3: Number (left panel) and proportion (right panel) of articles with OA copies by publisher for the 20 most prolific publishers. Estimated based on a sample of 100,000 Crossref DOI-assigned articles.**

# 21<sup>st</sup> Century Opportunities

- **Economic:** to fundamentally shift the business relationships between scholarly publishers and the research community from a model based on ownership, control, and journal brands to one based on value-added services, collaborative partnerships, and community engagement.
- **Technological:** to create a truly open and reusable technical infrastructure for scholarly communication.
- **Cultural:** to decouple the communication of scholarly work from its evaluation, in particular removing journal competition and evaluation as a proxy of the quality of individual outputs and researchers, which has been a key barrier to realising these technological and economic opportunities.

Open Science = (Open Outputs + Open Infrastructure) X Cultural change

OPEN  ACCESS

& Open Standards



Access, reuse &  
discoverability



Evaluation &  
Researcher behaviour

# Technical Infrastructure

The platforms and services that the research community use and the data and metadata about outputs and individuals.

- Persistent Identifiers
  - DOIs
  - ORCID IDs
- Publisher metadata
  - Citations...
- Software Platforms
  - Aries, Scholar One - Submission systems
  - PHENOM, Libero
  - F1000 Research

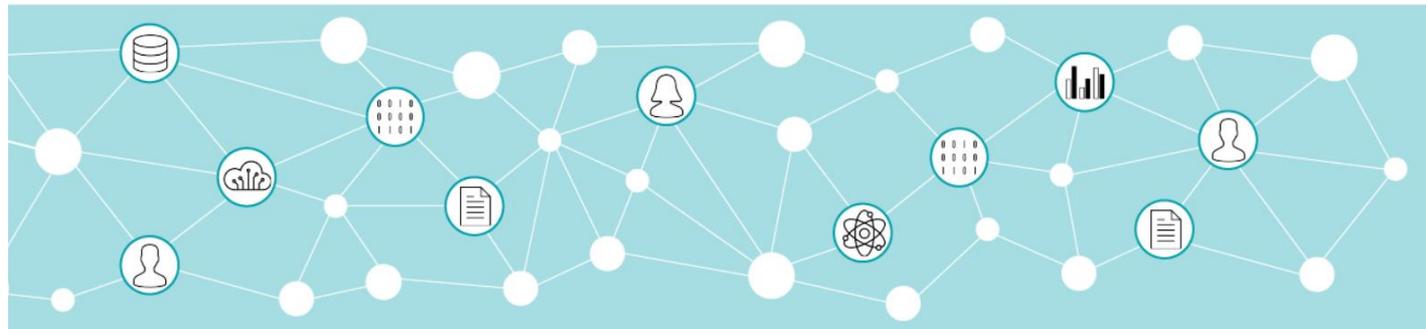


# The European Open Science Cloud (EOSC)

*Offers 1.7 million European researchers and 70 million professionals in science and technology a virtual environment with open and seamless services for storage, management, analysis and re-use of research data, across borders and scientific disciplines.*

[More about EOSC](#)

**ACCESS EOSC SERVICES & RESOURCES**



## Welcome to FREYA

Connected Open Identifiers for Discovery, Access and Use of Research Resources



Read more about the project



Join our Ambassador  
Programme



Follow FREYA's news & blog

# Social Infrastructure



...FORCE11 seeks ways to support the ideas and projects that can bubble up when disparate groups of people come together. My view of what makes FORCE11 unique and valuable is that it is a kind of social infrastructure that can support this.

....funders are starting to [...] support technical infrastructures, but sustaining shared social platforms, social institutions that mediate difficult conversations, lags far behind.

we need platforms that first bring people together and then create the right conditions for conversation, developing consensus and then working towards implementation

Everyone assumes that just happens, or perhaps that particular individuals make it happen.

there is an important role for an organization or organizations like [FORCE11] that can provide the glue and support for communities to come together and find common ground for experimentation and innovation.

*Neylon, Cameron. 2018. "Social Infrastructures in Research Communication: A Personal View of the FORCE11 Story". Insights 31: 8. DOI: <http://doi.org/10.1629/uksg.404>*

 Follow us on [twitter](#)

# Improving how research is assessed

Join the organizations and individuals who have signed the Declaration on Research Assessment.

[Sign the declaration](#)

[Read the full declaration >](#)

## Latest news



Improving How We Evaluate Research: How We're Implementing DORA

CANCER RESEARCH UK

Few UK universities have adopted rules against impact-factor abuse

NATURE

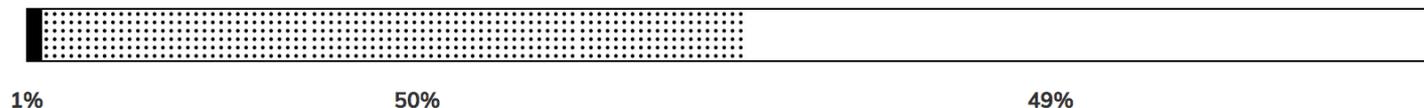
OASPA Endorses the Declaration on Research Assessment (DORA)

OASPA

# The Initiative for Open Citations • I4OC

**Making tens of millions of machine-readable citation metadata** openly available to everyone, with no copyright restriction.

