

## Open Access and the Self-Correction of Knowledge

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Here's an epistemological argument for OA. It's not particularly new or novel. In fact, I trace it back to some arguments by John Stuart Mill in 1859. Nor is it very subtle or complicated. But it's important in its own right and it's importantly different from the moral and pragmatic arguments for OA we see more often.

The thesis in a nutshell is that OA facilitates the testing and validation of knowledge claims. OA enhances the process by which science is self-correcting. OA improves the reliability of inquiry.

Science is fallible, but clearly that's not what makes it special. Science is special because it's self-correcting. It isn't self-correcting because individual scientists acknowledge their mistakes, accept correction, and change their minds. Sometimes they do and sometimes they don't. Science is self-correcting because scientists eventually correct the errors of other scientists, and find the evidence to persuade their colleagues to accept the correction, even if the new professional consensus takes more than a generation. In fact, it's precisely because individuals find it difficult to correct themselves, or precisely because they benefit from the perspectives of others, that we should employ means of correction that harness public scrutiny and open access.

I draw on two propositions from John Stuart Mill. It may seem odd that they don't come from his philosophy of science, but his short treatise on the freedom of expression, *On Liberty* (1859). Mill made a powerful argument that freedom of expression is essential to truth-seeking, and in elaborating it pointed out the essential role of opening discussion as widely as possible. Here's how the two propositions look in their natural habitat:

Mill, *On Liberty* (Hackett Pub. Co., 1978) at p. 19:

[T]he source of everything respectable in man either as an intellectual or as a moral being ... [is] that his errors are corrigible. He is capable of rectifying his mistakes by discussion and experience. ... The whole strength and value, then, of human judgment depending on the one property, that it can be set right when it is wrong, reliance can be placed on it only when the means of setting it right are kept constantly at hand.

Mill at p. 20:

The beliefs which we have most warrant for, have no safeguard to rest on, but a standing invitation to the whole world to prove them unfounded. If the challenge is not accepted, or is accepted and the attempt fails, we are far enough from certainty still; but we have done the best that the existing state of human reason admits of; we have neglected nothing that could give the truth a chance of reaching us: if the lists are kept open, we may hope that if there be a better truth, it will be found when the human mind is capable of receiving it; and in the meantime we may rely on having attained such approach to truth, as is possible in our own day. This is the amount of certainty attainable by a fallible being, and this the sole way of attaining it.

Here's a quick paraphrase: To err is human, but we can always correct our errors. We needn't distrust human judgment just because it errs. But to trust human judgment, we must keep the means for correcting it "constantly at hand." The most important means of correction is "a standing invitation to the whole world" to find defects in our theories. The only kind of certainty possible for human judgment is to face and survive that kind of public scrutiny.

Let's look more closely at the process.

Mill argues at length that self-correction only works when people who think a theory is false or incomplete are allowed to say so. If church, state, tenure committees, or department heads punish deviations from orthodoxy, they will silence many voices, including—for all we know—the voices that could identify and correct its deficiencies. In short, scientific self-correction depends on the freedom of expression and works best in a free society.

Mill at pp. 20–21:

To call any proposition certain, while there is any one who would deny its certainty if permitted, but who is not permitted, is to assume that we ourselves, and those who agree with us, are the judges of certainty, and judges without hearing the other side.

Of course scientific self-correction depends on the usual ingredients of good science: observation, evidence, experiment, reasoning, and imagination. What is usually overlooked, and what Mill is adding to the list, is that it also depends on institutions, like legislatures, courts, and universities, in a position to protect the freedom of expression.

It's not enough to free up large numbers of people. We also need to free up all kinds of people. The reason is simply that there is such a thing as perspective, partiality,

or prejudice. In fact, these are among the usual suspects for causing errors in human judgment, including errors in science. If the only people free to speak their minds are people like the author, or people with a shared belief in current orthodoxy, then we'd rarely hear from people in a position to recognize deficiencies in need of correction.

In short, we must issue "a standing invitation to the whole world" to find fault with our knowledge claims. This requires disseminating our claims as widely as possible. We don't have to compel everyone to read our work and comment on it. (It's an invitation, not an obligation.) But we do have to make our claims available to everyone who might care to read and comment on them.

