OPINION ARTICLE

Amending published articles: time to rethink retractions and corrections? [version 1; peer review: 2 approved with reservations]

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Abstract

Academic publishing is evolving and our current system of correcting research post-publication is failing, both ideologically and practically. It does not encourage researchers to engage in necessary post-publication changes in a consistent way. Worse yet, post-publication 'updates' can be misconstrued as punishments or admissions of misconduct.

We propose a different model that publishers of research can apply to the content they publish, ensuring that any post-publication amendments are seamless, transparent and propagated to all the countless places online where descriptions of research appear. At the center of our proposal is use of the neutral term "amendment" to describe all forms of post-publication change to an article.

We lay out a straightforward and consistent process that applies to each of three types of amendment that differ only in the extent to which the study is amended: minor, major, and complete. This proposed system supports the dynamic nature of the research process itself as researchers continue to refine or extend the work, and removes the emotive climate particularly associated with retractions and corrections to published work. It allows researchers to cite and share the most up-to-date and complete versions of articles with certainty, and gives decision makers access to the most up-to-date information. Crucially, however, we do not underestimate the importance of investigations of potential misconduct. This proposal allows two interrelated processes - amendment of articles and investigation of misconduct - to be uncoupled temporally, allowing a more rapid correction of the literature at a journal while institutional investigations take place, without either having to follow the others'

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timeline.

Keywords

Post-publication amendments, corrections, retractions, expressions of concern.

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Competing interests: VB is the Director of the Australasian Open Access Strategy Group. She also works part-time for Queensland University of Technology (QUT), Brisbane as a Professor in the Office of Research Ethics & Integrity and in the Division of Technology, Information and Library Services. She was the Chair of COPE until May 2017 and was a COPE Trustee until November 2017. She is also an Editorial Board Member for Research Integrity and Peer Review. TB is Executive Editor of The BMJ. She chairs the scientific advisory board of EMBL-EBI Literature Services. JL is Director of Product Management at Crossref. She serves on the Dryad digital repository board. ECM is Senior Editor (Peer Review Strategy and Innovation) at BMC (part of Springer Nature). She is also a COPE Council Member, an Editorial Board Member for Research Integrity and Peer Review, a member of the Advisory Board for EnTIRE (an EU proposal for Mapping the research ethics and research integrity framework) and mentor for MiRoR (Methods in Research on Research).

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Introduction

Academic publishing is evolving. It is no longer the case that, once published, articles remain unchanged for ever. It is also no longer the case that the final published version is the only version that is made public. Increasingly, preprints, datasets and authors' accepted versions (and revised versions) of manuscripts, are made available via a variety of mechanisms. A key question that needs to be addressed in the context of this evolving landscape is: are we well-served by the notion of a 'version of record' that is *static* post-publication?

This article reviews current 'best practices' for amending published articles and discusses problems that are encountered as a result. We suggest an alternative system, first proposed in a preprint¹ which challenges current thinking but proposes a future solution. We highlight seven key principles that we believe do, and should continue to, apply to the integrity of the literature, the approach to authors suspected of misconduct, and how best to resolve these potentially conflicting issues (Figure 1).

The main guideline for journals, publishers and other publishing organisations handling retractions is the Committee on Publication Ethics (COPE) Retraction Guidelines², published in 2009. Although the guidelines have been helpful, their consistent implementation has proved more difficult as publishing has evolved. Nonetheless, the guidelines, combined with regular discussion between editors, have provided a core framework for handling retractions that now covers many disciplines and countries. Of particular importance has been the repeated assertion of the overarching intention of the guidelines to assist in correction

of the literature, whatever the cause. Thus, a **first key principle** is that the publisher's role is to maintain the integrity of the literature. A **second principle** enshrined in the COPE's Retraction Guidelines is that in cases where misconduct is suspected, it is the role of the authors' institution or employer to investigate and provide a ruling. As in all legal and quasi-judicial systems, the accused are considered innocent until guilt is proven. Currently, in our experience many retractions occur only after such an investigation has been completed, and investigations can take many months or even years. The need to be fair to the authors and the need to maintain the integrity of the literature are therefore in opposition during the period that an investigation is underway.

