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COMMENTARY

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Constructive and obsessive criticism in science

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Abstract

Social media and new tools for engagement offer democratic platforms for enhancing constructive scientific criticism which had previously been limited. Constructive criticism can now be massive, timely and open. However, new options have also enhanced obsessive criticism. Obsessive criticism tends to focus on one or a handful of individuals and their work, often includes ad hominem aspects, and the critics often lack field-specific skills and technical expertise. Typical behaviours include: repetitive and persistent comments (including sealioning), lengthy commentaries/tweetorials/responses often longer than the original work, strong degree of moralizing, distortion of the underlying work, argumentum ad populum, calls to suspend/censor/retract the work or the author, guilt-by-association, reputational tarnishing, large gains in followers specifically through attacks, finding and positing sensitive personal information, anonymity or pseudonymity, social media campaigning, and unusual ratio of criticism to pursuit of one's research agenda. These behaviours may last months or years. Prevention and treatment options may include awareness, identifying and working around aggravating factors, placing limits on the volume by editors, constructive pairing of commissioned editorials, incorporation of some hot debates from unregulated locations such as social media or PubPeer to the pages of scientific journals, preserving decency and focusing on evidence and arguments and avoiding personal statements, or (in some cases) ignoring. We need more research on the role of social media and obsessive criticism on an evolving cancel culture, the social media credibility, the use/misuse of anonymity and pseudonymity, and whether potential interventions from universities may improve or further weaponize scientific criticism.

KEYWORDS

cancel culture, criticism, peer-review, social media, Twitter

Medicine, health and science are ripe with disputes and debates. Throughout history, spirited replies and rebuttals have been written and accompanied by rejoinders, responses and editorials, and helped clarify or rebut important concepts. Post-publication review should be further strengthened and enhanced.[1] Certain limits placed

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by journals are too restrictive (e.g. maximum length and allowed timing of letters to the editor).[2,3] Correction of the scientific literature is not efficient and reforms are needed.[4] However, concurrently, criticism is taking new forms and some of them are not only unlimited, but also unrestrained, directed at specific individuals rather than scientific claims.[5,6]

Social media in particular have unlocked new mechanisms of engagement. Many aspects of the new media are an improvement: platforms are democratic—anyone may engage—and the pace of response can occur in real-time—shaping ongoing discussions. Concurrently, maladaptive processes may evolve: excessive focus on single individuals, ad hominem comments, use of multiple, pseudonymous or anonymous accounts to create the impression of mass opposition, and the increasingly prevalent tactic of calling for scientists with whom one disagrees to be fired, banned or de-platformed.[7] Criticism may become targeted harassment.

As shown in Table 1, the number of published scientific papers has been increasing with a small acceleration in the last 6 years, but the number of papers that attract extreme attention in media and social media increased tremendously in 2020. It is unknown whether this massive public spill-over of science will continue in the future. Most comments are probably neither constructive nor obsessive and most people who comment or share a new paper through social media may have not even read the full paper. It is not easy to separate how many comments represent obsessive criticism, but the wide public visibility of many scientific papers provides attractive material for both constructive and obsessive critics.

Science must promote constructive criticism, even enhance it, while avoiding abuse. Here, we offer preliminary diagnostic criteria, and suggested prevention/treatment strategies for what we call obsessive criticism.

1 | DIAGNOSTIC CRITERIA

Obsessive criticism may have several hallmarks (Table 2). Not all are necessary to make the diagnosis, but typically many are present. We divide this into issues of focus, behaviour and duration.

Obsessive criticism focuses excessively on individual authors or specific teams on one side of the issue, ignoring complementary work. This may be coupled by lack of a track record of field-specific skills on the debated topic. Obsessive critics may ruminate on topics that require technical expertise they do not possess. The rumination may also acquire a strong personal focus.

