THE FUTURE OF PEER REVIEW
AND WHY RESEARCHERS ARE LIKE PENGUINS

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An interesting experience in collaborative authoring and review in itself.

Have a pretty good peer review and publishing history for career stage.

Executive Editor for OA journal, Geoscience Communication.

And also Flaminio hasn’t banned me from his events. Yet.
WHAT DID WE DO?

- It all began at the Mozilla Global Sprint in 2016…
- Open to anyone to contribute via Overleaf.
- Created a 42 page behemoth.
  - History, present state, and future of PR.
- We explored a range of services and their potential parallels with PR.
- Inadvertently ended up modelling a ‘hybrid PR and publishing’ platform.

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Actual footage from the sprint
What do you think of when you hear “peer reviewed”?
How old do you think “peer review” is?
Do you see peer review as a single, static process?
Do you trust work more if it has been peer reviewed?
How often do you read peer review reports for papers?
Have you ever been frustrated by peer review?
TO DIVINE THE FUTURE OF PEER REVIEW...

...YOU MUST FIRST UNDERSTAND ITS HISTORY
CHEERS, FLAMINIO...

Going to be fun reviewing your paper now... #Reviewer2
“Although the beginnings of "peer review" are frequently associated with the Royal Society of London when it took over official responsibility for the Philosophical Transactions in 1752, antecedents of peer review practices go back to the 17th century.”

- David Kronick (1990)

Henry Oldenburg – The first Editor?

http://jamanetwork.com/journals/jama/article-abstract/380935
The formalised practice that we now call “peer review” actually only emerged in the early 19th century.

Learned societies were absolutely key in this.
EMERGENCE OF PROTO-PEER REVIEW

- Editorial committees had collective responsibility.
- Referee reports by Fellows of the Society – based on subject-specific expertise.
- Key tasks:
  - Eliminating obvious errors and oversights.
  - Improving the rhetorical style, and argumentation of the article.
  - **NOT** ‘gate-keeping’.
- Peer review was more of a ‘gentlemanly discussion’.


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THE 19TH CENTURY REVOLUTION: THE FIRST WAVE

- Originality of research key as societies sought public interest.
- Origin of “peer review” as we now know it.
- Between 1,000-2,000 scientific periodicals.
  - Nature launched around 1869.

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The 20th Century Explosion

- English becomes the dominant language of science (yay colonialism).
- Huge increase in the number of papers being published.
- Industry begins to get interested (££).
- Typewriters (1890s), photocopiers (1959).
- Professional services become involved (££).
- Editorial, publishing.
- Use of formalised peer review becomes more widespread.
- Around 21,000 peer reviewed journals (Dalen & Klamer, 2005).
- Geographic expansion and specialisation of journals.
Based on a paper on gravitational waves submitted to Physical Review in 1935.

"According to the physicist and historian of science Daniel Kennefick, it may well be that only a single paper of Einstein’s was ever subject to peer review."

http://michaelnielsen.org/blog/three-myths-about-scientific-peer-review/
Nature did not implement any system of formal peer review until 1967, almost a century after it launched.

I published a few things in Nature when I was a PhD student [in the 1960s] and almost anything could get into it at the time, if it wasn't actually wrong. Refereeing was pretty erratic and I think they took more notice of where it came from than the content.

- Walter Gratzer, 1966
The practice of editorial peer review did not become general until sometime after World War II.

These procedures did not spread in an orderly way.

Institutionalization of the process took place mostly in the 20th century.

- To handle new problems in the numbers of articles submitted.
- To meet the demands for expert authority and objectivity in an increasingly specialised world.
- Becomes synonymised with ‘value’.
- Commercialist opportunities arise.

http://jamanetwork.com/journals/jama/article-abstract/380937

https://www.timeshighereducation.com/features/peer-review-not-old-you-might-think
WHAT CAN WE LEARN FROM HISTORY?

- The practices of peer review (and publishing) are not set in stone.
- They began with learned societies – they matter!
  - Priority was serving communities, not shareholders.
- Peer review is a very diverse process. More than you might think.
- Key questions:
  - Should practices developed for a print era be the same in a digital world?
  - Is the ideal of peer review still matched by the process?

"The Present is the Key to the Past is the Key to the Future". James Hutton.
LATE 20TH CENTURY: THE SECOND WAVE

Aka the time when people began to realise that the Web exists…

At one extreme were enthusiasts for electronic preprints, who regard them not as scientific papers in evolution but as near enough finished articles. To these respondents, the current long process of peer review and paper publication is detrimental to science and the public health: any way of getting scientific advances into the public domain fast is worth supporting.