We are by no means downplaying the need for rigorous investigation and, if needed, sanctions for potential misconduct. By contrast, we believe that our proposal would strengthen such investigations by ensuring that amendments to the literature and investigations can happen independently. This procedure is standard for many other areas where rapid notification of an incident is required; the notification for example of a consumer product failure happens as quickly as possible; the investigation of the cause and the application of any sanctions happens after due process has occurred, often much later.

Current and evolving best practices

The traditional publishing workflow was originally established to facilitate robust peer review within a print publishing paradigm and is carried out with very little variation amongst conventional publishers (Figure 2). Following publication, however, the traditional scholarly communications process gives way to

Figure 1. Seven key amendment principles.

Figure 2. Publishing outline from HEFCE³.

“best practices.” For concerns raised about an article, or author-initiated changes, there are a number of approaches that can be taken to correcting an article, depending on the scale of the issue. Small errors which do not undermine the findings of the published article can be resolved with a ‘correction’. Historically, some printed journals used to distinguish between errata and corrigenda, according to whether the author or the journal introduced the error - a now meaningless and poorly understood distinction. In other more recent situations, a comment, editorial or blog (or sometimes many tweets and blogs⁴) have been helpful in providing commentary with or without a correction to the article itself. Letters to the editors also have a long tradition as a place for signed criticism, (e.g. rapid responses and letters at *The BMJ*⁵, although many journals do not allow letters. PubMed Commons⁶ also offers a place for any qualified individual to comment on any article that is indexed in PubMed.

Where an article is so seriously flawed or erroneous that the findings can no longer be relied on, then the method of correction is typically wholesale i.e. the article is retracted. COPE guidelines on retraction¹ advise retracting articles if the main findings are found to be unreliable, redundant, plagiarised or if the authors have reported unethical research or failed to disclose a major competing interest which could influence the interpretation of the article. COPE’s intention was to offer practical guidance and not be overly prescriptive (for example the guidelines deliberately did not contain information about the process of retraction and the wording to be used). The guidelines also do not offer guidance on what is to be done after a retraction. For example, some publishers are now experimenting with retracting and replacing an article in its entirety, for example, “retract and replace” by the JAMA network⁷. In other situations, where it is unclear whether a retraction will be the final outcome, ‘Expressions of Concern’ typically flag issues that do not yet have a final resolution^{2,7,8}. A recent study has made plain the inconsistent and variable way ‘Expressions of Concern’ have been used in the past 30 years⁹.

These approaches were designed to help resolve issues with published articles while maintaining the integrity of the research literature - preserving the original article for the record. But increasingly, such approaches are inconsistently adopted by researchers and editors because they seem a less than perfect response to

an evolving literature in the digital age. In parallel, readers are becoming accustomed to news sites and blogs posting rapid corrections when errors occur. Also, sites that encourage anonymous discussion of research, e.g. PubPeer¹⁰ have provided a route for all readers to comment in an only lightly moderated way on research articles, and to continue commenting while institutions attempt to investigate. Thus a **third principle** is the need to be able to correct rapidly, while implying no fault on the part of the authors until or unless any case against them is proven.

A fundamental underlying problem

To date, we have observed a bewildering variety of notices on articles posted after publication. We have captured nine most commonly used and point to examples in Table 1. Furthermore, many of these are implemented differently by different publishers. No standard taxonomy of updates exists for publishers to adopt. This leads to inconsistencies from journal to journal and potential confusion for the reader.

Moreover, a lack of willingness to engage in proper post-publication correction and amendment of the literature is further exacerbated when any type of post-publication ‘updates’ are misconstrued as punishments or admissions of guilt. This is particularly the case with retraction, a term which many feel has come to be loaded with blame and recrimination. It is fair to say that no one who has been involved with the retraction of an article – either as an editor, publisher, reviewer or author - has ever walked away from the process feeling wholeheartedly good about the experience. This is the case even if a retraction is done for the best of reasons – a genuine, no fault mistake^{11,12}. As a result, we believe a ‘retraction’ will never be fully embraced as a positive outcome by researchers.

There is a fundamental misconception that retractions are ‘bad’ without pausing to ask *why* the retraction took place. A **fourth principle** is, therefore, that we need neutral terminology for the method of correcting published work that implies no fault on any party. In order to provide this, it is important to distinguish the correction of the published record from any investigation or description of misconduct that has occurred. If misconduct or fraud has occurred, this should be reported on, but such reporting should be considered as distinct from the process of correcting the literature.