How many citations are open today?



As of January 2018, the fraction of publications with open references has grown from 1% to more than 50% out of 38 million articles with references deposited with Crossref.

# Open citations: A letter from the scientometric community to scholarly publishers

December 5th, 2017

Openness is central to the research endeavor. It is essential to promote reproducibility and appraisal of research, reduce misconduct, and ensure equitable access to and participation in science. Yet, calls for increased openness in science are often met with initial resistance. The introduction of pre-print servers, open access repositories, and open data sets were, for example, initially resisted, but eventually adopted without adverse effects to the scholarly ecosystem. The launch of the [Initiative for Open Citations \(I4OC\)](#) is facing similar obstacles. This initiative has campaigned for scholarly publishers to make openly available the references found in articles from their journals. Many publishers, including most of the large ones, support the initiative and have opened their references. However, the initiative still lacks support from a minority of the large publishers.

*“References are a product of scholarly work and represent the backbone of science—demonstrating the origin and advancement of knowledge—and provide essential information for studying science and making decisions about the future of research. References are generated by the academic community and should be freely available to this community.”*

*Scientometrics is widely used to support science policy and research evaluation, with consequences for the entire scientific community. There is a need for specialized organizations, both commercial and non-commercial, that offer scientometric services.*

*...to guarantee full transparency and reproducibility of scientometric analyses, **these analyses need to be based on open data sources.***

TSP<sup>OA</sup>



## TRANSITIONING SOCIETY PUBLICATIONS TO <sup>OA</sup>

[HOME](#) • [ABOUT](#) • [SERVICES](#) • [RESOURCES](#) • [CONTACT](#)

A group of like-minded individuals from libraries, academic institutions, publishers, and consortia have organized to connect society journal editors and publishers (and any libraries or consortia that support them) with support and useful resources related to transitioning society publications to open access (OA).



# Social Infrastructure

- FORCE11
- I4OC
- COKO
- DORA
- ORCID (the organisation)
- MetaData2020
- Make Data Count
- CreDiT Taxonomy
- RoR (Research Organisation Registry)
- OpenCon
- Crossref
- Datacite
- CoData
- SPARC
- COAR

# Open Science?



# Closed versus Open



# Good Science versus Open Science



# 'Toll-access' versus 'Toll-publish'



# Green versus Gold



# Commercial versus Not-for-profit



Bad news is Good??



# Open Science is a false dichotomy



# Good Science versus Open Science



# What is Quality?

- Context dependent
  - Discipline
  - Stage of your career
  - Different levels
    - Individual
    - Project
    - Institutional (rankings...)
    - National and International
- Cannot be distilled into a single number or proxy
  - Multi-variate
- Metrics need to be qualitative as well as quantitative

# Is science (communication) trustworthy?

Science  
Communication

The screenshot shows the top navigation bar of PLOS ONE with 'PLOS MEDICINE' on the left and 'Browse Publish About Search' on the right. Below the navigation bar, there are links for 'OPEN ACCESS' and 'ESSAY'. The article title 'Why Most Published Research Findings Are False' is prominently displayed, along with the author 'John P. A. Ioannidis' and the publication date 'August 30, 2005'. A table of metrics shows 13,307 Saves, 1,792 Citations, 1,448,771 Views, and 4,859 Shares. Below the metrics are buttons for 'Download PDF', 'Print', and 'Share'. The 'Abstract' section is visible, starting with 'Modeling the Framework for False Positive Findings'.

- Poorly Designed studies
  - small sample sizes, lack of randomisation, blinding and controls
- ‘p-hacking’ (selective analyses) widespread<sup>1</sup>
- Poorly reported methods & results<sup>2</sup>
- Negative/inconclusive results are not published
- Data not available to scrutinise/replicate

The screenshot shows the top navigation bar of PLOS ONE with 'PLOS MEDICINE' on the left and 'Browse Publish About Search' on the right. Below the navigation bar, there are links for 'OPEN ACCESS' and 'ESSAY'. The article title 'How to Make More Published Research True' is prominently displayed, along with the author 'John P. A. Ioannidis' and the publication date 'October 21, 2014'. A table of metrics shows 1 Save, 29 Citations, 91,123 Views, and 1,610 Shares.

<sup>1</sup>Head ML, Holman L, Lanfear R, Kahn AT, Jennions MD (2015) The Extent and Consequences of P-Hacking in Science. PLoS Biol 13(3): e1002106. doi:10.1371/journal.pbio.1002106

<sup>2</sup>Landis SC, et al. (2012) A call for transparent reporting to optimize the predictive value of preclinical research. Nature 490(7419): 187–191.

# Does prestige ensure 'quality'?

- Higher ranked journals have more papers retracted<sup>1</sup>
- Papers in higher ranked journals are more likely to report either no or inappropriate statistics<sup>2,3</sup>
- Papers from highly ranked institutions have poorer reporting standards<sup>3</sup>

<sup>1</sup>Fang, Ferric C., and Arturo Casadevall. "Retracted Science and the Retraction Index." *Infection and Immunity* 79, no. 10 (October 1, 2011): 3855–59. doi:10.1128/IAI.05661-11.

