

Does science need philosophy?

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ABSTRACT: Feynman is credited as saying that “Philosophy of science is about as useful to scientists as ornithology is to birds”. So perhaps no other philosophical subject – ethics, logic or the philosophy of language – is of any interest to scientists as scientists. On the other hand, Einstein believed in “the significance and educational value of methodology as well as history and philosophy of science”. He believed this was important to scientists’ research. Who is right, Feynman or Einstein? Not surprisingly, I argue that Einstein is right. In order to do that, the nature of both philosophy and science must be clarified. I will then argue that philosophy is of value to scientists not just for methodological reasons, as Einstein argues, but also for theoretical reasons.

KEY-WORDS: Metaphilosophy, science, reality, knowledge, value, teaching.

Feynman is credited as saying that “Philosophy of science is about as useful to scientists as ornithology is to birds”¹. So perhaps no other branch of philosophy — ethics, logic or the philosophy of language — is of any interest to scientists as scientists. As persons and citizens, scientists may find some of those subjects of interest, but Feynman’s thought is that to their scientific work, philosophy of science, and perhaps philosophy in general, is not useful.

In stark contrast with Feynman, Einstein believed in “the significance and educational value of methodology as well as history and philosophy of science” (Einstein, 1944). He believed these subjects are important to scientists’ research, and not just to their general education. His argument was roughly that even if philosophy is not important to do everyday science, it certainly is important “when experience forces us to seek a newer and more solid foundation” (Einstein, 1936).

Who is right, Feynman or Einstein? Not surprisingly, I will argue that Einstein is right. In order to do that, the nature of both philosophy and science has to be clarified. I will then argue that philosophy is of value to scientists not just for methodological reasons when they face foundational problems, as Einstein argues, but also for theoretical and broader educational reasons.

Most learning time we spend in school is devoted to learning facts and established theories. These theories are not open to debate. The student is not expected to evaluate the truth-claims of those theories against competing theories, because there are

¹ I was unable to check the source of this widely quoted sentence. It may be apocryphal. See Kitcher (1998).

no competing theories. The student is required only to understand them. This is true of natural sciences like biology and physics, but also of subjects like history. There are certainly unsolved problems in physics, biology or history, but the student is not expected to learn about them until after he or she masters the established theories. This usually happens only at post-graduate level.

Studying philosophy for the first time can be very puzzling because philosophy is not like this. We do not have in philosophy a large body of well established theories. There is no agreed upon solution for most philosophical problems. Instead of having a large body of well established theories, we have a large (larger?) body of competing theories. Thus, the student is required not only to understand those theories, but also to assess their truth-claims.

Schools and even universities are mostly fine-tuned to teach results, that is, theories that are true, as far as we know. They are not so good at teaching students to evaluate competing theories, assess their truth claims and make up their own minds. Perhaps because of that, philosophy is sometimes taught as if it was just a question of understanding competing theories, and not a question of assessing them and creating new theories. Thus, a familiar reaction to philosophy is this: “Why should I bother to understand all those complicated theories philosophers are keen to present in hard to master jargon, if one philosopher’s truth is another’s mistake?”. The trouble is certainly not the effort needed to understand complicated theories presented in hard to master jargon because the same amount of effort is needed to understand biology or physics, and those subjects also use a jargon that is not easy to master. The trouble is that the effort needed to master these subjects is rewarding in a way that the effort needed to master philosophy does not seem to be. The effort needed to master science is rewarding because in the end we get true theories or at least theories as close to being true as anything. But the effort needed to master philosophy does not seem rewarding because in the end we do not seem to get any closer to true theories, or at least theories that are largely taken as true by the philosophers themselves; all we get in the end is competing theories. So why bother?

The best answer I know of to this question is almost as old as philosophy itself. It was presented by Aristotle (384-322 B.C.), no less, in a highly influential small treatise he wrote to his fellow citizens, common Greek people, and not to his philosophical colleagues. It is called *Invitation to Philosophy*, and is also known by the first word of its original Greek title: *Protrepticus*. This book was highly influential and famous for about one thousand years, and we are told it was everybody’s favourite introduction to philosophy. When Boethius (480-524) wrote his *Consolation of Philosophy* he had in mind Aristotle’s work, the ideas of which had come to him through Cicero’s (106-43 B.C.) *Hortensius*, which in turn was something of a Roman rendition of Aristotle’s original work. However grateful many generations of common readers were to Aristotle for his lucid and illuminating introduction to philosophy, this is not the kind of work past academics and intellectuals tended to prize. They cherished, re-read and kept in good condition more sophisticated works by Aristotle, but not his humble introductory book. I guess that if anyone were to ask all those past scholars the proverbial question “What works by Aristotle would you take with you to a desert island?” the answer would not include *Protrepticus*. And so it came to be that this little book by Aristotle was lost and all but forgotten until Ingram Bywater rediscovered a few fragments of it in the nineteenth century. I guess everyone remembers their best teachers very fondly but not as fondly as to keep their introductory books close by; these books are rather like good practical clothes that in time we outgrow and eventually forget.