Table 1. Common amendments currently in use.

Amendment	Uses/purpose	Example
Retraction	Alert readers to serious problems	http://onlinelibrary.wiley.com/doi/10.1002/app.44938/abstract
Retract and replace	Alert readers to major errors not the result of misconduct	http://jamanetwork.com/journals/jamapsychiatry/fullarticle/2466828
Partial retraction	Alert readers to a problem with an aspect of the article	http://www.neurology.org/content/88/7/721.1.short
Expression of Concern	An issue has arisen but outcome is undecided	https://translationalneurodegeneration.biomedcentral.com/articles/10.1186/2047-9158-3-18
	Inconclusive outcome, not warranting retraction	http://bmccgenomics.biomedcentral.com/articles/10.1186/1471-2164-14-260
Mega correction	Alert reader to extensive corrections	http://retractionwatch.com/category/by-reason-for-retraction/mega-corrections/
Correction/erratum	Alert reader to small problem that does not change the article conclusions	http://journals.plos.org/plosone/article?id=10.1371/annotation/dcde3f9c-4be2-40a0-b9a2-152f6772fb6d
	Alert reader to authorship changes	http://journals.plos.org/plosone/article?id=10.1371/annotation/d598d976-2604-429b-a76f-14aeca628a8e
Editor's Note	An issue has arisen but outcome is undecided	http://journals.plos.org/plosone/article/comment?id=info:doi/10.1371/annotation/28283552-3fc4-4db9-9474-5034816e9162
Comment	Sometimes used to alert readers to small typos in article	https://www.ncbi.nlm.nih.gov/pubmed/26701674#cm26701674_14209
Version	Alert readers to revisions on article	https://f1000research.com/articles/5-2741/v2

Such a separation is especially important as those who are likely to be responsible for an investigation into misconduct will be different from those issuing any correction of the published record, and the two may need to happen on quite different time frames. During this time, we feel it is important to alert readers to the possible issues with the published work, and to update the literature without awaiting the final outcome of a lengthy investigation¹³. Once any investigation is complete, however, its outcome should be recorded on any it has considered.

Although corrections may not be as universally disliked as retractions, once an article has more than one or two corrections, in the current publishing system it is difficult to track what has happened. Tracking corrections is even more challenging when they are documented outside of the publication itself. For such 'external corrections' tracking is arguably even more crucial, as articles (as well as references to them) increasingly propagate across the internet and often do not link back to one version of record. However, developments such as Crossmark¹⁴ are beginning to address this issue. Furthermore, there are no universal guidelines for corrections, and editors and publishers often act on a case-by-case basis. Many

editors and publishers struggle with the need for a correction notice for a very minor amendment to an article (such as a typographical error that has no effect on meaning), while many readers feel that all amendments post-publication need a clear audit trail. Our **fifth key principle** is that all changes made post-publication should be traceable and all versions of an article should be preserved. The circumstances in which an article should be removed (for ethical, legal or safety reasons) are extremely rare, and even in these cases a metadata record should remain, alongside an explanation.

Now is the time for change

There are better approaches for amending scholarly communications post-publication. Examples from newspapers and blogs [e.g. 15] take a simple approach to corrections which are effective, speedy and user-friendly. However, these types of outlet rarely require any cross-referencing to external articles and hence the process is much simpler than for academic research articles.

While we reaffirm the importance of preserving the integrity of the published literature, we equally strongly affirm that research outputs are now dynamic objects online. Our **sixth key principle**

is that the idea of the journal article as a monolithic object that will stand for all time unless formally retracted has gone. Rather we are seeing calls for articles to be viewed as organic publications or “living articles”¹⁶. If this idea is to be accepted, it is critical to ensure that updates to the scholarly record of a publication are appropriately made and that they properly link the latest update to the original record. Readers need a complete history of changes to an article. We now have the technical tools at hand to do this, and indeed a number of publishers now publish successive versions. These versions can be elegantly handled for readers online by making it clear which version is being displayed and by employing links to help readers navigate between versions (e.g. *F1000Research*¹⁷). Crossmark also provides a vital insurance mechanism, as it displays the publication history consistently across publishers¹⁸. Our **seventh key principle** is that both human and machine readers should be able to trace the full history of an article with ease, and should by default be taken to the most recent version of any article.