<sup>2</sup>Tressoldi PE, Giofre D, Sella F, Cumming G. High impact = high statistical standards? Not necessarily so. *PLOS ONE* 2013; 8(2):e56180. doi: 10.1371/journal.pone.0056180 PMID: 23418533

<sup>3</sup>Macleod MR, et al. (2015) Risk of Bias in Reports of In Vivo Research: A Focus for Improvement. *PLOS Biol* 13(10): e1002273. doi:10.1371/journal.pbio.1002273



“As competition for jobs and promotions increases, the inflated value given to publishing in a small number of so-called “high impact” journals has put pressure on authors to rush into print, cut corners, exaggerate their findings, and overstate the significance of their work.

Such publication practices, abetted by the hypercompetitive grant system and job market, are changing the atmosphere in many laboratories in disturbing ways.”

Rescuing US biomedical research from its systemic flaws  
Bruce Alberts , Marc W. Kirschner , Shirley Tilghman, and Harold Varmus  
PNAS | April 22, 2014 | vol. 111 | no. 16 | 5773–5777  
doi: 10.1073/pnas.1404402111

# 21<sup>st</sup> C Culture of Science?

- Hypercompetition
- Increased number of retractions
- Salami Slicing
- Fraud – by Editors, Reviewers & Authors
- Conscious and Unconscious bias
- Bullying
- Sexual Harassment
- Age Bias
- Gender Bias
- Geographic Bias

# Cultural Capital

The objective mechanisms which enable the ruling class to keep the monopoly of the most prestigious educational establishments, while continually appearing at least to put the chance of possessing that monopoly into the hands of every generation, **are concealed beneath the cloak of a perfectly democratic method of selection which takes into account only merit and talent**, and these the members of the dominated classes whom they eliminate in the same way as they convert those whom they elect, and which ensures that those who are 'miraculously elected' may experience as miraculous an exceptional destiny which is the best testimony of academic democracy.

**The current evaluation system prides itself on a system based on meritocracy when it is not based on real merit at all**

# Current culture embeds status quo

- Researchers gain from publishing in 'designer' journals
  - Career/reputation making
  - Financial security (Grants and promotion)
- Publishers/ Journals gain financially from their brand/ Journal Impact factor
- Institutions gain financially by hiring and firing based on where researchers publish, not on what they publish (or the mission of the University)
- Research assessment by funders often based on very few publications and brand/impact factor (some are changing)

# Cultural Capital

In short, an institution officially entrusted with the transmission of the instruments of appropriations of the dominant culture **which neglects methodically to transmit the instruments indispensable to the success of its undertaking** is bound to become the monopoly of those social classes capable of transmitting by their own means, that is to say by that diffuse and implicit continuous educational action which operates within cultured families (often unknown to those responsible for it and to those who are subjected to it), the instruments necessary for the reception of its message, and thereby to confirm their monopoly of the instruments of appropriation of the dominant culture and thus their monopoly of that culture ....

**Lack of transparency about evaluation and what constitutes merit maintains the power imbalance and inequity of opportunity in academia  
'the rich get richer'**

*Bourdieu, P. (1973). Cultural Reproduction and Social Reproduction. In R. Brown (Ed.), Knowledge, Education, and Cultural Change (pp. 71-112). London: Tavistock Publications Limited.*  
*Bourdieu, P. (1984). Distinction: A social critique of the judgment of taste. Cambridge, Mass.: Harvard University Press.*

Share on Facebook Tweet this article

# Italian scientists increase self-citations in response to promotion policy

Study reveals how research evaluations can lead to self-serving behaviour.

