Understanding the Social Method of Science

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This blog post started out as a thread on Twitter.

There have been many complaints during the COVID-19 crisis about "amateur epidemiologists" opining on things they don't understand. Rather than discouraging people from engaging with science, I want to share my views on how to deal with our limitations as non-specialists when we read peer-reviewed scientific reports, preprints, or just interviews with experts in the general media. Approaching science in a good way as an amateur requires that one understands that the scientific method is essentially a *social method*.

I'm a philosopher of science by training. This means that, while I'm not a scientist, science is my object of study. As a consequence, I have to read scientific texts all the time, in addition to philosophical research. I'm always acutely aware of not having specialist knowledge in whatever area of science my attention is currently aimed at, and I've had to teach myself what I can and cannot do with the information I consume. This seems like a great time to share some lessons from being a professional dabbler in science. These are lessons based in my personal experience, but they are also informed by some useful ideas from philosophy, about the scientific method and the conditions for knowledge.

But first, do we want non-specialists to engage with science at all? By "engaging with science," I simply mean, not just reading passively, but applying concepts and theories in one's own thinking, as one must do to understand new ideas.

While "knowing just enough to be dangerous" may be a real thing, surely the positive correlation between knowledge and good reasoning dominates. That is, people trying to understand science is something we ought to welcome in general, and not discourage. I recognize that there are annoying and potentially harmful side-effects to this. When an understanding of some field of science is severely impeded by unconscious or hidden motives, then this can create an *alternative*

discourse, where data and technical jargon are used in deceptive ways. Superficially credible but ultimately invalid and misleading arguments begin to circulate, turning possibly well-meaning people over to a counterproductive cause—say, a general resistance to vaccines (although that particular movement appears to be in decline right now).

First, very generally, even if some bad is unavoidable when non-experts engage with science, I think the beneficial consequences will outweigh the bad ones. More apropos to our current topic, however, one of the best antidotes to contra-scientific alternative discourses is a proper understanding of how to approach science as a non-expert. That is to say, *being a good amateur with respect to science itself requires some training*. That's a challenge but a worthwhile one.

Science should be regarded as *authoritative* in many respects, but there are ways to misunderstand this. The knowledge that science produces is a social thing. It grows over time in a community of scientists, not in the minds of individual researchers. That science is a collective enterprise at its core has been a fact ever since the dawn of the scientific revolution and Francis Bacon's insistence that scientists freely share their own, and examine each other's, results. Such thoughts inspired the formation of the *Royal Society* as well as the French *Encyclopédistes*, and by extension the creation in 1793 of the *Royal Swedish Academy of Sciences* in my home country. The professionalized science of our time depends essentially on the peer review process and division of labor among researchers that Bacon described in the early 17th century.

Despite this, most explicit theories about the scientific method (including Bacon's own theory of induction) focused until quite recently on the individual scientist, theory, or experiment. The many social dimensions of scientific knowledge have been explored by philosophers more recently. For example, that the scientific method is ultimately a social method has been argued by the philosopher of science Helen Longino in her book *Science as Social Knowledge* (1990, Princeton University Press). Longino claims–in extreme brevity–that only if the results of science come out of a critical discussion among scientists with shared access to the phenomena can they be understood as *knowledge* rather than opinion, because only then are they *objective* in a real sense. Philosophical theories about the social aspect of scientific knowledge have largely come out of the widely recognized fact that how we evaluate data *as evidence* depends on our preexisting background beliefs. But here we can make do with the relatively straightforward idea that scientists who operate within the same field but nevertheless come from different contexts and specializations systematically proof read and double check each other's work. This process doesn't end with some work being accepted for

publication in a scientific journal, but goes on as other scientists decide to use the publication in their own work, try to refute it, or (worst of all) ignore it completely.

The suggestion, then, is that science, properly pursued, is a social process that produces more credible results than any method that can be employed by an individual, because it tends to over time filter out results that are due to accidents and personal idiosyncrasies. (Different areas of science can be differently successful at this, as is perhaps suggested by the so-called replication crisis of the last decade.) We can learn something from this as science amateurs, and consequently here is our *first lesson*: A dominant view within a science is authoritative to us amateurs, because the process by which that view comes about is more reliable and credible than whatever belief-forming processes are available to us as individuals.