We now have the technical tools to ensure there is clear notation of version history in the citation record. The digital object identifier (DOI) is central to this as a unique alphanumeric string that identifies the content and provides a persistent link to the location of each resource on the Internet. It is an actionable identifier as it resolves to (i.e., takes the user to) the corresponding resource online. It is also descriptive as it binds the DOI to specific metadata about the digital object.

To support versioning, publishers could assign a new DOI (or, more logically a DOI with a suffix), to each version, and link to the previous version in the metadata record. Crossref ensures that all versions are linked through the relationship metadata included in the record. Once deposited with Crossref¹⁹, all versions could be threaded together²⁰ through their DOIs and made available to systems across the research ecosystem. This practice provides specificity and precision to the citation record that has not been possible before. Researchers can thus cite a specific version, rather than, unintentionally, the original one. Essentially, we can now, technologically, think beyond the article of record to a number of versions, whether they are preprints or postprints or institutional copies. The primary challenge, however, is facilitating publisher (and perhaps institutional) adoption and implementation of practice to deposit and update metadata records as changes occur.

If a fundamental change in how we amend published articles is to be successful, we need both the technology to make it happen (as outlined above) and the will and support from the community to embrace the change.

A proposal for the future

The amendment model

In order to facilitate a more reliable and useful scholarly literature, we propose the following components of handling changes to published articles. The changes can be implemented by the same journal (or other publishing venue) that published the original research and be linked to the original article. We propose removing

the terms correction and retraction altogether and instead using the term “amendment” to describe all forms of post-publication change to an article.

The term “amendment” carries a neutral tone and is generic enough to apply to a wide array of cases, including the smallest instances such as a typographical error all the way to wholesale withdrawal of an article. By employing a uniform term, we hope to remove any associated stigma in the context of scholarly literature. When readers encounter each amendment, they can read the notice for details on each change, and can judge the article and its revisions on their own terms.

We considered alternative names such as “update” but we felt they imply progress or addition. In particular, we strongly feel that retaining the word “retraction” even for the most egregious instances of scientific malpractice would further perpetuate the problem of stigma and is thus not desirable.

We propose an amendment model made up of three different types: minor, major, and complete (Figure 3). These are distinguished by the scale of change entailed. **Minor amendments** cover small changes such as typographical errors, or other minor amendments to the content or metadata that has no effect on the substance of the article. Issues currently worded as corrections belong as **Major amendments**, but might also include clarifications and addenda (which are not currently easy to make under most current publishing workflows). Amendments of this type would make changes to one or two small parts of the article but not its whole message. Examples are changes in authorship, correction of one figure or method, or additional data or discussion. Lastly, **Complete amendments** covers situations where the article as a whole is considered unreliable in its current form. There may be elements that remain ‘correct’ but large proportions are not. Instead of “retract and replace” as currently practiced by some publishers, we would recommend “retract and republish” with a new DOI that resolves on the newer version and makes plain the chain of events. In cases where authors and/or journal may wish to dissociate themselves from the original article completely, this can be noted with a complete description in the associated narrative and no attempt to insert new text or other content. We would emphasise the importance of using the single neutral term ‘complete amendment’ to cover all types of retraction including those for honest errors retractions and misconduct. The narrative should include explanation of why the amendment is being made, and can report on any misconduct allegations once they are known and proven. However, an amendment could nevertheless be made initially without awaiting the outcome of any misconduct allegation or investigation.

The amendment notice

The notice (for all amendment types) is comprised of a declaration followed by key details. The declaration is posted at the forefront of the document stating that: “The authors and/or the journal wish to make the following amendment to the published article [article full reference].” We envisage this declaration being authored most

Figure 3. Three amendment types.

often by the authors of the original article, in consultation with the journal or publisher, but the format allows for the possibility that a journal or publisher can amend an article without an author's consent if that proves necessary. In either case the source of the amendment will be clearly visible to readers.