4 June 2018

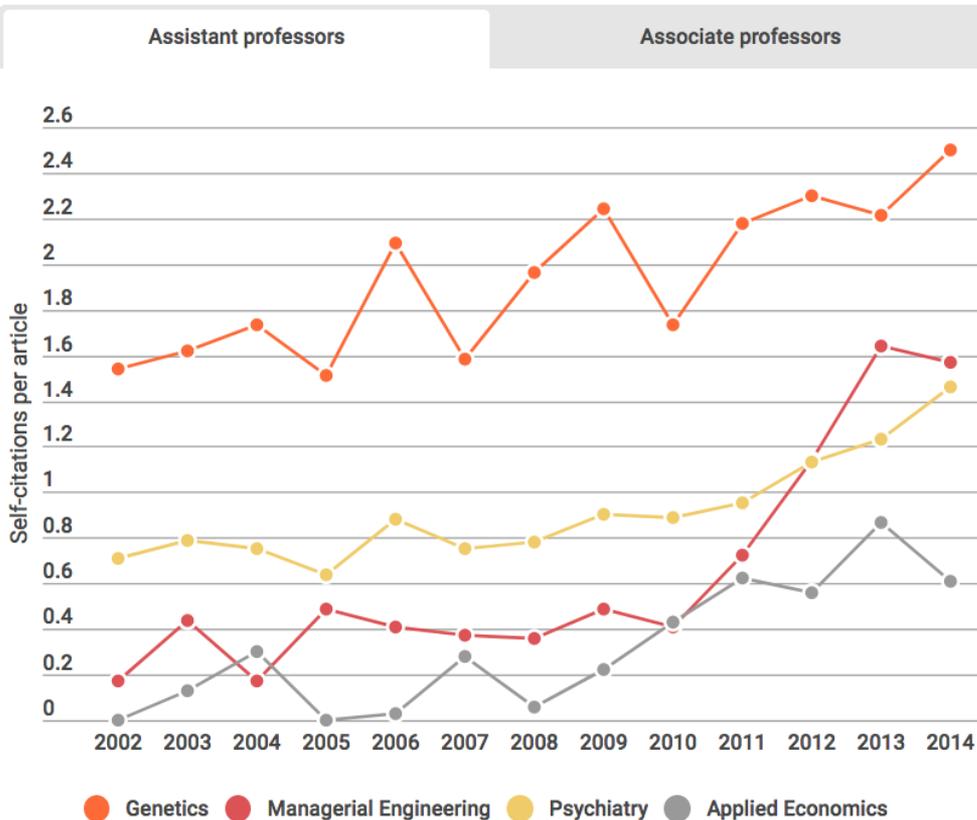
Dalmeeth Singh Chawla



Topp\_Yimgrimm/iStock/Getty

## Citation selfies

Italian researchers cite more of their own work following a 2010 law that links promotions to citation metrics in certain fields in the natural and social sciences. Quantitative measures are used to assess researchers in genetics, psychiatry and managerial engineering, but not in applied economics.



# Open Science

## 1. Openness is intrinsic to good science and to excellence

- openness is a fundamental component of excellence; it is not a competing values system
- good processes make good science, and open processes improve science

## 2. Science as a process

- research viewed, managed, accessed & assessed in terms of the integrity of processes, rather than purely in terms of product/output
- shifting the focus from not only what was produced (and what 2-3 reviewers liked) to how it is/was produced.

# The Dimensions of Good & (Open) Science

1. Ensures research is **ethical & conducted with integrity**
2. Recognises **diverse outputs & contributions**
3. Recognises **diverse communication channels**
4. Facilitates **access to & discoverability of research findings** (such as publications, data, software and methods etc)
5. Actively **supports open knowledge practices** across the organisation (training, advocacy)
6. Actively **engages with the public**

More openness  
**improves**  
every dimension

*'intelligent openness'*

# Commercial versus Not-for-profit?

## Closed versus Open?



Higher Education Network Occam's corner

It's time for academics to take back control of research journals

The evolution into a highly-profitable industry was never planned. Academics must make the case for lower-cost journals



Stephen Curry Professor of structural biology at Imperial College London

@Stephen\_Curry

Thursday 25 May 2017 07:30 BST



Academic publishing originated as a vehicle for communication for the gentlemen scholars. Photograph: David Levene for the Guardian

"Publish or perish" has long been the mantra of academics seeking to make a success of their research career. Reputations are built on the ability to communicate something new to the world. Increasingly, however, they are determined by numbers, not by words, as universities are caught in a tangle of management targets composed of academic journal impact factors, university rankings and scores in the government's research excellence framework.

Untangling academic publishing: a history of the relationship between commercial interests, academic prestige and the circulation of research



Research output: Book/Report > Other report

- Overview Citation formats Activities and awards Funded projects

Standard

Untangling academic publishing : a history of the relationship between commercial interests, academic prestige and the circulation of research. / Fyfe, Aileen; Coate, Kelly; Curry, Stephen; Lawson, Stuart; Moxham, Noah; Rostvik, Camilla Mork.

St Andrews : University of St Andrews, 2017. 26 p. Research output: Book/Report > Other report

Harvard

Fyfe, A., Coate, K., Curry, S., Lawson, S., Moxham, N & Rostvik, CM 2017, Untangling academic publishing: a history of the relationship between commercial interests, academic prestige and the circulation of research. University of St Andrews, St Andrews. DOI: 10.5281/zenodo.546100

APA

Fyfe, A., Coate, K., Curry, S., Lawson, S., Moxham, N., & Rostvik, C. M. (2017). Untangling academic publishing: a history of the relationship between commercial interests, academic prestige and the circulation of research. St Andrews: University of St Andrews. DOI: 10.5281/zenodo.546100

DOI

10.5281/zenodo.546100 Final published version

Open Access permissions

Open

Links

Open Access version in St Andrews Research Repository



Of the top-20 biggest publishers with citation data, **all but four** now make these data open via Crossref.

Two represent Scholarly Societies...

