

More reasons to be an open scientist

Comment on Ihle et al 2017 Striving for transparent and credible research: practical guidelines for behavioral ecologists. *Behav. Ecol.* 28, 348–354.

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Ihle et al [1] make a thoughtful and thought-provoking case for why scientists should open up the process underlying their research rather than just its outputs. They clearly explain the urgent need for researchers to adopt an open science framework, and the many “researcher degrees of freedom” that can interfere with the objectivity of the scientific process and affect the quality (reliability, replicability and reproducibility) of scientific outputs. The authors provide an introduction to the burgeoning literature on this subject and showcase the rich and growing collection of tools and technologies that are freely available to help researchers achieve openness in their workflow.

Here are some additional thoughts on why the scientific community should re-examine and reformulate the way we work in line with what the authors suggest.

1. Why do we need new incentives and practices in science?

Replicability, reliability and reproducibility are not new concepts to science. These are old ideas central to scientific philosophy. When science was practiced by small communities (of rich estate owners or monastic groups who could afford the time to do science), it was perhaps easier to achieve these principles because only very few people worked on a topic and could more easily verify each others’ findings. Luckily today a much larger number of people from a wider range of socio-economic backgrounds and regions of the world can practice science. This means that science has become large-scale and rates of scientific output have increased. Perhaps as a consequence these larger volumes of output are more difficult to verify. Therefore, new processes and practices are required to ensure we can follow these same ideals of scientific philosophy in a much larger scale world; we should not shy of changing our practices in response especially given the tools and technology available to us which scientists 200 years ago did not enjoy.

Incentivising replication or rather simply re-recognizing its centrality to the scientific process is also necessary to reduce counter-productive competition amongst scientists, and instead recognize the importance of two independent labs finding the same thing. Researchers would then feel less pressure to be the first to find something and could work more freely without the fear of being “scooped” as their contribution would be valued regardless of whether it came first or second. This in turn may encourage the opening up of the scientific process as people feel more free to share and exchange ideas. Instead, the dis-incentivisation of replication leads to competition, the pressure to work more rapidly rather than carefully and an atmosphere of closed science that potentially encourages erroneous findings.

2. Are there any other advantages to practicing open science besides achieving transparency and reducing scientific bias?

Until recently the only part of most scientific investigations that was available to the world was the final output in the form of the scientific paper; increasingly data is being made available too. Additionally opening up the process of the investigation allows people to build on any stage of the scientific process including an intermediate null finding, the methods that did not work, early observations about the nature of a dataset, the difficulties in collecting or processing it and so on. Being able to build on all these stages rather than only the final stage should accelerate the rate of scientific growth and knowledge production. Note that a study need not necessarily be opened to the world until the researcher is happy to share its output, but if the researcher has catalogued every step of the process including data collection, processing and analyses then this can be opened up with the publication of the output so that others can see the work in its entirety and develop on any part of it. Opening up our workflow also gives scientists the chance to show the world the volume and detail of thought that goes into a scientific undertaking; it provides a glimpse at the years of sweat and toil that we each invest in our projects and that otherwise often go unseen and unrecognized.

Open science need not mean that we do not get to complete our work in the best way that we see fit. The scientific paper is simply the point at which a researcher decides that they have finished working on some particular question. It is also an opportunity for the researcher to place their findings within the larger body of knowledge as they see the world. It is by no means the end point of that line of enquiry; in fact every researcher hopes that others will build on his or her work and findings. Opening up our science allows us to accelerate the rate at which we ourselves find out about the topic that interests us; the more people working on something and the more stages of that process that are being worked on, the greater the rate at which we gain knowledge about our topic of interest.

3. How do we justify the time researchers will invest in opening up the scientific process on top of the time we spend actually doing the research?

Some of us may feel that we already spend a significant amount of time doing good science and following best practice; the additional time spent documenting and opening up the process may feel weighty. However, if we are following best practice, we should already be documenting every stage of our studies so the additional time burden of opening this up to the rest of the world may be small given the technology available and highlighted by Ihle et al [1]. Moreover, documenting our workflows using the toolkit Ihle et al [1] outline (Box 2) including version control, annotation, records of our data manipulation histories and analytical scripts, allows us to revisit our own work easily even years after we have completed it.

An open workflow will likely also attract more people to our work. Students starting new projects and looking for studies to build on may gravitate towards projects that

provide data, code, analytical scripts and information on failed methodologies. If we want new investigators entering our fields to follow the good practices that we adhere to then it is worth investing some time to exemplify these practices and encourage a scientific ethos that embraces them. The increased quality (reliability, reproducibility, replicability) of scientific findings produced will also reduce the time that we spend reading irreproducible papers and trying to replicate and build on erroneous findings. Hence, the time spent on opening up the process of our research will be well compensated in a number of ways.

On an individual and personal level, I think that there is a pleasure in knowing that we are working at the cutting-edge; pursuing cutting-edge questions with cutting-edge methods. This adds no end of value to our everyday time.

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References:

- 1 Ihle, M., Winney, I. S., Krystalli, A. & Croucher, M. 2017 Striving for transparent and credible research: practical guidelines for behavioral ecologists. *Behav. Ecol.* **28**, 348–354.