Every amendment notice would then include the following:

- a) *Who* is issuing the notice (an author, all authors, editor, journal, publisher, institution), and whether any of this group dissents from the notice. The CReDIT taxonomy might be applied to specify the role entailed in crafting the amendment.
- b) The *type* of amendment (as above)
- c) *Link* to the article that is being amended as well as other relevant links to associated resources
- d) *Date*
- e) Associated *narrative* (optional for minor amendments). This is particularly critical in the case of removal of an article without replacement: there needs to be some narrative notice that indicates the reason. This should be updated as needed with links to any investigation if that is publicly available

The process of the amendment within the publication lifecycle is straightforward and consistent for all types of amendment. Whether the incident at hand merits a minor, major, or complete amendment, the publisher can issue the notice, assign a new DOI to it, register it with Crossref and link to the target publication. Moreover, the same process is also consistent and streamlined to apply at a higher level to include all the various versions of the publication from the original publication to the posting of amendments (Figure 4).

Publishers register all amendments and versions of the paper as they currently do now with Crossref. Each amendment is assigned a DOI, and its metadata should contain a link to its associated article. This links the amendment notice and specific version of the paper in both directions. When a subsequent version of a paper is published, the publisher registers it with Crossref with a new DOI so that it can contain its own, independent set of metadata.

The metadata should contain a link to the previous version, thereby creating a sequential chain across multiple updates.

This version of scholarly communications supports the dynamic nature of the research process, as researchers continue to refine or extend the work. They can publish updates along the way, sharing their latest findings, analysis, and conclusions. For each version of an article an amendment can be issued. In each case, the publisher assigns a new DOI and deposits the metadata with Crossref so that researchers can cite with clarity and specificity.

Amendment display and linking

While the proposed amendment model simplifies the process by which published results are shared and updated, it also increases the potential number of components that might be published from a single set of research results. As such, linking amendments to their associated articles and across individual versions needs to be carefully implemented online so readers can easily navigate between versions.

Since every publisher employs their own specific design approaches to content delivery, we recommend the following linking and display strategies to ensure that amendment display fully supports editorial intent (Figure 5). We also illustrate the proposed amendment model, to a generalised case in [Supplementary file 1](#) that contains elements of a number of COPE cases²¹.

Linking. Link from each amendment to the respective article it amends and vice versa, so that the reader can easily navigate back and forth between the notice and the research itself. Also link general amendments to their respective article version to ensure that the amendment notice links back to the specific article version to which it amends. And in the event of a correction to a figure legend, the link should direct users to the latest version of the article, complete with the correct figure legend. Readers can then go back and look at it with the wrong legend as they wish (i.e. be transparent about the change). This is akin to the journalistic model and is much cleaner.

Article versioning. Each article version has its own DOI and URL, which persists even with the publication of subsequent versions. Where the reader is on an outdated version, clearly

Figure 4. The amendment process.

Figure 5. Amendments display and linking.

communicate its date on the article and provide a prominent link to the most up-to-date version. Provide a clean and simple way for readers to navigate to and from each version. In cases where the publisher is linking to the article in general (e.g. from a journal home page, etc.), directing users to the latest version is recommended.

DOI handling. Although any two DOIs can be linked via Crossref to explain the relationship between versions of an article, or between an article and an amendment, we suggest that the relationship between these would be more obvious to human readers if the original article's DOI were given a suffix (e.g. <https://doi.org/10.1136/bmj.j1072.1>; <https://doi.org/10.1136/bmj.j1072.2>, etc). Furthermore, The DOI should direct users directly to the specific document at hand, which corresponds to the precise version at hand. (This goes hand in hand with the recommendation to assign a new DOI to each version.)

Amendment metadata and propagation

All amendments must be evident to readers and machine harvesters of the literature. They must be inextricably and permanently linked to the original article and also propagated to systems that index articles. Some instances of complete amendments would mean publication of a new article, with a new DOI linked to the original article.

For publication updates to reach all the places online where articles are read, indexed, shared, discussed, recommended, etc. publishers need to make the metadata available in a central store where the data is freely available for systems and applications to consume. Crossref currently provides this facility and their metadata framework fully supports full disclosure of amendments. Once metadata updates are available from publishers, systems need to apply the latest information wherever the publications affected may appear online. All metadata are openly licensed for reuse, propagated through a variety of interfaces and formats via Crossref APIs²².