- Tony Delamothe (1998)
“In the physical sciences, preprints have been de rigueur for a quarter of a century—the majority of research across a wide spectrum of disciplines is first posted on arXiv as non-peer-reviewed manuscripts.”

- Paul Ginsparg, 2016.

“Thus, more than 100,000 research manuscripts annually on arXiv are open to comments from colleagues, which fosters collaboration and helps scientists to improve manuscripts before they are submitted to a peer-reviewed journal.”

http://emboj.embopress.org/content/early/2016/12/01/embj.201670030
WHERE ARE WE NOW?
WELCOME TO THE WORLD OF BIG PUBLISHING

http://whyopenresearch.org/costs

http://cassandralegacy.blogspot.co.at/2014/08/the-decline-of-science-we-are.html

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There is no such singular entity as ‘peer review’

- Single blind
- Double blind
- TRIPLE blind
  - Mostly revolved around reciprocal anonymity
- Open peer review. How many definitions are there for this alone?

122, Jon, according to my systematic review. Thanks for asking.
COMPLICATIONS THROUGH COMMERCIALISM

- Peer review gains status as a form of academic capital
- Peer reviewed papers equated with ‘prestige’
- And a nice method for scholarly publishers to develop their brands

Peer Review Guidelines at Elsevier
http://www.elsevier.com/reviewers/reviewer-guidelines
PEER REVIEW IS A SACRED COW (TO SLAY?)

- Publisher-driven.
- Anonymous.
- Closed and exclusive.
- Biased and subjective.
- Non-accountable.
- Time-consuming.
- Expensive (~$2bn/year).

= Higher Quality?

https://www.timeshighereducation.com/features/peer-review-not-old-you-might-think

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Think about this both as a commercial publisher and as a researcher, and the tensions this creates.
“There is a nearly unanimous perception among molecular and cell biologists that publishing has become the most discouraging and frustrating part of research. The trepidation level peaks at each stage of the process: the editorial stage where rejection without review has become the norm; the review stage where reviewers frequently do not fully understand the work or its implications; and the revision stage, when authors shoulder the disproportionate effort to revise the paper per reviewers' demands.”

Peer review: A necessary evil, a hoop to jump through.

http://embor.embopress.org/content/16/12/1588

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PEER REVIEW AS PARODY

Pinned Tweet

ShitMyReviewersSay @YourPaperSucks · 13 Nov 2014
"I am afraid this manuscript may contribute not so much towards the field’s advancement as much as toward its eventual demise."

💬 21  🔲 861  ❤️ 1.8K

ShitMyReviewersSay @YourPaperSucks · 17h
"This paper is absolutely ridiculous. It shouldn't be published anywhere and the author should not be encouraged to revise"

💬 8  🔲 31  ❤️ 241

https://twitter.com/YourPaperSucks
Peer review is... “slow, expensive, profligate of academic time, highly subjective, something of a lottery, prone to bias, and easily abused.”

- Richard Smith, former EiC of the BMJ

“Pre-publication peer review is no longer necessary because the power of the internet now allows instant publication of all results without requiring assessments of their novelty or impact in the field.”

http://embor.embopress.org/content/16/12/1588
THE DIVERGENCE BETWEEN THE IDEOLOGY AND THE PROCESS

JONATHAN DUGAN TAUGHT ME THIS, AND IT HELPS EVERYTHING TO MAKE SENSE

Everything has geological analogues..

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Reader: “Why should we trust this scientific article?”
Scientist: “Because it has been published in a scientific journal, and has been peer reviewed.”
Reader: “What does that mean?”
Scientist: “Specialists in the field vetted the information to see if it is scientifically rigorous.”
Reader: “Which specialists? How many of them?”
Scientist: “We don’t know. Maybe 2. Maybe not.”
Reader: “Can we see what they wrote?”
Scientist: “No.”
Reader: “How did you handle bias and conflicts of interest?”
Scientist: “I don’t know. We also did not review the code or the data, and the article is paywalled. But trust us.”
SO WHAT PEOPLE CALL A ‘GOLDEN STANDARD’ IS NON-TRANSPARENT AND COMPLETELY UNVERIFIABLE.

THIS IS THE SCIENTIFIC EQUIVALENT OF BULLSHIT.
“Social influence, bias and herding are also important factors in the peer review process that further compound the problem of unpredictability in complex networks.”

http://embor.embopress.org/content/16/12/1588

“Every scientist has a story (or ten) about how they were poorly treated by peer review – the important paper that was unfairly rejected, or the silly editor who ignored their sage advice as a referee. Despite this, many strongly presume that the system works “pretty well”, overall.”

http://michaelnielsen.org/blog/three-myths-about-scientific-peer-review/
WHY THE RESISTANCE TO CHANGE?