It's important to recognize that the authority of science isn't due to scientific experts constituting some sort of priesthood who have exclusive access to the truth by stipulation. It's authority is due to the (relatively) superior reliability of the process that generates scientific knowledge about the world. The idea that having knowledge depends necessarily on the reliability of the process that generated the corresponding belief is another philosophical theory relevant in our context, that has been extensively discussed by a number of philosophers.

It's equally important to recognize that I'm *not* saying that whatever is the *consensus* within a scientific community constitutes scientific knowledge, by definition. Everyone can be wrong—and often everyone has been wrong. I'm saying that if there currently exists a consensus, or a majority view, or even a dominant view, in a field of science then this view is *our best bet*, even if our confidence in that view remains quite low.

The amount of disagreement between experts differs between the sciences, and between topics within any science. This complicates things for us amateurs. How do we know if the statement of some particular scientist is representative of the collective understanding within that scientific field? Maybe the only way to know this is by being an expert. But more optimistically, just as a scientist may regard the outcome of a new experiment tentatively until more evidence comes in, we can take the same attitude towards a statement by an individual scientist that we hear for the first time. That is to say, we can tentatively accept the claims made by some particular scientist on some occasion, keeping in mind that this may be an outlier opinion in the scientific community. This is particularly relevant right now, when COVID-19 related news reports often consist in statements by individual experts.

But what if there genuinely does not exist a dominant view within the relevant scientific community in relation to some important question—as indeed seems to be the case with respect to many things pertaining to the COVID-19 pandemic

when I'm writing this? If we are forced to base a decision on how to act on one view or other of the available alternatives, then we will have to make do as best we can, relying on the expertise we deem most reliable. (And possibly some decision theoretical principles.) There is no way around that. But most of us are not in that situation, and our understanding of scientific knowledge implies that we do best in suspending judgment until the scientific community sorts things out. (Suspending judgment is also a hard mental exercise that builds character.)

The fact of our first lesson does not hold in precisely the same way to an expert in the scientific field in question. This has to do with the particular limits of the amateur perspective. As amateurs, we can advance our understanding of the scientific theories, models, and evidence in many ways. (YouTube is full of credible open lectures and tutorials on any scientific subject you can imagine.) This is a Good Thing. But there are things we cannot do. To wit, if I cite a scientific paper in my philosophical work, it's because I take it to express a common enough view in that science. My goal is usually to report what I take to be the state of knowledge within that field at the time of writing. My citation adds no weight to the views expressed in that paper. It's because *I can't read that paper critically*.

An expert, on the other hand, can have good grounds for rejecting a consensus view in their science. Science is a rational enterprise after all, not only a social one, and the overall scientific process ultimately works only because individual scientists can make substantial contributions to the end result. (A contribution that will still have to pass through an extended peer review process before it can be elevated to the status of scientific knowledge.) But the probability of an amateur finding an error that has escaped the scientific community is very low.

In short: to be part of the critical peer review process of science, you need the right training. And the best reason we as amateurs can have for being skeptical of the claims of an individual scientist is that we doubt that it represents the dominant view in that science. This is then our *second lesson*: As amateurs, we can strive to understand what scientists say—but we normally lack the tools for critically evaluating what they say. (This holds when the scientist is speaking on their area of expertise, of course.)

So, this suggests at least two ways of being a bad amateur epidemiologist. First, we might confuse the claims by a particular scientist with the knowledge that has accumulated within that research community. The cure is to read more broadly and aim for a sense of what views are dominant within the field. This is hard work, and moreover requires knowledge of what are good, reliable sources.

Second, we might underestimate the amount of knowledge and training that is needed for reading science critically. As amateurs, we likely don't even know

how much we don't know, and this can mislead us. The cure for this is to make the safe bet, and again hone in on what seems the dominant view in the field, and base any skepticism on that. (Or to get a relevant degree.)

Acknowledging these limitations to the amateur point of view, we can strive to better understand, through science, the world in general, and our current situation in particular. And we really should. For the sake of our society and ourselves as individuals.

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