Anyone can search the published literature (humans and machines) to find the latest updates for any publication regardless of origin in the Crossref corpus (85+ million publications at time of writing). Publishers can flag this not only in their own content (online and PDF versions) via Crossmark, but also in the references of papers they publish. They can propagate these notices through other delivery channels offered such as email alerts, RSS feeds, recommendations, and so on. Non-publisher platforms such as indexers, reference managers, recommendation systems, social bookmarking tools, researcher profile systems, and others, can apply the update information and bibliographic metadata to the content they display as well. This information is also potentially useful for research information systems used by funders and research institutions, which also track scholarly outputs.

Conclusion

Our current system of correcting research post-publication is failing both ideologically and practically. We propose a model that publishers of research can apply to the content they publish which ensures that any post-publication amendments are seamless, transparent and propagated to all the numerous places online where descriptions of research appear. We believe that this proposal puts in place a system which both incorporates new technological thinking and removes the emotive climate now associated with retractions and corrections to published work. It also exploits the opportunities of new technologies to allow researchers to cite and share the correct

versions of articles with certainty. Furthermore, it allows readers to have the most up to date information in order to support academic research. We recognise that there are aspects of the model that need to be further refined, including for example how to handle changes in authorship. We look forward to initiating a pilot test of our model to learn how it could work in practice, please contact us if you are interesting in testing this model.

There is a growing openness in various aspects of research and movements towards linked documentation of the methods, results and discussions derived from such research. We envisage a future with a fully seamless means of publishing that starts with protocols and registered experiments then moves to results publication and data sharing and finally onto revisions, with version control. This system incorporates easy amendments, which are themselves integrated with the articles they amend; articles may have multiple versions. “No fault” amendments will be enabled and encouraged, and reporting on the changes that need to be made to an article may be separated in time from the reason the changes happened. The degree of reliability of a study will be separated from the notion that the author and/or a prestigious journal provides an absolute guarantee for the work. In all cases by default a human or machine reader will see the most recent and up-to-date version, but they will also be able to navigate to previous versions. There will be full disclosure of publication history and metadata that is made freely available to humans and machine applications.

Competing interests

VB is the Director of the Australasian Open Access Strategy Group. She also works part-time for Queensland University of Technology (QUT), Brisbane as a Professor in the Office of Research Ethics & Integrity and in the Division of Technology, Information and Library Services. She was the Chair of COPE

until May 2017 and was a COPE Trustee until November 2017. She is also an Editorial Board Member for Research Integrity and Peer Review. TB is Executive Editor of *The BMJ*. She chairs the scientific advisory board of EMBL-EBI Literature Services. JL is Director of Product Management at Crossref. She serves on the Dryad digital repository board. ECM is Senior Editor (Peer Review Strategy and Innovation) at BMC (part of Springer Nature). She is also a COPE Council Member, an Editorial Board Member for *Research Integrity and Peer Review*, a member of the Advisory Board for EnTIRE (an EU proposal for Mapping the research ethics and research integrity framework) and mentor for MiRoR (Methods in Research on Research).

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Provenance

This work was conducted as part of an ongoing open discussion within an initial working group and a wider consultation. COPE convened the working group that wrote this paper. This is one of the ways that COPE helps foster high-quality and progressive discussions that, one day, may be reflected by changes in practice. This paper and the ideas presented within it exemplify COPE's commitment to collegial discussion and debate.

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Supplementary material

Applying the amendment model: an illustration.

[Click here to access the data.](#)

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The proposal for an amendment system is an important contribution on a topic central to research integrity. It is a thought-provoking and strong proposal that has merit and could be an advance if adopted broadly with a central refinement to exclude documented misconduct. A no-fault system that focuses on the integrity of the literature is positive and could have some positive effects. The attempt to encompass *all* post-publication change into three categories stretches a good idea too far. It overlooks impulses contributing to the current situation that features a “bewildering variety of notices” and “inconsistencies” across journals illustrated in Table 1, namely that humans seek proportional responses and labels for documented lapses.

An analogy can be found in criminal justice systems worldwide, which typically differentiate conduct that has resulted in death with gradations of responsibility that factor in severity, intent, and surrounding circumstances. Findings can range from self-defense to involuntary manslaughter (criminally reckless or negligent behavior resulting in death) to voluntary manslaughter (performed in the heat of the moment) up through degrees of “murder,” a label that generally implies premeditation. Collapsing all post-publication anomalies into a no-fault system is likely to give rise over time to the creation of embellishments through additional labels that allow for degrees of fault, causing more confusion.

