Response to Synthese Reviewer

C.Jeynes, M.C.Parker, M.Barker, 26th February 2022

The author of this work has done an outstanding job in erudition. The number of books cited all throughout is remarkable.

A main goal of this essay is to emphasize the role played by works from the paleo-Hebrew tradition to demonstrate that the understanding of language —and specifically poetic language as the ground base for the epistemology and ontology of physics—predates the Hellenic period. For this purpose, the author includes a paleo-Hebrew artifact with an inscription from the first century. There are also frequent references to authors such as Augustine, Anselm and Paul as sources that are not as commonly cited as other from a Hellenic tradition.

We thank the Reviewer for these kind comments.

One goal of the work was certainly to demonstrate that a sophisticated knowledge of ontology and epistemology long predated the Hellenic period, and we welcome the Reviewer’s recognition of this. However our main purpose was to show that *all* knowledge ultimately rests on poetic language, and this is at least as true for scientific knowledge as it is for any other sort of knowledge. We did not succeed in communicating this to this Reviewer, as will become even clearer as we address the further points made in this Review.

Recognizing those valuable aspects of this work, I am not favorably inclined to evaluate it positively for publication in its present state for the following reasons.

The study of the poetic foundation of physics is not a new topic, as it has been explored by critics in different cultures and by physicists as well. Niels Bohr, one of the architects of quantum physics, declared that when it comes to atoms, the only language that can be used is poetry. Quantum physics, in general, recognizes the inevitability of paradox, ambiguity and irrationality when the observer’s consciousness is the cause for the collapse in the quantum superposition. Bohr, Heisenberg, and others understood that quantum theory illustrates the fact that to understand a connection fully the only way possible is to speak of it in images and parables. Gödel and his theorem of incompleteness put an end to the belief in the exactitude and reliability of mathematics, and the displacement of Euclidean geometries in the 19th century gave way to conceptions about the cosmos and reality where poetic values, such as probability, uncertainty and acausality began to dominate. H.M. Enzensberger and Jorge Wagensberg both affirm the metaphorical foundation of sciences. On this basis, this reader finds puzzling the essay’s author insisting <<on the unity of truth>>.

It is true that Jorge Wagensberg’s long paper “*On the Existence and Uniqueness of the Scientific Method*” (*Biological Theory*, 2014) is relevant and should have been discussed. It is also true that we merely assert the “*unity of truth*” without any discussion. (But Enzensberger is known as a poet not as any sort of scientist, and we already cite sufficient poets.) And we agree with the Reviewer that quantum mechanics cannot be saved from the inevitability of irrationality if it is the observer’s consciousness that is the cause of the “collapse of the wavefunction” during a measurement.

But Gödel’s incompleteness theorem put an end, not to the “*belief in the exactitude and reliability of mathematics*” but in the belief in the *completeness* of mathematics. And we would not express out thesis as “*affirming the metaphorical foundation of science*”. Nor do we think that “*to understand a connection fully the only way possible is to speak of it in images and parables*” (since a “full understanding” is prohibited by Gödel’s theorem). We had intended to explain what we meant by “metaphor” by using the citations from Iris Murdoch, but clearly we did not succeed sufficiently well in this.

Although the topic of poetics of physics has been addressed, it could still be explored from some other innovative angle, as this reader expected when first approaching this work. What was found, however, was not so much a new articulation of the thesis —physics is poetry—, but a tautological repetition of it substantiated with too many references to what other critics have said about it directly or indirectly. The author quotes a great many sources as applicable to the discussion, but his or her own view remains obscure. The author seems to assume that most physicists work on the belief that there is a reality out there, that the world is precisely knowable. When he refers to Niels Bohr and his remark about being suspended in language (quite pertinent to this essay!), the citation is done through Karen Barad who, in turn, cites Petersen. As a result, the reader is not enlightened with new knowledge, but rather with a feeling of confusion about how to process the proliferation of quotations. Footnotes are often so long that they constitute an essay by themselves.

We apologise both for the profusion of quotes and for the extensiveness of the footnotes. It seems clear that the treatment is compressed too much. We do tend to agree with the Reviewer’s view (shared by the Editor) that our work is more suited to the form of a monograph than to a journal article. Intelligibility is lost if the argument is over-compressed.

But we are surprised that the Reviewer found that our own view was “obscure”. We are surely right to think that “*most physicists work on the belief that there is a reality out there*” (noting that we point out that this belief is not usually explicitly articulated), but nowhere did we assert “*that the world is precisely knowable*”: we must assume it is “*knowable*” to do science at all, but we had thought that we had gone to some trouble to make it clear that we thought it was irrational to believe that the world could be “*precisely* knowable”.

And when we cite Neils Bohr through Barad and Petersen we are only crediting our own thought to those with precedence. Bohr’s opinion is not sufficiently well-known, and it would appears distinctly counter-intuitive were credence given to current (crude) theories of the “scientific method”.

Our thesis is not “*Physics is Poetry*”: we carefully deny this! It seems to us that here the Reviewer oversimplifies to the point of absurdity. We say that *poetic language* is needed to grasp the meanings of physics, and therefore that C.P.Snow’s view of the “*Two Cultures*” as a major handicap to thought (and lots of other things too!) is correct and remains pertinent. Of course, the Reviewer is quite right to say that this view is today a commonplace; however, nothing has changed since a generation ago – Snow’s observation that “*the great edifice of modern physics goes up, and the majority of the cleverest people in the western world have about as much insight into it as their neolithic ancestors would have had*” remains as true today!

