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The Vacuum Shouts Back: Postpublication Peer Review on Social Media

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Social media has created new pathways for postpublication peer review, which regularly leads to corrections. Such online discussions are often resisted by authors and editors, however, and efforts to formalize postpublication peer review have not yet resonated with scientific communities.

Before anyone heard the phrase "social media," writer Joe Straczynski was online promoting, discussing, and occasionally defending *Babylon 5*, a science fiction television show he created. His assessment of the online community was prescient. He wrote, "The online audience is bracingly honest: if a show stinks, they will tell you so in utterly unvarnished terms. This is a benefit more producers should recognize, since working for TV is like shouting into a vacuum" (http://archiver.rootsweb.ancestry.com/th/read/GH-CASSADINE/1996-12/0850409764).

For a long time, scientific publishing was like shouting into a vacuum. Authors tended to view surviving a journal's peer review as the "finish line." Once a paper was accepted, it was time to move on to the next project and next manuscript. After publication, discussions about a paper were often ephemeral: opinions expressed over lunch at conferences or around journal club tables wouldn't go any further than the four walls of the room. More lasting evidence of a research community's opinions about a paper, like citations, could take years to accrue.

Today, scientific publishing is a lot less like shouting into a vacuum because of social media: blogs, Twitter, Facebook, and innumerable discussion forums. At over a decade old, science blogs are a mature medium (I've been blogging since 2002 at http://neurodojo.blogspot.com/), with several "best of" anthologies. Twitter has likewise established a strong scientific community.

Of all of the ways scientists use social media, postpublication peer review—online comments about research articles by people with scientific bona fides—attracts some of the most attention from other scientists. Postpublication peer review isn't anything new, although the term seems to be a relatively recent one. Some journals have had technical comments and letters to the editor as regular features for decades. But not all journals had these, and the limitations of print meant that commentary that appeared was tightly controlled. Due to the physical processes of editing, proofing, and printing the journal on paper, comments might be slow to appear. Due to lack of space, very few comments might be published. And there was always that possibility that editors or authors of articles being commented on might try to obstruct unflattering critiques. Consequently, the process of correcting the scientific literature was, and remains, long and difficult (Tatsioni et al., 2007), particularly if the impetus for the correction was coming from someone other than the original authors.

Postpublication peer review through traditional scientific publishing is like kabuki theater: a slow, rehearsed drama in which the viewer must recognize the subtle profundities of performers wearing deliberately ambiguous masks.

Postpublication peer review on social media is like the mosh pit at a punk rock show. It's fast, uncoordinated, a lot less subtle, more in your face, and involves a few more risks.

Online commentary has proved very effective in attracting attention to certain classes of journal articles. For instance, papers making extraordinary claims with less than convincing evidence are often forced—sometimes unwillingly—into the spotlight (e.g., cells living without phosphorus [Reaves et al., 2012; Wolfe-Simon et al., 2011]; mitochondria as a link to the soul [Warda and Han, 2008]; dubious links to genetically modified corn and cancer in rats [Séralini et al., 2012]). Worrying signs can go viral, like embarrassing notes coauthors left for each other that they failed to take out of the manuscript ("for this compound, just make up an elemental analysis," from supplemental material in Drinkel et al., 2013). We've all read papers and asked, "How did this get published?" by the end.

The "How did this get published?" reaction reminds us of some of the limitations of normal, prepublication peer review. Because of those imperfections, some people have suggested that scientific publishing move from a "filter, then publish" model to "publish, then filter" (Hunter, 2012). I'm not one of them. Postpublication peer review can't do the entire job of filtering the scientific literature right now; it's too far from being a standard practice. Prepublication peer review is arguably the defining characteristic of academic writing. It has been built into the research enterprise from the ground up and is recognized as absolutely integral to science. Reviewing journal articles for editors is recognized as a service to the scientific field and can be rewarded in merit and tenure review. As a result, essentially every serious scientific article is peer reviewed before publication. In contrast, there are no incentives for anyone to engage in postpublication peer review, other than someone's own intrinsic interest in understanding a journal article and desire to share what they've learned. Only a miniscule fraction of published papers generate discussion substantial enough to be termed postpublication peer review. I think of postpublication peer review as an extraordinarily

valuable addition to, not a substitute for, the familiar peer review process that journals use before publication. My model is one of continuous evaluation: "filter, publish, and keep filtering."