Rather than seeking to avoid all differentiation, the amendment process could be a improvement if it focuses on documenting changes over time, and reserves another category entirely for the most serious cases of willful, intentional conduct or bad practice, cases in which the article should be disavowed completely. “Complete amendment” will be valuable for circumstances described in present proposals for “honorable retractions” and the like, as there is room for a complete replacement in circumstances that do not imply fault. If the goal is the integrity of the literature, then no-fault terms are a strong advantage in a large set of—though not all—circumstances.

The crux of the matter seems to be that the authors believe that “If misconduct or fraud has

occurred, this should be reported on, but such reporting should be considered as distinct from the process of correcting the literature." The authors also state the "we strongly feel that retaining the word retraction even for the most egregious instances of scientific malpractice would further perpetuate the problem of stigma and thus is not desirable." I disagree. Stigma for egregious malpractice is warranted. If the integrity of the literature is at issue, then notorious cases of substantiated misconduct should be labeled as such, in no small part to address the continued citation of such work. At the same time, given current uses of "retraction," indeed, a new term may be needed to differentiate from historical usages that have not been restricted to misconduct. A middle ground is possible: if the amendment process is used for all revisions short of proven misconduct, a hybrid system could exist and be valuable: the amendment system for changes post-publication, and a different label for publications containing adjudicated misconduct.

The proposal is strong where it focuses on its key principles and the mechanisms in place that now allow for clear adoption of a linking system and versioning documentation. It seems muddier when it attempts to correct vexing problems journals face when institutional review of misconduct allegations are underway. Several statements in the effort to make this case seem problematic:

- "The need to be fair to the authors and the need to maintain the integrity of the literature are therefore in opposition during the period that an investigation is underway." It is not axiomatic that they "are" in opposition and this tension exists beyond the investigation period.
- "Thus a third principle is the need to be able to correct rapidly, while implying no fault on the part of the authors until or unless any case against them is proven." The proposal doesn't provide for labels of fault once a case is proven, apparently seeking to divorce the integrity of the research literature from institutional findings.
- "As a result, we believe a 'retraction' will never be fully embraced as a positive outcome by researchers." True as far as it goes, and yet could be remedied if a category is created and reserved for documented misconduct.
- "...removes the emotive climate associated with retractions and corrections to published work." This seems unlikely. Amendments post-publication are never likely to be any researcher's choice of outcome. It could reduce the overly broad associations with post-publication notices that are indeed confusing in their lack of consistency as currently applied.

Finally, the illustration in Supplementary File 1 is confusing. It begins "An institution finds misconduct from one of their senior scientists who has reused the same images to show controls in many figures." The publisher is notified and opens an investigation into the three affected publications, as apparently the institution will not share its findings, so the illustration involves great exertions on behalf of the journal and its editorial board members to parse the appropriate label to apply.

This illustration seems at odds with the descriptions of how principles two and three in the proposal will improve the current system. First, the journal's process here hasn't even started until after the institution has already notified it that there has been a finding, so the amendment to the literature is not independent of that process at all. Further, the authors are integrally involved in the case involved in the illustration. This is counter to my experience, where more often authors protest and will not cooperate in any corrections or retraction, and the process more often

involves the institution and the journal (and their respective lawyers). The proposal does not address what happens when the authors are not cooperating, which seems an oversight, and again argues for application of the amendment process in situations absent findings of misconduct. There is nothing that would prevent amendments before and the revised/new label after such a finding.

An especially strong feature of the proposal is the key principle calling for clear audit trails and full disclosure of publication history and metadata. A revised amendment system is worthy of our attention and the adoption of such a system should be considered.

Is the topic of the opinion article discussed accurately in the context of the current literature?

Yes

Are all factual statements correct and adequately supported by citations?

Partly

Are arguments sufficiently supported by evidence from the published literature?

Partly

Are the conclusions drawn balanced and justified on the basis of the presented arguments?

