*The Poetics of Physics*

Reviews, and Response to Reviewers

Clearly, we find these Reviews disappointing. And equally clearly, we have failed to establish things that we thought we had established.

# Reviewer #1:

1. I'm afraid that this essay is not suitable for Studies [*Studies in the History and Philosophy of Science*]. It is too long, too rambling, makes little if any contact with the existing literature and the overall argument is unclear. As I understand it, the conclusion is that scientific terms such as 'entropy' must be based in 'natural' language and hence introduce a fundamental ambiguity into our theories that undermines our knowledge of the world. There are numerous points at which the line of argument might be contested: even if we grant the origin of such terms in natural language, their formulation in mathematical terms removes any such ambiguity; even if we grant such ambiguity, it is not clear how this blocks us gaining knowledge; it is certainly not clear that knowledge or the 'meanings of things' must be intuited. Consider as a further example that of 'spin': introduced by analogy with the classical example of a spinning object, it was quickly appreciated that it could not be understood in classical terms.
2. Does that undermine our knowledge of spin? That seems a hard line to take given that there is now a whole technology known as spintronics that utilises this property! Of course, that doesn't mean there aren't issues to be explored here. The very nature of spin precludes taking a straightforward realist stance towards it and perhaps likewise with regard to entropy. But the 'straightforward' realist stance is not the only game in town and there is a considerable, not to say \*huge\*, literature on these kinds of issues. There is an even larger literature on the meaning of theoretical terms, going back decades, and on the nature of scientific understanding and knowledge, little if any of which is touched on here. I'm afraid that it is not enough to bring in lots of disparate quotes from a variety of sources, not matter how interesting they may be, in order to bolster your claims - others have worked on these issues and that work needs to be acknowledged, even if ultimately you disagree with it (in which case, explain why and show how your argument is better!). This might be a suitable essay for a popular on-line magazine such as Aeon, say but not for an academic journal such as this.

## Response

***para #1:*** It is clear Reviewer #1 has misapprehended what we were attempting to claim; with their ‘strawman’ description of our apparent claims certainly not congruent with our thinking. But, this underlines that our paper needs to be rewritten to make significantly clearer what it is that we *do* claim! And we are grateful that the ‘fresh’ eyes of Reviewer #1 make this deficiency clear to us!

We do *not* claim that the ambiguity of language “*undermines our knowledge of the world*”. On the contrary, we claim that our knowledge of the world is *not* undermined by the ambiguity of language. The point is precisely that in general knowledge *can only be* partial (that is, incomplete): we do not know most things as well as we would like to think we know them. And this must also apply to scientific knowledge, where we have an unfortunate habit of thinking of our knowledge as “complete” in important ways.

Also, we do *not* claim that “*that scientific terms such as 'entropy' must be based in 'natural' language*”: rather we claim that all scientific terms (such as 'entropy') are in fact based *ultimately* in 'natural' language. It is true that “*their formulation in mathematical terms*” is certainly intended to “*remove ambiguity*”, and it is certain that the formulation of scientific ideas in mathematical terms allows us to discuss and develop them without increasing ambiguity, but the history of science assures us that there is an irreducible remnant of ambiguity that is the source of the periodic re-evaluation of theories that keep us interested. Of course, it is also *not* true, as some 19th century physicists thought, that “*All that remains is more and more precise measurement*” (attributed to Lord Kelvin).

***para #2:*** It seems pretty clear that there *is* no “*straightforward realist stance*”, although perhaps the Reviewer intends us to understand “naïve realist stance”. We take a “critical realist” stance informed by recent (well, 20th century) developments in logic and epistemology which we think is *not* naïve. But it may well be that we have not properly confronted the relevant more contemporary literature.

# Reviewer #2: Review of The Poetics of Physics

1. This paper (I think) aims to consider the role of poetic language in physics, arguing that 'the epistemology and ontology of physics ultimately rests on poetic language'.
2. I say 'I think' as the paper goes through a wide range of topics, thinkers, claims, and ideas, but there is little structure to this paper, and no clear line of argument at all. The use of sources and quotes in this paper is unusual, and makes any claims that the author wants to make unclear and hard to follow. It reads in places as though the quotes are unconnected, and no real work is done by the author to show what connections we are meant to draw from these disparate quotes/claims cited.
3. Reading this paper was like reading a written stream of consciousness, and not a carefully constructed addition to the literature on a particular topic. I do not doubt that the author is well-read. But expressing that we are well-read on paper does not make a paper. It needs a clear line of argument, with unnecessary aspects cut away to make the aims clear. This paper fails on this account significantly, and hence I recommend in the strongest terms that it should be rejected without the possibility of resubmission.

If author wants to continue working on this paper, here are some other (I hope) helpful comments.