In all this discussion and proliferation of quotes there is, however, the absence of specific references to poetic texts and / or metaphors articulating the language of physics. The author asserts that in writing this essay s/he has had in mind McLuhan’s 1964 book *The Medium is the Message*, however the <<medium>> is somewhat missing or barely represented*.* This reader would have liked and expected to see specific texts in which the fields of physics and poetry intertwine. When Einstein developed his famous formula E=mc2, he founded it on a view of the cosmos that was poetic in itself, which leads to an important point in a work focusing on the poetics of physics: the consideration of how formulas and equations work as metaphors. Newton’s law of gravitation offers a perception of the apple (whether the scene in his garden is a fact or a legend) that is in itself poetic because it views the fruit in a new way, providing the apple, condemned from Genesis, with an entirely new semantic dimension. Faraday in turn developed another metaphor when fusing electricity and magnetism, and the list goes on.

It seems to us that our thesis is misunderstood when the Reviewer “*[considers] how formulas and equations work as metaphors*”. What is meant by “metaphor” here? Does the Reviewer intend a mental model of the thing-in-itself as the reality represented by the scientific equations, which is then “explained” at the level of metaphor? That is, is it that there is a reality (touched by the formulae) and also some approximation of it, more or less, given by the metaphor? What is fundamental? Viewing gravitation through the apocryphal story of the apple does not illuminate the reality usefully in our view. It seems to us that the Reviewer underlines the “red-herring” nature of this purported metaphor when we are reminded of the Genesis story (which surely was not in Newton’s mind!). Creation and salvation are very much bigger ideas than the mere movement of the planets, and the generalisation and interpretation of Kepler’s Laws.

The issue is the ontology of things, together with our epistemology of them. How do we touch reality? It is not a matter of mere metaphor! We don’t want to have to say, it’s *like* this; we want to be able to say, it *is* this! We are certain that Newton, Faraday and Einstein all understood this perfectly, but it is very hard to explain to people today both because the *Two Cultures* remains firmly sewn into our perceptions, and also because we have had a generation and more of propaganda on what the “*Scientific Method*” actually is. Of course, this is a very big subject that we only nodded at in our treatment: the Reviewer is right that the *medium* is inadequate.

Despite the many citations in this work, this reader has missed some that seem totally relevant. For instance, the author’s approach is clearly transdisciplinary, although it is not described as such anywhere. The reading of Basarab Nicolescu regarding transdisciplinarity would be a required addition to this essay, while the reference to the two cultures —specifically Charles Percy Snow’s 1959 lecture—is a commonplace in this field that in an academic paper requires no more than a passing mention.

Of course, we do only mention Snow in passing. But we do not share the Reviewer's view of the value of Basarab Nicolescu's idea of "transdisciplinarity", although it is plain that this ought to have been cited too, and discussed to a certain extent.

When dealing with intuition and inspiration as basic ingredients in both poetry and physics, the name of Henri Poincaré is peremptory but missing in this work. This author’s very appropriate appeal to imagination to be able to see new things seems to correlate with Archimedes’s <<Eureka>> or <<dawning>> moment that scientists like Poincaré (the coffee, stumbling, and Fuchsian theorems) and writers like Proust (the madeleine, tea, and memory) have so convincingly described. It would afford another specific instance of correlating poetry with physics.

We thank the Reviewer for so kindly acknowledging our “*very appropriate appeal to imagination to be able to see new things*”. His/her encomium on Poincaré reminds one of George Szpiro’s article: *Mathematics: Poet of the infinite* (Nature, 2012), a brief review of Jeremy Gray’s biography (2012). Perhaps in a longer treatment we could include further examples, but the subject of (scientific) imagination has already been covered very well by others, including by Tom McLeish to whom we refer at length.

In accordance with the name of the journal to which it has been submitted, *Synthese,* this reader advises the author to synthesize his essay focusing on the following points:

-clearly state once the thesis and how it enriches the existing knowledge on the topic

-develop what the transdisciplinary approach means as support for the thesis

-provide specific examples in texts from physics and poetry that illustrate the stated thesis

-bring to the fore (not at the end as an appendix) the Hebrew tradition as the main example of the antiquity of the thesis (this could even be the focal point of the essay because of its novelty)

-elaborate a bibliography at the closing where the many works that are cited appear organized according to topics thus providing readers with a very practical tool to further the discussion and research.

This reader surmises that the author of this essay may be a very diligent graduate student who has covered dutifully all the available bibliography on the topic. The tendency to refer to etymology and dictionary definitions points to a European tradition in which erudition is highly valued, perhaps above the critical elaboration of the thesis. These assumptions may be wrong, but they are expressed as possible explanations for the foci in the essay.

Obviously, a “bibliography” implies a much longer work. Reiterating: we agree with the Reviewer (and the Editor) that the journal article is not really the appropriate medium for this topic.

We are encouraged that the Reviewer agrees with us on the antiquity of this view of knowledge, represented here by the Hebrew poetic tradition.

We also accept that the present compressed form of the work has not enabled as much lucidity and intelligibility of exposition as is desirable. This has encouraged the unfortunate impression that “erudition” has been prized over clarity.