- Peer review has become synonymous with quality.
  - Despite the overwhelming lack of evidence supporting this.
  - But it defines *everything* in academia.
- The myth that journals and peer review belong together.
- The myth that “it has always been this way”.
- An industry that relies on perpetuating these myths.

"Yes, the planet got destroyed. But for a beautiful moment in time we created a lot of value for shareholders."

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INERTIA AND PENGUINS
Researchers are all guilty of “glam-humping”.
- Impact factors mean very, very little.
  - About research.
  - And researchers.
- Except the higher it is, the more likely it is that you committed fraud.
- If you use the impact factor for anything other than its intended purpose, you are statistically illiterate and should have all of your research retracted.

http://www.nature.com/news/why-high-profile-journals-have-more-retractions-1.15951
OPEN ACCESS HAS NOTHING TO DO WITH PEER REVIEW?

- But OA publishers were some of the first to experiment with peer review.
  - Publishes “scientifically rigorous research regardless of novelty”.
  - “Direct online dialogue, enabling quick iterations and facilitating consensus”.
BUT…REALISM VERSUS RADICALISM

- We really don’t know that much about peer review.
  - Many highly-opinionated editorials.
  - Many anecdotes.
  - Many small, population-level studies.
- Can we really say anything about the reliability of peer review?
- We know that the process must exist in scholarly communication in some form.
  - But what form should that take?

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Most scientists regarded the new streamlined peer-review process as ‘quite an improvement.’
People realise that the Web is actually pretty powerful.

Most new tools developed around a journal-based system. Therefore depend on publishers for sustenance.

Very little thought generally into either long-term sustainability or the social aspects governing PR practices.

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F1000 Research – make papers (preprints) available first, then invite post-publication peer review later.
  - Takes advantage of version control.
  - Continuous peer review.
  - Open commenting.
Overlay journals – a gamble?
Dozens of new preprint platforms launched.
  - And new services around them.
  - Mostly community-governed.

"I don’t mind your thinking slowly. I mind your publishing faster than you can think."
(The Nobel Laureates physicist Wolfgang Pauli)
“If preprints should attain the dominant role they have in physics, publishing papers in journals may remain attractive only in journals that add real value to the scientific communication process.”

- Bernd Pulverer (2016)

It only took 27 years..

http://emboj.embopress.org/content/early/2016/12/01/emboj.201670030

https://twitter.com/Graham_Coop/status/819738131612123137
Everywhere we are using networks to evaluate information on the Web. Why not in science? Use the power of professional networks to evaluate scientific results.
WHAT IS BEING DONE ABOUT THE KNOWLEDGE GAP?

- Lots of pretty awesome research.
- That reveal the different dimensions of dysfunction and bias.
IT FEELS LIKE WE’RE TRYING TO FORCE A CARTHORSE TO TROT FASTER, WHILE IGNORING THE JET-POWERED CAR WE HAVE INSTEAD.

A 19TH CENTURY PROCESS APPLIED TO A 17TH CENTURY COMMUNICATION FORMAT

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WHAT IF WE REBUILT THE ENTIRE SCHOLARLY COMMUNICATION SYSTEM FROM SCRATCH IN 2018?

BECAUSE THIS IS ESSENTIALLY THE ULTIMATE GOAL, RIGHT?

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KEY ISSUE: MOST ACADEMICS REALLY DON’T GET IT

- The history of peer review – “Hasn’t it always been this way?”
- The distinction between the ideology and the process.
- That there is a incredible dearth of evidence around peer review.
  - And much of that is quite fragmented (Grimaldo et al., 2018).
- But we don’t actually really need their permission to change things.
  - It hasn’t mattered much in the past.
  - They can come willingly, or kicking and screaming, into the future.
- There is an incredible potential scope for systemic peer review reform.
WE HAVE THE TOOLS TO BLOW PEER REVIEW WIDE OPEN

Stack Exchange

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THREE CORE ASPECTS FOR SUCCESS OF ANY PEER REVIEW PLATFORM

1. Quality control/moderation
2. Certification/reputation
3. Engagement incentives

So, how..?