Aristotle's answer to our question takes the form of a valid deductive argument that looks like one of those traps that gives philosophy a bad press. It is this:

If you should philosophize, then you should philosophize.
 If you should not philosophise, then you should philosophize.
 Therefore, in any case, you should philosophize.

We do not have the actual text from Aristotle's book, nor its context. We have however several citations from different authors that had Aristotle's text before them, and they all agree that an argument like this was offered by Aristotle. I am aware that to present this argument to people who are not philosophically minded to begin with will most probably encourage their feeling that philosophy is really not worth studying. However, I believe that explaining the argument may teach them something important about philosophy: that it is unavoidable.

Let us start by analysing the argument carefully. It is formally valid, that is, its logical form is such that we can prove its validity using formal logic, which is pretty much like mathematics. Using those outlandish symbols we academics cherish because they give us the comforting feeling that we are not spending tax-payers money with trifles, we get this:

$$\begin{array}{l} p \rightarrow p \\ \neg p \rightarrow p \\ \therefore p \end{array}$$

Any second-year philosophy student would tell you that the first premise is un-touchable because it is a logical truth. The second premise, however, is certainly not a logical truth. It does not even look true, let alone logically true. And it looks like a trap. How can it be that if we should not philosophise, then we should philosophise? In order to understand this let us draw a parallel with astrology. Suppose you are arguing that we should not believe in astrology. It would be rather odd and indeed self-refuting if you used an astrological chart to argue for your point. Imagine someone saying something like "You should not believe in astrology because the astrological chart makes it very clear that astrology will bring you bad luck, since Saturn is your ascendant". This is self-refuting because you have to believe in astrology in the first place to buy the argument that you should not believe in astrology.

What Aristotle has in mind is something like the mirror image of this. In order to argue that we should not philosophise we have to use a philosophical argument, thus defeating the purpose of our argument. We cannot come up with a sound biological, physical, mathematical or historical argument against philosophy. The contradiction we face when we try to argue against philosophy is the sort of contradiction we face when we try to persuade someone that we are not trying to persuade him or her. It is like screaming "I am not screaming!". In philosophical jargon this is called a pragmatic contradiction.

That there is no non-contradictory way to argue against philosophy is certainly surprising. I believe it is also illuminating. It tells us something important about the nature of philosophy. Philosophy is not about coming up with more or less arbitrary and personal worldviews about life, the universe and everything. If that were the case, arguing against philosophy would not be contradictory. We could argue that those personal

and more or less arbitrary worldviews are groundless, and this argument would not necessarily be committed to a personal and more or less arbitrary worldview.

So what is philosophy? Philosophy deals with any open problems that we cannot solve scientifically or mathematically. That is, philosophy is not about empirical nor formal problems. Biology, physics and history, for instance, deal with empirical problems. These are problems we can solve by more or less heavy theorizing based on evidence and experiment. Mathematics and logic deal with formal problems. These are problems we can solve not by using evidence and experiments, but by reasoning alone. However, we only accept a single sort of reasoning: mathematical or logical reasoning. This is the kind of reasoning in which formal proofs are available.

So far, I presented philosophy in negative terms. I told you what philosophy is not. It is not an empirical science and it is not a formal science (or whatever you want to call mathematics and logic). It is at this moment that one may be tempted to say something like the following: “Well, you pretty much exhausted the domain of what can be the object of serious enquiry. If philosophy is neither empirical nor formal, then there is no serious method for philosophy to use and philosophy is just people talking past each other about what none of them can really know.” This sort of argument is self-refuting, and the point of Aristotle’s argument is to show that. What is at stake here is the claim that if there is no established empirical or formal method of enquiry, then that enquiry is worthless. However, what was the method of enquiry that led to that conclusion? It was certainly not an empirical or formal method. Certainly, the argument I sketched can be developed and presented in a less naïve phrasing. But however you phrase it, it turns out to be a typical philosophical argument: an argument that is not decidable either formally or empirically. So Aristotle was right: in the process of arguing against the possibility of philosophy we must philosophise, thus defeating the argument’s purpose.