Journal editors and lead authors on the receiving end of postpublication peer review often resist online critiques. There is a common pattern of objections raised from editors, authors, or both about maintaining the integrity of "the scientific record" and "going through proper channels." These protestations are a lot more fun to read if you say them out loud with a fussy English accent and an occasional, "Not cricket, wot?"

First, they imply that all online criticism is anonymous. Articles and editorials refer to online community as "faceless judges" (Couzin-Frankel, 2013b) operating under "the cloak of anonymity" (Parak et al., 2013). For instance, all online discussion of Wolfe-Simon et al. (2011) was dismissed as "anonymous electronic communications" by Rosen et al. (2011). Many bloggers use their real names. Many use pseudonyms rather than being anonymous, which is an important distinction. Writers with pseudonyms can create a track record of writing on which their expertise can be evaluated and almost always have ways to be contacted by someone who wants to talk to them. This is not to say that there are no anonymous comments; some postpublication peer review websites permit them (e.g., PubPeer, http://pubpeer.com/). Regardless, there are strong traditions for using both anonymity and pseudonyms in science (Neuroskeptic, 2013), not the least of which is journal peer review itself. It is a little audacious for authors and editors to decry the negative effects of "anonymous bloggers" when essentially every journal practices anonymous peer review. Bloggers are often easier to identify than journal reviewers. We still don't know who reviewed Wolfe-Simon et al. (2011) for *Science*. But we know Rosie Redfield critiqued it on her blog (http://rrresearch.fieldofscience.com/2010/12/arsenic-associated-bacteria-nasas.html), which ultimately led to a paper that failed to replicate key claims of the original paper (Reaves et al., 2012).

Second, they cheerlead for peer review. Editors and authors often make the motherhood and apple pie statement that journal peer review is an unalloyed good. Blogs are therefore suspect as "vanity press" with "no peer review" (North, 2013), leaving befuddled readers apparently unable to discern "how do we know that this is, in fact, true" (Parak et al., 2013). Even when faced with cases in which peer review failed to detect a highly problematic paper, editors rarely change their journal's policies to improve the peer review process. The rising number of retractions, most of which are the result of misconduct (Fang et al., 2012), suggests that prepublication peer review could stand a little improvement.

Third, they suggest that the Internet is untrustworthy, talking about "the massive misinformation that pervades the Internet" (Rosen et al., 2011) and "the magic and nonsense that floods cyberspace" (Silver and Phung, 2011). If you can't shoot the messenger, you might be able to fire some bullets into the horse the messenger rides in on.

If you are ever on the receiving end of criticism online, I suggest you not use any of the arguments above, particularly if you do not address the specific critiques about your paper. People will see the arguments as the diversionary tactics they are.

Finally, they complain that comments are not civil. Online critiques are described with phrases like "Trial by Twitter" (Mandavilli, 2011), "witch hunting" (Bracher, 2013), or "hate sites" (Couzin-Frankel, 2013a). One author accused his critics of "cyberbullying" (Service, 2014). These sorts of descriptions show that we scientists are a long way from the dispassionate image that we sometimes try to present. People get emotional about this stuff.

There are lines that people critiquing papers online should not cross. For example, it's clear that anyone making blatantly bigoted statements about sex, race, and so on has lost any claim to be performing peer review in a professional way, whether it be pre- or postpublication. The difference between an inflammatory and a moderate tone can have legal consequences. It is one thing to point out similarities in micrographs; it is another to say that they are a "smoking gun" demonstrating deliberate fraud. One website took Science Fraud as its name, and legal action against the author was not out of the question because some statements on the website were arguably libelous (Couzin-Frankel, 2013a).

Nevertheless, concerns about "tone" are often from established, tenured, white guys at big research universities working at established journals. One of the most profound things about social media is that it has lowered the barrier to creating and spreading conversations. This can give voice to people who were previously marginalized, for whatever reason. In the past, scientific commentary could be regulated by gatekeepers who were part of the scientific "in crowd." Now, people who are not part of that crowd don't need permission of gatekeepers to spread a scientific conversation to a wider audience. This means that the conversation cannot be as easily controlled by authority. Complaining about "tone" is one way to try to assert power and stifle voices by making "polite" equivalent to "innocuous."