- Elsevier
- IEEE
- Wolters Kluwer Health
- Institute of Physics Publishing

## Open Source

- prevents monopolistic control
- requires an active community of users and service providers to develop and maintain infrastructure

## Open Data

- metadata about the research process itself, such as funding data, publication and citation data, and “altmetrics” data

## Open Integrations

- standard metadata formats and open APIs

## Open Contracts

- completely open (public) and no lock-in (e.g. Non-Disclosure Agreements, multi-year contract terms, and privately negotiated prices)

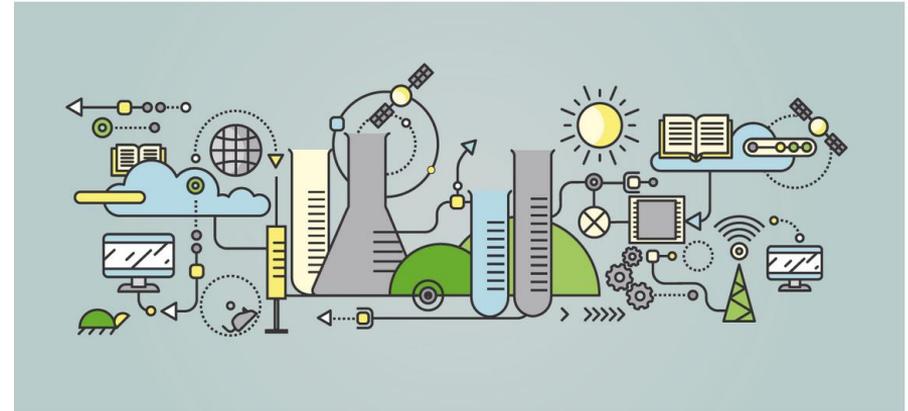
most of the data needed to support Open Science is controlled by commercial companies, both big and small. This growing reliance on a handful of companies to provide proprietary analytics and decision tools for research funders and universities poses serious risks for the future



# A radically open approach to developing infrastructure for Open Science

Paul Peters

October 23rd, 2017



Hindawi's CEO, Paul Peters, explains the problems inherent in proprietary solutions for Open Science infrastructure and presents a proposal for how things can be done differently.

Should commercial companies have a role in developing infrastructure for an Open Science future?

# Publisher as Service Provider

- Open Access (CC BY)
- Peer Review
- Encourage and facilitate better forms of credit
  - ORCID
  - CRediT taxonomy
  - Data /software citations
  - Protocols
- Preprints
- Encourage data / software / materials sharing (FAIR)
- Provide high quality metadata
  - Enable connections and discovery
  - Adopt relevant persistent identifiers
  - Enable a machine readable ecosystem
- Reduce friction
  - Reduce the burden on researchers
  - Reduce the burden for funders and institutions
- An Open Infrastructure
  - Open Citations
  - Open Source
- Charge for services not outputs

ADVERTISEMENT

PROJECT MUSE  Now and Always, the Trusted Content Your Research Requires.

## All Things Coko: A Step Towards a True Shared Infrastructure for Scholarly Communication?

By PHILL JONES | DEC 17, 2018 | 28 COMMENTS

BUSINESS MODELS | INNOVATION | TECHNOLOGY | TOOLS | USABILITY

  3  

PRINT THIS PAGE

The first week of December is an important week in the scholarly publishing calendar in the UK. As well as [STM Week](#) ([#STMWeek](#)), which includes a series of linked all-day seminars along with a committee and working group meetings, there are multiple community, vendor and industry events. It's a good opportunity

 **Collaborative Knowledge Foundation**

ABOUT HOW WE WORK TECHNOLOGY PARTNERS EVENTS BLOG

### Open source publishing technology.

The Coko Foundation is a non-profit organization transforming how knowledge is created, improved, and shared. Our goal – to replace current scholarly communication technologies with open, shared infrastructure.



## Office of Scholarly Communication University of California

- > Home
- > Open Access @ UC
- > Publisher Negotiations
  - > UC and Elsevier
  - > UC Libraries Journal Negotiations FAQs
  - > Alternative Access to Elsevier

### A scalable solution to a sizable problem: UCP, CDL & Coko's journey toward Editoria

By Alison McGonagle-O'Connell / September 6, 2018

 **editoria**  
powered by Coko

Despite the emergence, over the past few decades, of elaborate and powerful new forms of digital communication, the scholarly