Einstein’s point about the value and usefulness of philosophy for working scientists can now be clarified. He believed that a basic training in philosophy was crucial to scientists when research pushes them to the boundaries of science. Everyday science is certainly imaginative and creative, but only up to a point. Most of it is just a matter of using well understood methods and theories to uncover and explain details no one bothered with before. This is not to say those details are not important. However, when foundational issues are at stake — and that was the case with Darwin and Einstein himself — there is no “safety net”, that is, there is no set of procedures and basic established theories you can use to safely carry on your research. The methods and foundational theories are themselves at stake. When this is the case, it would be a shame to use that old argument against philosophy: “Drop it because there is no tested method of enquiry”. Einstein’s point was that philosophy is precious to working scientists because it teaches them that rational enquiry is still possible even in the absence of clear-cut methods of enquiry.

One cannot stress this point too much. Obscurantism includes the thought that unless results are easy and methods are foolproof, we should stop any rational enquiry — and perhaps accept religious authority and tradition instead. This sort of view is a self-fulfilling prophecy. If we stop trying to discover the truth about something because results are not easy and methods are unknown, we will never discover methods that will deliver results. Scientists themselves were victims of this kind of attitude in the seventeenth century, when few people would believe that careful measurement, experimentation and mathematical modelling could deliver solid results about reality. Had they stopped right there, we would not have modern science at all. Had philosophers stopped arguing among themselves in the fifth century B.C. about the nature of atoms, or

whether there really are atoms, and we would probably never have developed the right methods do find out whether there really are atoms. It is wrong to believe that we must come up with reliable methods of enquiry before we can ask meaningful questions. Difficult, puzzling questions drive the development of new methods of enquiry. Stop those questions and you stop the development of those methods of enquiry.

So Einstein had an important point regarding method. Working scientists have sometimes to devise new methods of enquiry because they face foundational issues. A proper training in philosophy can give them a head advantage because this is precisely what we do in philosophy: we insist on thinking rationally when there are no known methods to think rationally about that particular problem. In doing so, we inspire scientists to think “out of the box” and to discover new methods of rational enquiry. We map the possible territory, so to speak, before anyone can really go out there and check it. Much of today’s scientific results were philosophical puzzles centuries ago and it is doubtful that any real innovative science can ever be done if we refuse to face philosophical puzzles on the grounds that those puzzles are not scientific, well-behaved problems.

I believe however that philosophy is not important to scientists only when they face foundational issues, as Einstein seems to believe. A basic training in philosophy could help post-graduate science students to fare better. That is the case because our schools and universities are largely fine-tuned to teach how to understand established theories, but not how to assess competing theories or hypothesis and how to discover what is not yet known. Post-graduate science students have spent their entire lives as students learning what is known and now they face competing theories and hypothesis and have to come up with some sort of original scientific result which, by definition, was not previously known. Philosophy can help science students do that because that is what we do in philosophy.

Philosophy deals with two basic sorts of problems: problems about reality and problems about knowledge. Thus, metaphysics and epistemology are the two core branches of philosophy. Metaphysics deals with the most general problems about reality that are not the object of other branches of philosophy. And epistemology deals with the most general problems about knowledge that are not the object of other branches of philosophy.

For instance, take the philosophy of science. The nature of theoretical entities, for instance, is a much discussed problem in the philosophy of science. Are there really *quarks*? Or are *quarks* just theoretical models — useful fictions that helps us to predict nature’s workings? This is a metaphysical problem dealt with in the philosophy of science.

Another typical problem in the philosophy of science is the justification of induction. Empirical sciences like biology, chemistry and physics rely heavily on induction. Induction is a sort of reasoning for which there is no formal proof. We face a serious problem when we try to justify induction — we cannot do it deductively and it seems that any inductive justification of induction is viciously circular. This is an epistemological problem dealt with in the philosophy of science.

So particular subjects like the philosophy of science deal with metaphysical and epistemological problems.

Metaphysics proper, though, deals with the most general problems about reality that are not the subject of any other branch of philosophy. Here is an example. Intuitively, we can distinguish two different modes of instantiation of properties. Socrates had the property of being human, along with many other properties. Some of those

properties are intuitively necessary or essential in the sense that Socrates could not fail to have them. For instance, Socrates could not fail to be human — he could not have been a cat, a rock or a pair of slippers. Other properties, though, are intuitively contingent or not essential: Socrates was born in Athens, but he might very well have been born in Egypt. This division between modes of instantiating properties is certainly intuitive. But is it real? For many years philosophers were led to believe this division was a figment of our imagination. For them, once science tells us everything about the way the world is there is nothing more to be known. Some philosophers, however, believe that we do not know everything about the world once we know everything about the way the world is because we still need to know about the way the world must be. This is a central problem in the metaphysics of modality.