So far, I have discussed cases where postpublication peer review has been critical of papers. Dodgy results, retractions, and bad feelings all make for reading that has "grab the popcorn" entertainment value. This can lead to the mistaken perception that postpublication peer review is dedicated to tearing apart all papers that are not ignored. Perhaps sensing this perception, one pseudonymous blogger, the Neurocritic, who runs a blog of the same name (http://neurocritic.blogspot.com), felt compelled to create a sister blog, the Neurocomplimenter (http://neurocomplimenter.blogspot.com), to promote neuroscience papers that deserved, "That was a fantastic study! Good show!" People underestimate the number of journal articles that receive positive reviews online. Because there are no incentives to perform postpublication peer review, bloggers usually write about papers interesting to them personally. Many posts and comments reflect papers in a positive light and can act as a welcome signal boost. Some evidence indicates that postpublication review not only brings new research to the attention of a wider audience, including fellow scientists (Allen et al., 2013), it may increase later citations (Shema et al., 2014).

Online postpublication review is still a relatively new phenomenon, particularly

in the life sciences. People are still feeling out the potential pitfalls and best ways to reap the benefits of online commentary. There have been many attempts to create mechanisms for postpublication peer review, but the response has been largely underwhelming.

The first approach is for the publisher to create tools allowing readers to enter comments about papers on the journal website. When *PLOS ONE* launched in 2006, one of its prominent innovations was to provide tools for users to comment upon and rate papers very easily. These largely went unused. I don't know of any journal that has a thriving online community discussing papers within the journal.

A second approach has been tried by several scientific societies: creating specialized social media sites for scientists. I've seen many websites bill themselves as "Facebook for scientists." None have succeeded, probably because they ignore the simple fact that Facebook already exists. Why do I need one specifically for scientists? For me, part of the attraction of social media is that it is inclusive, rather than targeted to peers. Sites like Facebook and Twitter have more potential not only to reach people outside my scientific field, but to reach people outside of academia or research.

A third approach has been to create dedicated websites for postpublication peer review. Some have positioned themselves as online journal clubs, while others have taken a more expressly critical approach of policing the literature. It is too early to know how many of these websites will stand the test of time. For example, one website, The Third Reviewer, opened and apparently shuttered in 2010. Science Fraud opened in 2013 and closed within months due to the author's loss of anonymity and prospects of legal action (Couzin-Frankel, 2013a). PubPeer launched in May 2013 and has received some traction thanks to it hosting some prominent and controversial stories (Couzin-Frankel, 2013b; Service, 2014). A journal, *Proceedings of Peerage of Science* (http://www.peerageofscience.org/proceedings), was created earlier this year in hopes of becoming "the venue of choice for both positive and critical commentaries." But postpublication peer review may have received its biggest boost when PubMed rolled out a commenting feature late in 2013. It is too early to tell if people will use the PubMed commenting tools, but it certainly signals that authors should expect postpublication peer review.

None of these efforts to formalize and centralize postpublication peer review have come close to the effectiveness of social media, particularly blogs and Twitter. Many scientists have very systematic minds and see the current state of postpublication peer review as anarchic (which it is). Many like the idea of central repositories and would love to see all comments about a paper aggregated into a single place. This may not be necessary, considering that the original papers are deposited in many journals and in many places around the web. To this day, there are still scientific journals that are not available online but only as print copies. If the original work can be distributed in many different places, it should not be fatal to have the commentary about that work distributed in many places too.

Maybe an attitude adjustment is needed. People tend to ask whether social media should be part of the "scientific record" and whether discourse on social media should be held to the standards of journal articles. But rather than treating social media as the equivalent of letters to the editors and comment sections and journal articles, we should think of social media more like another scientific tradition: the research conference.

I'm on Twitter (https://twitter.com/DoctorZen) precisely because I get the same sort of intellectual stimulation I get at conferences. There are important differences in the scope and reach of a conference versus social media, but both are a means to end: more and better research. Everything that happens on social media has been happening at conferences for as long as there have been conferences. People ask pointed questions during presentations. People gather around lunch tables and discuss whether experiments had appropriate controls. These informal conversations were never part of the scientific record, but there was never any question that they were an important part of the scientific endeavor. Social media is just the biggest research conference in the world.

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