Obsessive disputes often take on moral properties. Opponents are not merely incorrect or misguided, they are dishonest or malicious actors. An obsessive critic may view the ideas of the opponent as dangerous are harmful, and this view may be used to justify or vindicate their behaviour. Repetitive, persistent, lengthy criticism is typical. It can take the form of typical sealioning, a technique of trolling or harassment where the critic claims to be sincere and civil but relentlessly and repeatedly asks for evidence and for answers to questions that have already been previously addressed. In addition, strawman arguments, argumentum ad populum, calls for cancellation, guilt-by-association, reputational tarnishing of individuals, posting sensitive personal information (like salary), anonymity, pseudonymity, and fake accounts may be deployed. In an era where social media follower counts, likes, favourites and retweets are widely visible, these metric may be seen as rewards. In some forms of social media, engagement carries financial benefits. For example, Medium, a blogging platform, pays based on the number of "claps" an article receives.[8] Diverse indirect financial gains (e.g. contracts, book sales or advisory roles) may follow meteoric rise in public prominence. Obsessive critics often display a skewed ratio of criticism to pursuit of one's research agenda. Another hallmark is distorting the target researcher's message, and claiming, without evidence, that most other scientists disagree.

Obsessive critics may create substantial followings since heated controversy and outrage capture attention on social media. Amplification via sharing or retweeting can give the appearance of massive disapproval of those criticized. However, this may not represent average opinions. There are over 30 million scientists who author scientific papers and the vast majority engage minimally or not at all in social media for their scientific work.[9,10] Highly visible scientific critics on social media tend to be macro-influencers (i.e. have 10,000–1,000,000 followers) and most of them are meso-influencers (at the lower end of that spectrum). For comparison, mega-influencers who have >1,000,000 followers are mostly actors, musicians,

TABLE 1 Increase in total published items in the scientific literature and of published items with extreme attention in media and social media (Altmetric scores >4000)[a]

Year	Published items	Items with Altmetric >4000
2022 (first half)	3,099,247	104
2021	6,624,362	327
2020	6,575,801	351
2019	5,829,102	39
2018	5,394,434	39
2017	5,066,175	38
2016	4,617,354	19

[a]Data are derived from the dimensions.ai database with search in July 7, 2022; the year 2022 may be partly incomplete even for the first half due to registration delays.

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TABLE 2 Proposed diagnostic criteria for obsessive criticism

Focus	Focusing on one or a handful of individuals and their work, as opposed to collections of scientific papers that all point in a single direction
	Tinged with ad hominem: comments about the person who is authoring, including nature of their job, past work, past collaborations
	Lack of track record of field-specific skills and sufficient field-specific technical expertise
Behaviour	Repetitive and persistent comments, including sealioning
	Lengthy commentaries/ twitter threads/ rapid responses often several times longer than the original work
	Strong degree of moralizing: claiming the work will lead to evil or wrong policy choices
	Distortion of the underlying work/ strawman arguments
	Argumentum ad populum: claiming, without evidence, that most scientists disagree or believe the work is harmful
	Calls to suspend/ censor/ retract the work; and suspend/ censor or retract the speaker
	Guilt-by-association: claiming that since some nefarious groups enjoy the work, the work must be incorrect
	Reputational tarnishing of individuals and of their associates: distortion or misrepresentation of conflicts, speculation regarding true motives and funders
	Large gains in followers on social media platforms gained specifically through attacks
	Finding and positing sensitive personal information like home address or annual salary about the target
	Anonymity, pseudonymity, recruitment of fake accounts -- amplifying these accounts through retweets/ quote tweets
	Social media campaigning - Interaction with and retweeting accounts that parody or target the scientist as an individual or reiterate/echo some of the above-listed features
	Unusual ratio of criticism to pursuit of one's research agenda
Duration	The duration of this interaction often lasts months or years

and athletes. Among 100,000 followers of a highly visible obsessive critic, few may be practising scientists, and even fewer may have both the technical knowledge and the interest to assess in depth the topic being debated. Most tweets, retweets or comments in blogs may occur without reading the criticized papers nor even the full criticism.

The length of rebuttal may be a crucial sign of obsessive criticism—cumulatively it may exceed the original work in volume many times over. Criticism may acquire the features of "Gish Gallop": the critic hurls a huge amount of diverse material, including some reasonable statements, but also many half-truths and obviously wrong statements, in a way that the person criticized is given no chance to combat each point meaningfully, even less so during the time-pressed environment where such criticism occurs. For example, some journals employ rapid response sections, encouraging readers to comment in real-time. This format offers advantages over the more formal letter writing, with strict word limits and limited response. However, back and forth dialogue can quickly become repetitive and no longer constructive. The authors of a 3000-word research article may find themselves embroiled in 30,000 words of back-and-forth response with no end in sight and nothing new after the first few thousand words. Links to these responses may then be posted on social media to draw in new discussants.