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QUALITY CONTROL AND MODERATION

COMMUNITY, COLLABORATION, CONSENSUS
### Quality control and moderation

<table>
<thead>
<tr>
<th>Traditional</th>
<th>Future</th>
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<tbody>
<tr>
<td>Gatekeeping function as a content filter (varying selectivity criteria)</td>
<td>Collaborative, constructive PR as ‘issues’ or comments</td>
</tr>
<tr>
<td>QC incredibly difficult to measure, little evidence of actual success</td>
<td>QC achieved via consensus and evaluated based on engagement</td>
</tr>
<tr>
<td>Typically closed system with a secretive and selective process</td>
<td>Self-organised, open and unrestricted communities</td>
</tr>
<tr>
<td>Organised around journals (“papers” – it’ 2018..)</td>
<td>Unrestricted content types and formats</td>
</tr>
<tr>
<td>Non-accountable editor-controlled “black box of peer review”</td>
<td>Elected ‘moderators’ accountable to communities (QC &amp; engagement)</td>
</tr>
<tr>
<td>Structurally limited (2-3 people)</td>
<td>Semi-automated matching of content to reviewers</td>
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CERTIFICATION AND REPUTATION

BECAUSE WE LOVE GIVING AWAY OUR LABOUR FOR FREE

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## Certification and reputation

<table>
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<th>Traditional</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Poorly recognised and rewarded activity for researchers</td>
<td>Performance metrics based on nature and quality of engagement</td>
</tr>
<tr>
<td>Difficult to effectively measure due to opacity of process</td>
<td>Open, continuous community-based evaluation tied to reputation</td>
</tr>
<tr>
<td>Often inappropriate journal-level proxies</td>
<td>Revealed at object and individual levels</td>
</tr>
<tr>
<td>Issues surrounding identification within closed process</td>
<td>Fully transparent by default (e.g., via ORCID)* and portable</td>
</tr>
<tr>
<td>High reviewer turn-down rates for various reasons</td>
<td>Reviewer pool greatly expanded with low barrier to entry</td>
</tr>
<tr>
<td>A bit shit, really…</td>
<td>Potential for engagement filters</td>
</tr>
<tr>
<td>But getting better!</td>
<td>Appealing for those in charge of assessment</td>
</tr>
</tbody>
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* @protohedgehog
INCENTIVES FOR ENGAGEMENT

BECAUSE SHEEP LIKE CARROTS

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Incentives for engagement

### Traditional
- Shared sense of duty as a natural, altruistic incentive
- Researchers generally feel they receive too little credit
- Incentives only for engagement, not for high quality engagement
- Incentives not tied to academic reputation or career progress
- ‘Prestige’ obtained by journals

### Future
- Virtual rewards such as points, ‘karma’, badges or abilities
- Creates an incentive ‘loop’ as authors incentivised to maximise engagement
- ‘Reviewing the reviewers’ system incentivises high quality PR
- Can be tied to academic records and career advancement
- Establishment of individual prestige

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SOME OF THE MAJOR FUTURE CHALLENGES

- Catalysing wider discussion, education, and innovation in peer review.
- Demonstrating that new models outperform traditional processes (or not).
- Agreement on interoperability requirements across stakeholders.
- Adoption of elements of the new system across specific communities.
- Increasing the role of peer review in research[er] evaluation processes.
- Adapting social communication traits into novel peer review models.
- Overcoming the “If you build it, they will come” fallacy.

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“For better or for worse, science will have to live with traditional peer-reviewed journals, which are, in any case, already evolving and adapting.”

But...

- Do we really need journals?
- Do we really want journals...?
ALL OF US NEED TO BE DEEPLY INTROSPECTIVE AND ASK THE BIG QUESTIONS ABOUT PEER REVIEW

► How divergent are the ideologies and practices of peer review?
► How can Web-native technologies be used to address some of the major criticisms and issues with ‘traditional’ peer review?
► How is the Internet changing our expectations of how communication works, and why are scholarly publishing and peer review seemingly lagging behind this?
► How can we integrate Internet-style communication norms with peer review?
► How do we increase cross-stakeholder engagement to implement optimal models and practices of peer review?
► How much do we want to disrupt the relationship between peer review and journal articles? And what will the impact of this be?
► How can we regain the ‘peer-to-peer’ nature of peer review again?
THE DREAM?

- Building a peer review and scholarly communication platform designed for a Web-native research community.
- Resolution of all the technical and social issues associated with PR.
- Disruption of the entire scholarly communication process.
- Decoupling of peer review and communication from journals.
  - Or at least commercial entities who parasitize the process.
- Community adoption of standards to encourage practice and adoption.
- Put research communication in the hands of researchers.
- Saving the global research community $billions every year.#
- Collectively address the real issue of control and governance of public research. Bam.

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A multi-disciplinary perspective on emergent and future innovations in peer review
- What is open peer review? A systematic review
- You never said my peer review was confidential – scientist challenges publisher
- Breaking the traditional mould of peer review: Why we need a more transparent process of research evaluation
- What are the barriers to post-publication peer review?
- We have the technology to save peer review – now it is up to our communities to implement it
- The history of peer review, and looking forward to preprints in biomedicine
- Three myths about scientific peer review
- Peer review: not as old as you might think

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