Partly

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 27 December 2017

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This is an opinion article on a very important topic: how to make necessary post-publication changes to a scientific article as quickly as possible and in a way that will not confuse readers. It argues that the current methods (retraction, replacement, expression of concern, correction,

erratum, comment) are slow and confusing. Instead a proposal is launched to separate making the changes needed from the fact finding about why it went wrong and if someone is to blame and should be sanctioned. While developing their proposal the authors opt for more neutral language and suggest to let the term *amendment* replace emotionally laded terms like retraction.

I applaud the authors for raising the issue, but I should say that I'm more convinced by their analysis of the problem than by the solution they propose. The piece is well written and quite clear in explaining its core ideas, but I would like to raise a number of points with the single purpose of inviting the authors to broaden the scope of the article a bit and to rethink some of the elements of their proposal.

- The current manuscript is in fact a quite technical policy paper that contains many details on how all versions, amendment notices and metadata could be linked together with a view to make all changes transparent and traceable. While it indeed is important to be able to follow the history of changes to a published article, the technical details are only relevant for the small audience that would be responsible for 'making it happen' if the proposal is implemented. I assume that many readers will not be interested in the technicalities and will also find them difficult to follow.
- I was puzzled by the fact that the example that explains how the *amendment model* works in practice was buried in a supplement. This needs to be the core of the main text at the expense of the technical details that would be more fitting for a supplement.
- The example in the supplement illustrates my main concern by assuming that in cases of alleged research misconduct it's clear what is wrong and needs to be rectified before a full investigation is concluded. That may be the case in some instances of plagiarism like massive text recycling and clumsy image duplication. But in my experience most allegations of research misconduct are not so clear and almost always the accused does not only deny that he or she did something wrong, but also contests that it is wrong. Consequently authors will usually resist any amendment of their published work before - and often also after - the conclusion of the full investigation.
- I agree that the amendment model will probably help to make necessary changes more quickly and more clearly if the authors request them or agree to requests made by others. But editors and publishers have a track record of doing nothing without having consent from the authors. And I cannot see why this would be different under the new paradigm. This needs to be discussed in the opinion article.
- Who should make the final decision about publishing an amendment? The current manuscript seems to suggest that this is the role of the publisher. But I assume that most scientific journals have some form of editorial independency from its publisher and that consequently the editor-in-chief will decide. Of course the publisher has the role of providing technical assistance and legal advice.
- I would have expected some remarks that make clear that the authors are in favour of evidence-based policy and meta-research. That could for example imply a proposal to perform a Delphi study among editors and authors with the purpose to gain a better understanding of what these stakeholders think about the problem and which solution they would prefer. Similarly I would have expected a plea to thoroughly evaluate the intervention

proposed when it is piloted.

- I rather like the fact that at the end of their piece the authors link the amendment model to the broader picture of transparency of the publication process. The role of pre-prints, pre-registration, publication of data and data-analysis plans, post-publication peer review, and anonymous commenting (e.g. on PubPeer) are all very briefly mentioned. But the article might improve if they explain in a bit more detail how these phenomena may help or hinder the implementation of the amendment model.
- There is one technical detail that puzzles me. How can we make references to outdated versions go away? Authors that write a new paper often use their collection of PDFs or their own often quite primitive system for storing (the metadata of) relevant publications. This may be the main reason why retracted papers are still cited. Maybe the list of references of a new manuscript can be checked whether the latest version is referred to by some clever piece of software. And I wonder whether it would also be feasible to update the references of articles that are already published.
- I'm not convinced that the term *retraction* can be avoided completely. The authors propose to substitute this with *complete amendment*. But when for instance the data were fabricated or no mandatory informed consent was obtained, there is nothing to amend in the sense of providing a better version of the paper. The publication in these instances just needs to be disqualified and will not be substituted by a new version. Retraction seems to be by far the best word for it. Complete amendment will probably work well if the authors for instance acknowledge that huge mistakes have been made in the data-analysis and want to replace their article by a version in which that issue is solved. Complete amendment might then indeed be a better term than *honourable retraction* as proposed by Daniele Fanelli.

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Partly

Are arguments sufficiently supported by evidence from the published literature?

Partly

Are the conclusions drawn balanced and justified on the basis of the presented arguments?

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Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Epidemiology, methodology, research ethics, research integrity

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Comments on this article

Version 1

Reader Comment 05 Jul 2018

Kevin Darras

Very interesting debate. It would be good to see a new revised version that gets approved.

Competing Interests: No competing interests were disclosed.

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