Finally, the duration of the behaviour is noteworthy. Obsessive critics often repeatedly target the same individuals, following them across scientific fields and endeavours, and persist for months or even years. They may focus on a few individuals and ignore papers by other authors that make similar points.

2 | CONSTRUCTIVE VS. OBSESSIVE CRITICISM

A large proportion of published research may be inaccurate and flawed.[11] Detection and correction of flaws should be encouraged and this may sometimes require persistence and even repetition. Poor, even fraudulent research, is notoriously difficult to retract and there is resistance to refutation and persistent citations to contradicted work. Moreover, sometimes real ethical issues may exist, for example, major conflicts of interest and erosion of research integrity; these need to be revealed by whistleblowers. Efforts to identify and reduce obsessive criticism must not inhibit constructive criticism and honest whistleblowers.

At the same time, science cannot tolerate bullying and harassment of individuals. Indeed, it is odd to believe that a single researcher disproportionately contributes so much horrible work, such that obsession is justified. Sometimes there may also be gender, gender identity, sexual orientation, age or racial differences, raising the question of a cadre of inter-related inappropriate behaviours. At other times, base human emotions: anger, jealousy, feeling cheated, unhappiness may be root causes. Some practices adopted by obsessive critics are also inappropriate by default (e.g. use of strawman arguments and argumentum ad populum

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techniques, guilt-by-association, reputational tarnishing, fake accounts and screenshotting), while others become inappropriate due to personal focus and repetitiveness.

3 | OBSESSIVE CRITICISM AND TOPIC-SPECIFIC TECHNICAL EXPERTISE

Criticism should be encouraged regardless of credentials, stature and academic rank. It is particularly important to empower young researchers to participate in scientific debate. However, meaningful scientific debate requires topic-specific and/or methodological expertise. While several skills can be acquired fast and can be even self-taught, for other scientific tools, mastering them can take years of committed engagement, hands-on experience and specialized training environments. For some technical topics, the population of scientists who can debate meaningfully is very limited. This is not an issue of elitism or of early career versus senior exclusivity. A Nobel laureate in physics would not be able to criticize meaningfully surgical technique; and a surgeon is unlikely to be able to comment on bosons in a way that will promote the field (unless also trained on particle physics).

Because the audience on social media is predominantly non-technical, they may find it nearly impossible to differentiate debaters who understand the topics they discuss, from those who merely offer the veneer of understanding. This means journalists, lay people, and policymakers may amplify the more sensational delivery, or the better audio, visual or graphical presentation, rather than the truth.

The problem of lack of technical expertise affects also the peer-reviewed scientific literature. For example, statistical illiteracy is highly prevalent in the scientific workforce, and this shows in the poor statistical documentation of published work. Some types of studies such as meta-analyses are performed massively by authors with no skills and no technical training and the published literature is polluted massively with low-quality work. Some checks may be offered by peer-review, but this is also suboptimal and far from waterproof. For social media criticism, no barrier exists at all. Moreover, there is not even any education or training on how to use social media. Anyone can claim, pretend or ignore technical expertise in any inappropriate way imaginable—provided he/she has enough followers.

4 | OBSESSIVE CRITICISM AND COVID-19

Academic social media has taken on new dimensions during the COVID-19 crisis.[12] While "all hands on deck" was justified in a major crisis, this has led to millions of people with limited technical expertise to be massively engaged in scientific generation and criticism. Besides the general public, many physicians and scientists also ventured to comment (often passionately so) on fields that were remote from their own. Obsessive phenotypes can thrive under these abnormal circumstances. Naturally, the stakes of a global crisis and unprecedented response are massive. Individuals may feel that opposing policy positions are not only incorrect, but dangerous and they pose threats to their lives and the lives of their beloved relatives and friends. Coupled with the de-humanization of social media, anger and fear leads to increasingly personal attacks.[13] Anonymity, the ability to run multiple twitter accounts, screenshots are all tools that further fuel anger, outrage against individuals. The algorithms that high-tech companies use to attract and retain people in social media may also create echo chambers, and encourage extremes, rather than consensus or compromise.