That's OA in a nutshell, or OA from the perspective of authors and publishers. We can see the same point from the perspective of readers. Before we can identify the weaknesses in a theory, or hope to correct them, we must know what the theory says. Before we can decide whether an alleged error is an actual error, or whether a proposed correction is justified, we must know what the proponents and opponents of the theory have to say about it. Hence, another condition of scientific self-correction is access to the literature and discussion, the flip side of the worldwide invitation to scrutinize. Authors must provide access, and readers must have access. For the purposes of scientific progress, a society in which access to research is limited, because it's written in Latin, because authors are secretive, or because access requires travel or wealth, is like a society in which freedom of expression is limited. In both cases, we shrink the set of people who are in a position to notice and correct the deficiencies of a deficient theory. We add friction to the process of scientific self-correction.

Mark Twain said that the person who doesn't read has no advantage over the person who can't read. Similarly, at least for the purpose of scientific self-correction, scientists who are free to speak their minds but lack access to the literature have no advantage over scientists who lack the freedom to speak their minds.

Yes, this is the many-eyeballs theory, as it looked in the mid-19th century. Opening new theories to many eyeballs for scrutiny, especially when those eyeballs belong to people who are free to speak their minds, releases a torrent of many voices from many perspectives. The resulting disagreements make life difficult, and the standing invitation to the whole world makes it even more difficult. But working through those difficulties, or evaluating the evidence and arguments that can be brought to bear against a new claim, are exactly what scientists must do to inch asymptotically toward certainty. To short-circuit this process in the name of convenience is to compromise the possibility of correction.

Mill at pp. 19–20:

[T]he only way in which a human being can make some approach to knowing the whole of a subject, is by hearing what can be said about it by persons of every variety of opinion, and

studying all modes in which it can be looked at by every character of mind. ... The steady habit of correcting and completing his own opinion by collating it with those of others, so far from causing doubt and hesitation in carrying it into practice, is the only stable foundation for a just reliance on it: for, being cognizant of all that can, at least obviously, be said against him, and having taken up his position against all gainsayers knowing that he has sought for objections and difficulties, instead of avoiding them, and has shut out no light which can be thrown upon the subject from any quarter—he has a right to think his judgment better than that of any person, or any multitude, who have not gone through a similar process.

Mill at p. 36:

So essential is this discipline to ... real understanding ..., that if opponents of [an idea] do not exist, it is indispensable to imagine them and supply them with the strongest arguments which the most skilful devil's advocate can conjure up.

Scientific self-correction depends on public scrutiny for two different purposes: first for noticing any errors in a theory and then for correcting them. OA advances both purposes, by exposing the theory to more readers, just as political liberty advances both purposes, by freeing readers to register their dissent and argue for other points of view. But the two steps don't always occur together. When a theory is false or incomplete, we make progress by noticing its weaknesses, even if we don't immediately know how to correct them. We make progress on both fronts by enlisting as much help as we possibly can.

We may discover new ideas in private and shape them into plausible hypotheses in private. But we validate knowledge claims in public. By embracing the method of public scrutiny, we aim for the kind of certainty that can answer criticism, not the kind of private certitude that excludes it. But once we acknowledge that the process is intrinsically public, and designed to move beyond the private feeling of confidence to the public examination of evidence, we must protect the process that makes it work. We may have to accept access restrictions, when we can't remove them ourselves, but we shouldn't forget the principle and believe that the process works as well with access restrictions as it would without. In a similar way, patriots may put their country ahead of individuals, on the ground that the whole is greater than the parts, but shouldn't forget the principle and put their country ahead of the world.

Mill at p. 17:

All silencing of discussion is an assumption of infallibility. ... [W]hile every one well knows himself to be fallible, few think it necessary to take any precautions against their own fallibility. ...

Maximizing access to our ideas, and inviting the whole world to scrutinize them, is one precaution against our fallibility which we can keep constantly at hand with very

little effort. Print works better than letters to friends and colleagues; online access to paying customers, at least when many pay, can work better than print; OA works best of all.

The method of public scrutiny doesn't produce mathematical certainty in empirical sciences where the most we can expect is a high degree of confirmation. On the contrary, it introduces a very different standard: not proof, but longevity in a free society. The longer a theory survives the open challenge to expose its flaws, when everyone who cares has access to the literature and the freedom to speak their minds, the lower the odds that the theory has flaws to expose.

If a scientific result gains credibility the longer it lasts in a free society without falsification, then it gains an even greater measure of credibility the longer it lasts in free society *with* OA and without falsification. You might say that surviving  $n$  years with OA is equivalent to surviving  $mn$  years without OA, when  $m$  is a coefficient representing the friction in a non-OA system, or the inefficiency and delay caused by the lack of OA. Just don't start looking for  $m$  as if it were a constant of nature. Toll access varies widely in its extent, from work to work, place to place, and time to time, making  $m$  another variable, not a constant.