Hindawi Institutions Publishers Blog Meet the Team

## Hindawi launches open source peer review system

Andrew Smeall September 18th, 2018





### eLife, Coko, Hindawi Limited and Digirati commit to Libero for open-source publishing

FEATURED OPEN ACCESS ADMINBY

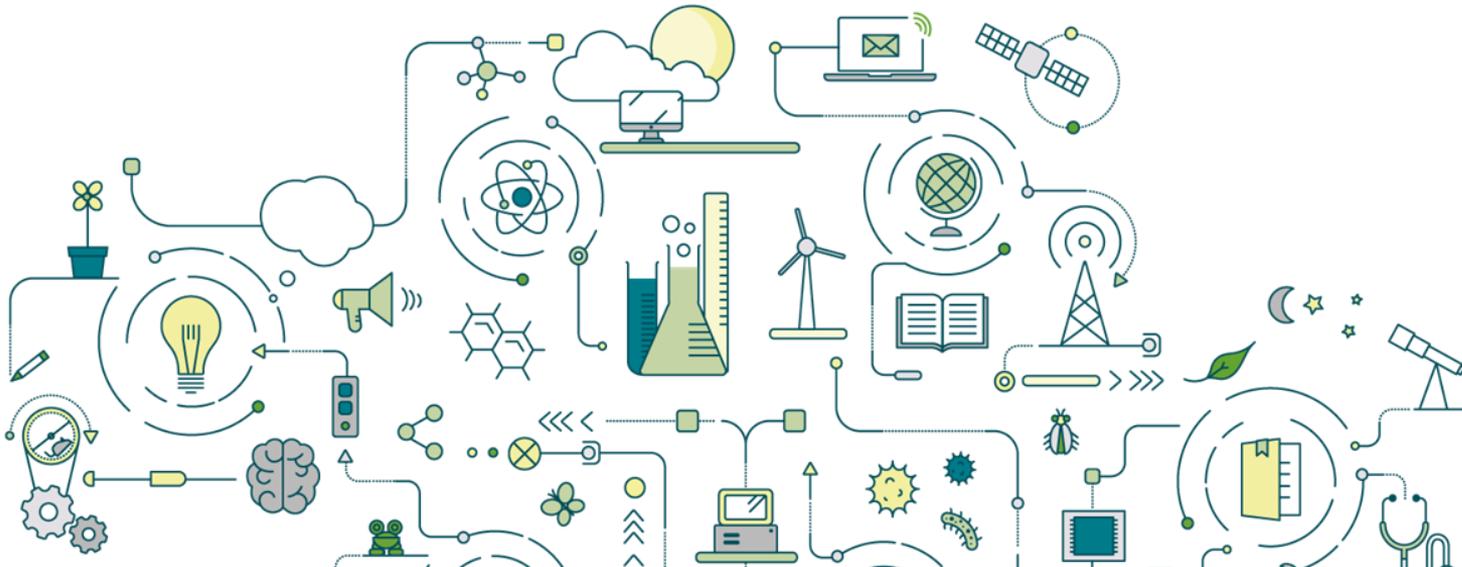
2018 26 NOV    

eLife, together with the non-profit Collaborative Knowledge Foundation (Coko), open-access publisher Hindawi Limited and digital consultancy Digirati, has today announced a new format partnership to develop the latest version of Libero.

What these changes allow us to do

# Open Publishing Solutions

Development of systems to support end-to-end open access publishing



# Open Publishing Solutions – Background

Our Open Publishing Solutions grew out of work on Publishing Partnerships



**WILEY**

- ▶ Flip subscription journals to APC open access
- ▶ 15 journals now included in partnership
- ▶ Strong publication growth and article usage



**AAAS**

- ▶ New institutional partner open access journals
- ▶ Operational partnership – support post-accept
- ▶ Systems and production processes provided