5 | CURRENT EPIDEMIOLOGY OF OBSESSIVE CRITICISM AND BULLYING IN ACADEMIC CIRCLES

Nature surveyed 321 scientists during the COVID-19 pandemic and found that more than two-thirds faced negative experiences, especially following media appearances. The majority witnessed obsessive attempts to damage their credibility, one out of seven received even death threats, and six scientists were also physically attacked. Professional complaints were sometimes filed against scientists. The survey did not clarify how often attacks included also (or were dominated by) obsessive contributions from other scientists with opposite views rather than general public outrage. However, anecdotally it is likely that obsessive contributions by other scientists (especially those with strong social media and media presence) may be particularly incendiary, since they also provide to non-specialist attackers "science-based" justification to enhance cancel campaigns.[14] In particular, online harassment of scientists was a common problem even in the pre-pandemic era, but it acquired far more visibility during the COVID-19 pandemic.[15–18]

Bullying and harassment in academic circles is very frequent: a national Swedish survey found that 7% of students and employees across 38 institutions of higher learning had experienced bullying or harassment in the previous 12 months,[19] and a Wellcome 2020 report on *What Researchers Think About the Culture they Work In* found that 61% of researchers had experienced bullying or harassment, but only 37% felt that they could speak about it.[20]

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6 | SOLUTIONS AND OPEN QUESTIONS

Empirical studies are needed to better document the phenomenon of obsessive criticism, its prevalence, and risk factors, and to identify effective preventive and therapeutic interventions. We should empower a constructive dialogue regarding the facts. Awareness, better understanding of aggravating factors, trying to find some reasonable limits, and integrating free-floating social media criticism into journals may help, but still many open questions remain (Table 3).

For example, in so far as disputes appear in or pertain to journal articles, Editors could commission a single back and forth, setting word limits, and decide whether any rejoinder(s) would offer added value. Editors should aim to be neutral rather than bias their judgement in favour of the articles they have published, and occasionally third-party editors could be invited to serve as ombudsman. Debate on the merits offers added value. Editors could also play a more pro-active role in the era of social media to bring these discussions into the journal pages. This preserves the scientific record—searching Twitter months later is hopeless—and anchors comments to the original piece.

Many social media comments in Twitter or blogs may be accurate and biting, but others are extravagant, wrong, fake, and inappropriate, and survive because they know that the original authors will not engage with them; or, if they do engage, this will be in a charged environment that tolerates (or even cherishes) extravagant, wrong, fake and inappropriate material. Editors can invite highly critical bloggers, PubPeer and/or tweetorial commentators to criticize a paper in a formal submission and then ask the authors to reply. Editors can use their discretion to ensure that comments stick to the topic, use evidence rather than emotion, and do not veer into personal matters. We suspect that obsessive critics may often not accept such invitations, as they would realize that they would have no chance of winning an argument in a civilized, evidence-based, impartial environment. It could then be recorded that such invitations were sent and declined.

Social media is largely impossible to shape and control, but awareness of the problem may help. Ultimately, it is up to communities to shape the language and behaviour they feel is appropriate. However, unfortunately, a key force in shaping these combative encounters is audience participation, and the algorithms that underlie what posts and comments are made visible to more people. Some posts may generate massive interaction because they are inflammatory or outrageous. Interactions are at times visible—replies, likes, quote tweets, shares, mentions—but also invisible—sending a link via private or direct message, email or other means. Companies that gain billions from their social media platforms may track both behaviours and fill feeds with extremely polarized content in an effort to capture and hold attention.[21–23] Such

TABLE 3 Proposed prevention and treatment options for obsessive criticism

Awareness	Increasing academic awareness of this phenomenon may permit others to name and identify instances of it
Aggravating factors	It is possible that there are underlying issues driving this behaviour, including perceived past slights, ongoing conflicts of interest, the ability to gain reputation or standing
Limits	Placing limits on the volume of submitted rapid response or comments, particularly when arguments become repetitive; editors may call for one final round of dialogue
Constructive pairing	If deemed appropriate by editor, a single salvo of paired editorials fleshing out areas of disagreement may be commissioned to set the issue to rest.
Incorporation	Editors may actively seek to transfer some hot debates from unregulated locations such as social media or PubPeer to their journal pages, preserving decency and focusing on evidence and arguments and avoiding personal statements
Ignoring	Ignoring obsessive critics may be the most effective way to cut their blood line
Open matters	Role of social media and obsessive criticism in cancel culture Credibility of social media Use and misuse of anonymity and pseudonymity Potential interventions from universities and regulatory institutions Moral support for those who are harassed Education on dealing with online harassment, appropriate use of social media, constructive and obsessive criticism