For scientific self-correction, OA is lubricant, not a precondition. Science made extraordinary progress during the age of print, when OA was physically and economically impossible. Indeed, much of the scientific progress in the 16th and 17th centuries was due to the spread of print itself and the wider access it allowed for new results. Widening access further through OA harnesses the same process for the same purpose. Limits on access (like limits on liberty) are not deal-breakers, just friction in the system. But we owe it to ourselves and our planet to take the friction out of the system as far as we can.

### Postscript

Here are a few minor points I'd include in footnotes, if I had footnotes.

In my opening paragraph I distinguished moral, pragmatic, and epistemological arguments for OA. But clearly they overlap. In particular, pragmatic arguments (for example, that OA accelerates research) are components of moral arguments (accelerating research is good). Likewise, the epistemological argument I just sketched (OA facilitates scientific self-correction) can easily become a component of a moral argument (facilitating self-correction is good). So I'm less interested in drawing sharp lines to separate the types from one another than in pointing out that there *are* epistemological arguments for OA. OA can affect knowledge itself, or the process by which knowledge claims become knowledge.

Here are some examples of what I mean by moral arguments: OA frees authors and readers from needless access barriers; it returns the control of scholarship to scholars; by increasing the author's impact, it advances the author's purpose in writing journal articles for impact rather than money; it counteracts the deliberate creation of artificial scarcity; it counteracts the deliberate and accidental maldistribution of knowledge; it de-encloses a commons; it serves the under-served; and for the special subset of publicly-funded research, it is part of fundamental fairness to taxpayers.

Here are some examples of what I mean by pragmatic arguments: OA accelerates research and increases the productivity of researchers; it makes research more useful and increases the research funder's return on investment; it helps authors find readers and readers find authors; it reaches a wider audience at lower cost than toll-access forms of distribution; it saves money at both the author and reader sides of the distribution process; it widens dialog, builds community, and supports cooperation; it enhances preservation by freeing downstream users to make copies and migrate content to new media and formats; and it makes research literature and data available for crunching by new generations of sophisticated software (indexing, mining, summarizing, translating, linking, recommending, alerting, mash-ups, and other forms of processing).

The Millian argument for OA is not the "wisdom of crowds," at least not in the way in which this term was used and made popular by James Surowiecki. It's not about averaging or taking the vector of many disparate judgments. In an important way, it's the contrary. It's not about synthesizing plural judgments, but eliciting plural judgments without attempting to synthesize them. The precious correction we need is at least as likely to be found in an eccentric loner or statistical outlier as in a popular proposal or artificial synthesis.

All correctness, confirmation, and certainty under this theory coexist with the fallibility of human judgment and the possibility of challenge from unexpected directions. We needn't say that perfect certainty and objectivity are attainable, or that we've attained them; and if we did, our claim would be subject to criticism and correction like any other human judgment.

I didn't try to give an exhaustive account of the conditions that make scientific self-correction possible, and wouldn't trust myself to do so. I only wanted to go far enough to show the role of OA. If I were to extend the analysis to other conditions, I'd start with peer review and the kind of empirical content that underlies what Karl Popper called falsifiability.

Finally, by chance, there was a beautiful illustration of the Millian thesis in the news during May [May 2008, the month before this piece was published]. Jeffrey Young reported in the *Chronicle of Higher Education* that journal editors are noticing an "alarming" level of image-tampering in submitted articles. But journals needn't

depend on the small number of in-house experts to detect the tampering. Quoting Young:

<http://chronicle.com/free/2008/05/3028n.htm>

<http://www.earlham.edu/~peters/fos/2008/05/oa-enhances-error-correction.html>

One new check on science images, though, is the blogosphere. As more papers are published in open-access journals, an informal group of watchdogs has emerged online.

“There’s a lot of folks who in their idle moments just take a good look at some figures randomly,” says John E. Dahlberg, director of the division of investigative oversight at the Office of Research Integrity [at the US Department of Health and Human Services, which includes the NIH]. “We get allegations almost weekly involving people picking up problems with figures in grant applications or papers.”

Such online watchdogs were among those who first identified problems with images and other data in a cloning paper published in *Science* by Woo Suk Hwang, a South Korean researcher. The research was eventually found to be fraudulent, and the journal retracted the paper. ...