# Open Publishing Solutions – Building Phenom

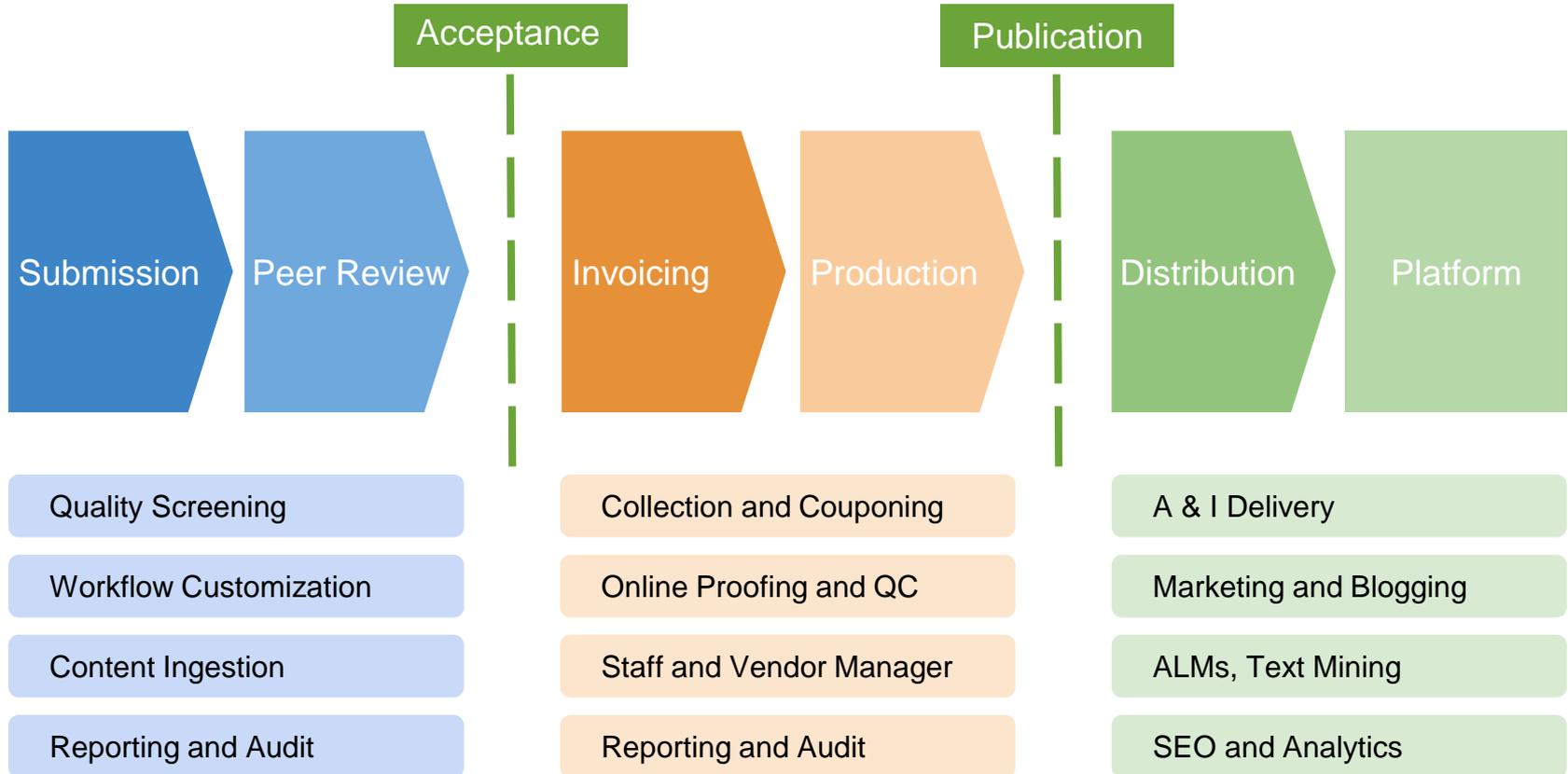


- ▶ End-to-end system for publishing open access journals
- ▶ Built as part of CoKo and Libero open source communities
- ▶ Not tied in with legacy systems, greater flexibility
- ▶ Cloud infrastructure ensures state of the art security, automated testing, continuous integration and continuous delivery

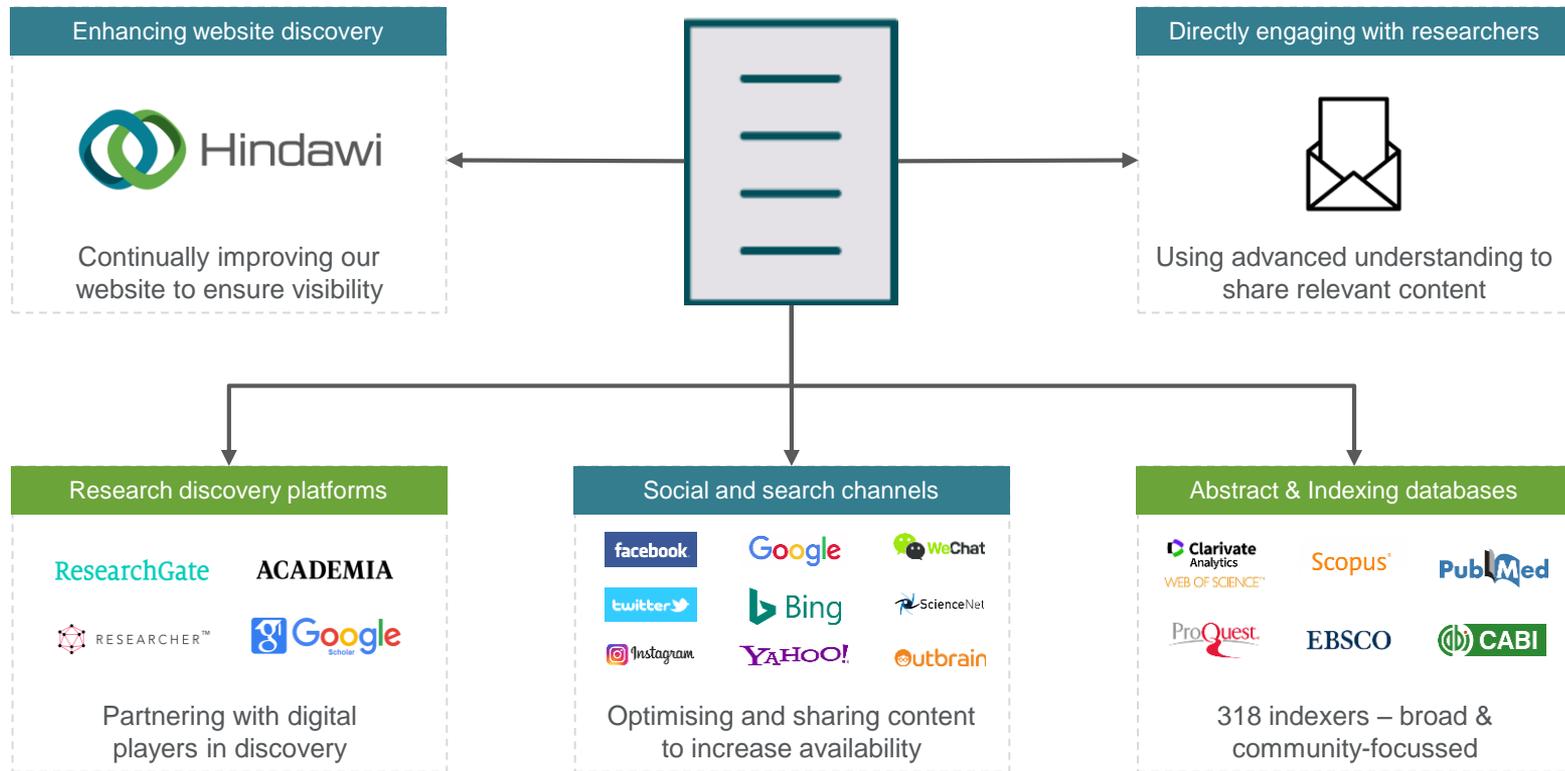


- ▶ Support and enshrine open principles (open access, open data, open source, open infrastructure)
- ▶ Empower institutions & scholarly societies to move towards OA without giving away the ownership of their journals
- ▶ Open source promotes true competition, innovation and development