1. Various key claims are not argued for. For example, why think that language is needed for knowledge? Is there no non-linguistic knowledge, and do animals thereby not know anything? Language is needed to communicate knowledge, but that is a distinct claim from the one being made by the author. It is claimed this is 'outside the scope' of the paper, but it is central to it.
2. It is also claimed that 'knowledge of the world is necessarily based ultimately on intuition'. Why should we accept this, and what is meant here by intuition? Why, also, should we think that 'the articulation of intuited knowledge is the business of poets'? Can we not express intuited knowledge in non-poetic language. On this point, the distinction between poetic and non-poetic language is never established.
3. The paper makes various claims about the nature of language, but does not engage with the philosophical or linguistic literature around such topics. Drawing on the meaning of terms in ancient Greek is useful for some topics, but it is unclear why it is useful here.
4. There are also generalisations and claims about the physics and metaphysics that are not supported (and some of which are simply false). For example, 'All physicists operate on the assumption (not usually explicitly acknowledged) that the thinginess of the phænomena they investigate is ontologically secure: that is, the world is real'. There are both physicists (and metaphysicians) that deny this.
5. Or, the claim that 'Physicists tend to think that they can manipulate the behaviour of phænomena symbolically'. Who thinks this? This would be to make a simple mistake between a theory and the world (that presumably the theory is about). If author thinks that practising physicists are making this mistake, some evidence of this is needed.
6. Or claims are not explained. In what sense is nature 'rational'? Under what definition of 'rational'? This is followed by discussions of the Liar's paradox, and Godel, but it is not clear what the intended connection between these ideas is.
7. Throughout, the author seems to view metaphysics as being a metanarrative to physics. This would be something like a novel idea that author might want to develop, but if they do, then we need an argument to understand metaphysics in this way. This is not the standard view of metaphysics, nor one that I have seen anyone defend. Also, if 'every narrative necessarily has its metanarrative without which it can make no sense', then would this not lead to infinite regress? We would need a metametanarrative to understand the metanarrative, etc. Author's claim that the 'poetic' language of metaphysics is the understandable metanarrative of physics would collapse as this metanarrative is just as unknowable as the physics without its own metametanarrative.
8. Note further, if author's claim is rather that physicists need to make use of metaphysical notions, this is very familiar from the literature, and I'd advise the author to look at work in the domain of the metaphysics of science. Authors in that domain have made that claim many times, without the need for author's detours through various unneeded aspects of the history of physics, or the detours through various religious topics/texts, or through examining ancient Greek texts that again add nothing new to the discussion here.
9. A claim at the end suggests that author's aims is different from the one that I summarised at the start of these comments. Author writes that understanding of physics 'depends on inspiration'. This is a different claim that physics relies on poetic language. Poetic language might be inspirational, and some poets might talk about what inspires them, but I see no concrete sense in which inspiration and poetic language are linked in a way that would make these claims synonymous.

## Response

***para #1:*** OK

***paras ##2,3:*** “*little structure … no clear line of argument … unclear … no real work is done by the author to show what connections we are meant to draw*” …“*needs a clear line of argument … to make the aims clear. This paper fails on this account significantly*”. What is clear is that we have failed to communicate our point.

***para #4:*** “*Is there no non-linguistic knowledge?*” We covered this point (however inadequately). We do not claim merely that “*Language is needed to communicate knowledge*”, but that there exists no inarticulate *scientific* knowledge. What is out of our scope is not scientific knowledge of any sort, but *wordless* knowledge (for example, the musical and artistic knowledge discussed by Tom McLeish, or the “tacit knowledge” discussed by Michael Polanyi).

***para #5:*** By the time we claimed that “*knowledge of the world is necessarily based ultimately on intuition*” we thought (erroneously as it appears) that we had established the point. We are therefore surprised that the Reviewer thinks that we “*never establish* *the distinction between poetic and non-poetic language*”. But we stand corrected.

***para #6:*** OK

***para #7:*** I did not know that there are both physicists and metaphysicians that would deny that '*All physicists operate on the assumption (not usually explicitly acknowledged) that the thinginess of the phænomena they investigate is ontologically secure: that is, the world is real*'. It is easy to find physicists apparently claiming this: for example, the claim by Fedrizzi that “Objective reality doesn’t exist” (*LiveScience* Nov.16 2019; discussing Proietti et al. *Science Advances*, Sep.20 2019). But Fedrizzi interprets (and probably misinterprets) the science using debatable (“insecure”) language.

***para #8:*** We agree that we gave no example of '*Physicists who tend to think that they can manipulate the behaviour of phænomena symbolically*'. Of course, the Reviewer is right to say that “*This would be to make a simple mistake between a theory and the world*”: but because it is a “simple mistake” does not mean that people (including practising physicists) do not make it (unwittingly, obviously). Distinguishing the “theory” from the “world” is precisely what is at issue in the whole activity of “*saving the appearances*”. It is easier said than done.

***para #9:*** The Reviewer asks, “*In what sense is nature 'rational'?*” We thought it was sufficient to merely observe that if it can be addressed rationally – that is (for physicists) with the apparatus of physics – then it is *per se* “rational”. And physicists would not do physics if they thought nature was irrational. But clearly there is a large (non-physics) literature effectively treating the (supposed) rationality of nature as an illusion, which literature we felt it unnecessary to confront. I am amazed (for example) at the paucity of argument in Bruno Latour’s highly regarded and apparently very influential 2004 attack on this “illusion literature” (*Critical Inquiry* **30**, 225-248).

***para #10:*** The Reviewer objects that the discussion of “meta-meta-narratives” leads to an “*infinite regress*”. But he did not notice that this problem of recursion is (potentially) solved by our claim that natural language is its own metanarrative. However, his opinion that we did not adequately establish our claim of “*metaphysics being a metanarrative to physics*” seems to be fair.

***para #11:*** Clearly, we believe “*that physicists need to make use of metaphysical notions*” as the Reviewer observes. We thought we had alluded to sufficient literature to make our point, but it seems that we did not, nor did we adequately discuss the idea of *metaphysics* itself (see #10).

***para #12:*** It is true that we treat ‘poetic language’ and ‘inspiration' as near-synonyms. It did not occur to us that this might be contentious.