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addiction and perpetual immersion in echo chambers may elevate personal obsessions rather than sober appraisals. Unfortunately, then good criticism may be mixed with more erratic criticism. The reader—particularly journalists and policymakers—is almost always unprepared to separate the two. The precise mechanism of these algorithms must be disclosed and studied. Obsessive critics can become powerful influencers. However, careers should not be hastily built and destroyed in these venues. In some cases, ignoring obsessive critics may be the most effective way to cut their blood line; however, this may not be easy.[24]

Anonymity and pseudonymity require special mention. They may be occasionally justified, for example, if a whistleblower might be threatened, were his/her identity revealed. However, in some cases, the ethical concerns may be inverse. When anonymous and/or pseudonymous accounts acquire powerful influencer status, the justification for concealing identities becomes dubious. When influencer obsessive critics exert major influence on decisions and policies that affect many lives, the society, or economy at large, it is essential to know the technical expertise of the influencer, the nature of the connections with other influencers, and the potential conflicts of interest. At a minimum, one would wish to know if several accounts are actually run by a single person or somehow synchronized—and why. While junior people naturally worry about retribution; this must be balanced against the potential for a distorted or fake consensus to be created.

Universities have been largely passive in this new world. Administrators and leadership may justifiably not wish to get involved in charged situations: they may be seen as taking sides and get attacked themselves. However, universities should condemn targeted harassment of their employees, particularly if these are done by faculty at other universities. Cross-institutional protocols may be considered, just as protocols for harassment exist within institutions. One has to be cautious, however, because obsessive critics may particularly weaponize any options that become available. They may then use these new options to intimidate their victims across institutions. For example, while they are harassing their victims, they may complain that they are the ones being harassed. They may mis-interpret any effort of the victim to rebut their attacks and even any attempt at kindness or reconciliation. Universities may also offer moral support to physicians and faculty who have been harassed in social media. This may be an important addition to other efforts to prevent and diminish burnout.

Even before the COVID-19 pandemic, several institutions and organizations had offered guidance on how scientists could deal with online harassment.[25–27] These need to be continuously updated given the expanding new challenges and should become a more standard part of the training and continuing education of scientists. Educating physicians and other scientists in the use of social media and on what are appropriate and inappropriate uses may also help. Some universities and physician regulatory organizations have already generated guidance on such matters.[28,29] Education on these issues could become part of training in responsible conduct of research that raise awareness on appropriate and inappropriate uses of social media and promote strategies and practices towards constructive criticism.

7 | CONCLUSION

Constructive and obsessive criticism deserve a research agenda. The determinants of obsessive criticism need rigorous study with both theory and empirical data. Medical and academic disputes are as ancient as antiquity. Science naturally is a combination of specific facts, methods of inquiry and social dynamics of involved individuals and this is even more true for contested topics on medicine and health. One can perhaps learn from previous attacks on science under authoritarian regimes or from sensitive issues such as climate change,[30] where scientists have been repeatedly targeted with obsessive attacks. Social sciences have studied some of these phenomena in the past and offer taxonomies and insights on how these types of "warfare" operate.[31–33] Barnes et al. have found in experimental studies that ad hominem attacks may have the same degree of impact as attacks on the empirical basis of the science claims, and that allegations of conflict of interest may be just as influential as allegations of outright fraud,[34] thus obsessive critics do have the power to cause major damage. While some of these problems have precedents, social media has created novel methods for dispute, which remain largely unmonitored and unchecked. At its best, social media is democratizing, capable of profound and biting criticism, disseminated in innovated and bold ways. At its worst, social media resembles a schoolyard, with bullying and harassment of individuals. We encourage others to study and contemplate this emerging problem. We suggest greater consideration into policies to help strengthen social media into a vibrant forum for discussion, and not merely an arena for gladiator matches. Institutions and journals can play an important role in reclaiming some portion of the dialogue to prevent excesses.

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Both VP and JI conceived this idea, wrote the paper, revised it and approved the final version. JI is guarantor.

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