# Open Publishing Solutions – Model



# Realising potential of open: ensuring content is as available as possible



# Invest in Open Infrastructure

An effort to enable durable, scalable, and long lasting open scientific and scholarly infrastructure to emerge, thrive, and deliver its benefits on a global scale.

## Our Statement

## Our Supporters

## Join the Census

## Leadership

## Blog

## Events

# Invest in Open Infrastructure: A Concept

version 0.2

We invite the community to respond to the ideas in this document using the embedded Hypothesis annotation interface.

## Preamble, The Why

We imagine a world in which communities of researchers, scholars, and knowledge workers across the globe are fully enabled to share, discover, and work together. It is clear that the needs of today's diverse scholarly communities are not being met by the existing largely uncoordinated scholarly infrastructure, which is dominated by vendor products that take ownership of the scholarly process and data. We intend to create a new open infrastructure system that will enable us to work in a more integrated, collaborative and strategic way. It will support global connections and consistency where it is appropriate, and local and contextual requirements where that is needed.

## The Issue

Open Infrastructure (OI) includes projects and organizations that support open scholarship, research, and education, and are most often built on

# Publishers as Service Providers not Gatekeepers

# Good Practice Principles for Scholarly Communication Services

COAR and SPARC have developed seven good practice principles to ensure that scholarly communication services are transparent, open, and support the aims of scholarship. These principles can be used by users to make decisions about which services they will contract with, and by service providers to improve their practices and governance



## GOOD GOVERNANCE

The service has strategic governance that allows community input on the direction of the service and operational governance with community representation and decision making power.



## OPEN STANDARDS

The service uses open APIs to enable interoperability, and adheres to open standards. Ideally, the platform is based on open-source software, but in cases where it is not, user-owned content is managed according to well-established, international standards.



## FAIR DATA COLLECTION

Only data necessary for the service's provision are collected from users and the type of the data collected and how they are used is clearly and publicly articulated.

These principles are informed by Principles for Open Scholarly Infrastructure-v1 by Bilder G, Lin J, Neylon C (2015) © 2019 COAR and SPARC, subject to a Creative Commons Attribution 4.0 International License



## TRANSPARENT PRICING AND CONTRACTS

The service's contract conditions and pricing are transparent and equitable, with no non-disclosure agreements included.



## EASY MIGRATION

User-owned or generated content can be easily migrated to another platform or service upon termination of contract, without any additional fee from the service provider.



## SUCCESSION PLANNING

If the service is a nonprofit, the organization's bylaws state the conditions and terms governing how the organization may be transferred or wound down. If the service is provided by a for-profit entity, the contract/agreement should not be assignable to another entity without the client's express permission.



## OPEN CONTENT

Content, metadata and usage data are immediately, openly and freely available in machine-readable format via open standards, and using licenses (like CC0 or similar) which facilitate reuse.

# Accountability and Responsibility



# Who are the actors/stakeholders?

- **Primary:** Those directly involved in evaluating and rewarding researchers
  - Institutions, other Research Performing Organisations and Funders.
  - Most powerful when acting together to change and implement policy (e.g. Plan S & OA2020)
- **Secondary:** Those maintaining or delivering the outputs used in evaluation
  - Publishers, Platforms, Repositories, eInfrastructures, Clarivate, Scopus etc
  - Respond directly to policy changes implemented by primary actors (e.g. Plan S & OA2020)
- **Tertiary:** Those benefiting from a new system of research assessment
  - Other researchers, science, society, business etc

*Researchers  
involved at all  
levels  
(everywhere &  
nowhere -  
trapped....)*

Take the burden off researchers



# A Virtuous [Open] Science/Scholarship Circle

*Primary Actors* can directly change the actions of **Secondary Actors**, whose behaviour in response will reinforce the goals of the primary actors (and accelerate further change), for the benefit of **Tertiary Actors**



# What is 21<sup>st</sup> Century Research & Scholarship?



Open Standards

Open Infrastructure  
(Technical and  
Social)

21<sup>st</sup> Science/  
Scholarship =

Practice + Process + Outputs + Outreach  
+ Impact



Access, reuse &  
discoverability



Evaluation &  
Researcher behaviour

**Culture  
Change**

# What is 21<sup>st</sup> Century researcher?



# What is a 21<sup>st</sup> Century Institution?



# What is a 21<sup>st</sup> Century Funder?



# What is a 21<sup>st</sup> Century Publisher?



**Focus not on open...**



but on 21<sup>st</sup> C scholarship...



**...& openness follows.**