There are many other central problems of metaphysics; for instance, the problem of defining truth, the problem of universals, the problem of identity across time. This last problem is particularly interesting to life scientists because life develops across time and the identity of organisms can be quite tricky. When an amoeba divides itself in two, which one, if any, is the original amoeba? A working scientist can certainly be sympathetic with Feynman's impatience. Why should a busy working scientist waste time thinking about this and other philosophical conundrums, for which there is no solution in the horizon? One reason is that sometimes they creep into your work even if you do not want it. And when that is the case it is not a good idea to close your mind to them, declaring them philosophical dead ends. The philosophical dead ends of today may very well be the scientific breakthroughs of tomorrow. Furthermore, to believe that a problem is only genuine or worth our attention if a solution is in the horizon is itself a philosophical assumption that needs to be explicitly argued for, instead of accepted as obvious.

To complete our tour of core branches of philosophy lets talk a bit about epistemology or the theory of knowledge. Philosophical problems are sometimes quite annoying in the sense that they are so basic and apparently unimportant that spending just a few minutes thinking about them seems a waste of time. Take this central problem of epistemology: What exactly is knowledge? Certainly, it is a relation between a cognitive agent and a content. But what sort of relation? What is the difference between belief and knowledge? We have a standard three-part analysis of knowledge as justified true belief. However, we also know that there are tough counter-examples to this analysis. Take Mary's true belief that her co-worker John has a red car. This belief is justified because she saw John driving a red car and talked with him about it. Now, logical entailment preserves truth. Here is one of Mary's beliefs that is logically entailed by Mary's true belief about John: "One of my co-workers has a red car". This belief is true because it is entailed by a true belief. Presumably, the evidence needed to justify this belief is exactly the same that justified Mary's belief about John. But now imagine that, without Mary knowing it, John sold his red car. So her original belief is now false. However, another co-worker, Tony, just bought a new red car. So the entailed proposition is now true, and certainly justified. Is Mary's second belief knowledge? It seems not. However, it is a justified true belief. Much contemporary work in this area is about trying to solve this annoying problem. Imagine that: philosophers do not even know what knowledge is. If you believe this is evidence that philosophers are really not that smart, try to solve the problem yourself.

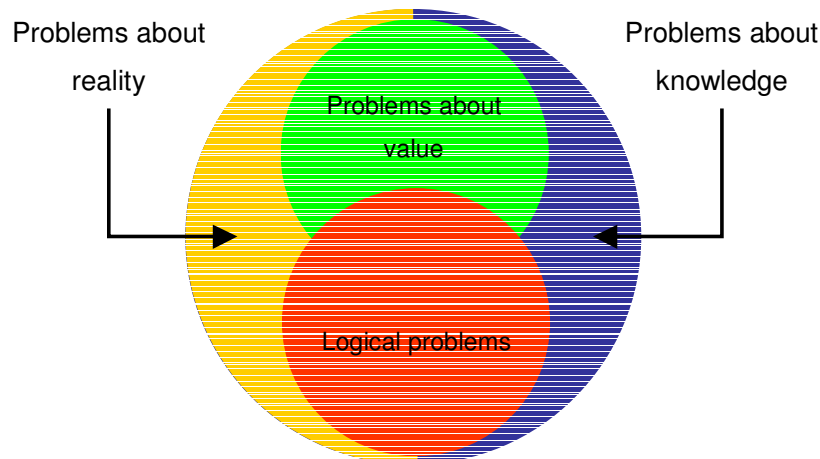


Figure 1

Finally, core philosophical problems are also either logical problems or problems about value, or both (see Figure 1). At bottom, these problems are also about either reality or knowledge. Take problems about value. The core branch of philosophy that deals with value is ethics — although not the only one. Ethics deals with three sorts of problems. What we call meta-ethics deals with the most abstract problems about ethics. These are problems about the very nature of ethical thought. For instance, are ethical statements objective or subjective? Are they relative to culture or history, or is there some objective standard of right and wrong? The second sort of problems is dealt with by normative ethics. For instance, what makes a wrong action wrong? Is it the agent's intention, for instance, or the objective consequence of his or hers action? The third sort of problems is much more down-to-earth and we call it applied or practical ethics. This deals with issues such as the morality of abortion and euthanasia, the ethical relevance of non-human animals, our duties regarding extreme poverty, and so on. In any case, ethics is about either the reality of value (e.g., what makes a right action right?) or the epistemology of value (e.g., what is the structure of practical reasoning?).

Many philosophical problems are logical problems, although not problems of logic. This is a bit of a terminological mess but I have no other way of putting it. What is at stake though is clear. Take a problem like whether a given conclusion follows logically from a given set of premises. This is a problem of logic and we solve it formally, using proofs, as we do in geometry. This sort of problem is not, usually, a philosophical problem. Compare this with a core philosophical problem: Is human free will compatible with nature's determinism? This is a logical problem in the sense that compatibility is the metaphysical counterpart of consistency, which is a logical concept. However, the free will problem is certainly not a problem of logic because it cannot be solved using the formal methods of logic.

The problem of evil is another problem of the same sort. This is a core problem in the philosophy of religion. This branch of philosophy studies a variety of metaphysical, epistemological and logical problems related to religion. The problem of evil is a logical problem because it is again a problem of compatibility. Could a theistic god — an all powerful, all knowing and perfectly good god — be compatible with all the evil there is in the world? Again, this is a logical problem — yet it is not a problem of logic.

Does science need philosophy, other than for the methodological reasons we have seen? I believe so. Sooner or later scientific questions lead to questions about reality, knowledge, value or logic that are so broad that no known scientific method exists to deal with it. Take questions of value. Life scientists have been pretty much pestered as of late by moralists trying to tell them what they can and cannot do. I find this worrying because academic freedom seems dangerously at risk. On the other hand, life scientists, like everybody else — including therefore presidents of very powerful countries and religious leaders — should behave ethically. I believe the way out of this is a close co-operation between these two groups of professionals: life scientists and philosophical ethicists. When I need to know something about biology I ask a biologist or read their books. When a biologist needs to know something about ethics he or she should ask a philosopher or read our books. The crucial difference is that in many cases the philosopher will not have a clear-cut largely agreed upon answer. That may prevent the scientist to ask the philosopher. And that, I believe, is a mistake.

Here is an annoying situation I am sure most of you have had to endure. Someone writes something in a newspaper that touches on your area of scientific expertise. As soon as you start reading you realise the author did not bother to check his facts. It is not just the case that the information the author uses is lame; worse, the author does not even seem to realise that he or she should ask anyone who really knows about the subject, if he or she is too lazy to bother reading a book. I suppose our schools and universities are failing in one of their chief tasks: to give the general population, including newspaper opinion-makers and journalists, an awareness of the importance of checking facts and listening to experts. Publicly expressed opinions based on distorted, incomplete or plain false information damages the very foundations of any rational society. In this respect, we are all failing as teachers, I guess.

However, when it comes to philosophy even some scientists tend to believe that there is no need to check anything other than their own thoughts. I guess the reasoning is something like this: “Since philosophers did not come up with any decent theory largely agreed upon even between them, why should I bother to pay any attention to what they are saying? Their opinions are as good as the next man or woman in the street. So I might as well contribute my own two cents.” The thought here, in a nutshell, is that either philosophers come up with solid results, as scientists do, or else we can safely ignore their jargon-filled, boring academic papers and books. What can be wrong with such a thought?

What is wrong is again an over-emphasis on results. Results are important and I am not one of those folks that seem to believe that the aim of an intellectual life is just to ask questions. That may be fulfilling for a five year-old but not for me. I want solutions, results, as much as anyone. However, we have seen how an over-emphasis on results can lead to precluding the very possibility of finding results — because it encourages us to stop our enquiry until we find a sure method that delivers sound results. Believing it is of no use to listen to professional philosophers because they have not arrived at sound theories that everyone can accept assumes that any partial results and any negative results we have can be safely ignored. The price to pay for this attitude however is far too high: we will repeat the same mistakes over and over; mistakes any well trained graduate philosophy student already knows how to avoid. And we will not see the whole picture, so to speak: we will tend to believe our thoughts do not face powerful counter-arguments and difficulties; worse still, we will not be aware of all the theoretical space available. We will fail to see that our cherished naïve theory is not more plausible, on the face of it, than competing and perhaps more sophisticated theo-

ries. We will fail to see that simply because we have no knowledge of competing theories. When we have five possible choices and no way to decide between them it is still a good idea to know about them all before we attempt to make a decision. A decision based on the belief that there are only two possible choices when there are really five has a higher probability of being wrong than a decision based on the knowledge that there are five, even though no one decision can be scientifically or mathematically proved to be the right one.

Thus, it is unwise for scientists to ignore the work of their philosophical colleagues. We all face philosophical problems sooner or later and scientists even more so. It would be unwise to declare those problems not only *terra incognita*, which they certainly are, but realms outside rational enquiry just because there are no established empirical or formal methods to address those problems. Those are the realms that we philosophers explore. And I believe our explorations can be as informative, illuminating and suggestive to scientists as theirs certainly are to me.

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