Expanded Science

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> "If truth were not the objective of philosophy, the Grimm brothers would have been the biggest philosophers in the world" (Jocax)

Abstract: *initially, in this article, we present the foundation on which current science stands. Next, we explain the main stream of modern science, the "Popperian Falsificationism", and show why the current criticism to the system is flawed. Later, we will prove that the "falsificationism" is logically inconsistent and we will propose a new concept of science, unifying it with philosophy.*

1- The objective of Science

Science has truth as its only objective. This objective is essential to any tentative of classification in science.

2- Basic Postulates of Science.

2.1- Compatibility with the Facts

The Truth in science can be defined as "all information compatible with reality". The term "compatible with reality", in our definition of truth, must be understood as "according to the facts", never in contradiction to them. This way, "compatibility with the facts" provides the empirical feature of science, as it links the scientific truth to the reality of the facts.

2.2 – The Universe is Logical

Likewise, we must also take the fact that our universe is logical as a scientific postulate. That is, the universe – defined as the set of all that exists – does not present logical contradictions between its element and laws. It must, therefore, follow the classical logic (aristotelic). Such an assumption is important because no illogical events have ever been verified in the universe. Secondly, if contradiction was allowed, science would be "trivialized", that is, every kind of affirmation would be true, even if it was absurd, since a logical system with incompatible premises necessarily implies that any proposition is true. In the appendix 'A', at the end of this text, we prove that the proposition "the universe does not exist" can be logically derived from a logical system that presents contradictory premises. Some usual definitions of science can be found in the appendix 'B'.

3- The scientific method

The set of rules with which science seeks knowledge (information considered 'true' or highly reliable) is what we usually call "Scientific Method".

3.1-"The Deductive Method"

The deductive method comes from the assumption that the universe is logical, so the logical inferences can be applied to scientific theories in order to extract other theories which, by logical consequence, should also have the same degree of reliability. The basis of the deductive method is the logical syllogism known as "modus ponens" [8]:

H => D (If "H" implies "D")
H (and "H" happens, i.e. H is true)
=> D (We can conclude that "D" will also happen)

This rule can be summarized in the following tautological formula:

((H => D) ^ H) => D
(If "H" implies "D" and "H" happens, we can conclude "D").

Example: "If all geese are white" and my aunt has a goose, I can conclude that it is white. Thus, from the general theory H: "all geese are white", we can extract the particular theory D, "my aunt's goose is white."

3.2-"The Hypothetical Deductive Method"

One of the most important rules of the scientific method, "The Hypothetical-Deductive Method" is based on the logical tautology known as "Modus Tollens" [7]:

H => D *(If "H" implies "D")*
~ D *(and "D" does not happen, i.e. D is false)*
=> H ~ *(We can conclude that "H" did not happen)*

And it can be summarized in the following formula:

((H => D) ^ (~ D)) => ~ H

(If "H" implies "D" and "D" did not happen, we can conclude that "H" did not happen).

Which can be interpreted as follows: "If 'H' implies 'D', and 'D' is false, we can conclude that 'H' is false."
As an example: If "all geese are white", it implies that my aunt's goose should be white,

but, in fact, my aunt has a red goose, so I can conclude that 'all geese are white' is a false theory.

Thus, in order to investigate a theory "H" under the conditions in which this theory implies the consequence "D" , if this consequence is not verified, that is, if the conditions where H is true the consequence "D" is not true, we can conclude, logically, that the theory "H" is not true (it is refuted). This is an important result since it becomes unnecessary to investigate directly theory "H"; investigating its consequences ("D") to conclude about "H" should be enough. Of course, if "D" is observed we cannot conclude that "H" is correct, but "H" will be “stronger”, that is, with a higher degree of reliability, having passed the test.

It is important to note that the scientific methodology comes directly from the postulate that the universe behaves logically. If it were not so, neither the hypothetical-deductive nor the deductive method could be justified.

The "Inductive Method", or simply induction, is not strictly considered part of the scientific methodology, as it goes from particular events, or samples, to derive general theories. Thus, we can never claim that what came from an induction is true simply because it came from an induction. For example: "All geese I have seen in my life are white, then, can I conclude that all geese are white?" We cannot. "The sun comes out every day since mankind exists. Can I conclude that this will happen forever? "We also cannot.

Nevertheless, we cannot put the "inductive method" in the ostracism because, although not very reliable, it provides us with important clues to connect our mind to reality. No scientific theory would have been discovered without induction. What are the scientific observation and the empiricism if not an inductive method to get to hypotheses of a general nature?

If we do not understand the "inductive method" as a criterion for evidence of scientific theories, but as a method to provide hypotheses for theories or ideas, it can be considered valid and very precious. Isaac Newton, for example, would not have discovered the law of gravity if he had not seen the attraction of matter. Einstein would not have created General Relativity if there were not experiments showing that the speed of light was constant.

*4-**The Origin of Scientific Theories***

It is important to note that science does not make any restriction on the origin of scientific hypotheses or theories. [We will consider, in this text, hypotheses and theories as synonyms. In general, a theory begins as a hypothesis, and after several tests, if it manages to pass unscathed, it receives the ‘status’ of scientific theory. However, a

'brand new' hypothesis can be true while a very old theory can be false (do you remember the theory about the Earth being the center of the universe?). This way, with all the logical and scientific rigour, a theory is not necessarily more valid than a hypothesis. New theories can be achieved through induction (which is the most used method), but they can also be achieved through pure imagination, or even dreams [9]. There are no restrictions to create hypothesis. The theories are not refuted by looking at their origins, but at their consequences.

*5-**Pseudo-Sciences***

There are no restrictions about the origin of scientific hypotheses. A priori, No hypothesis or theory can be discarded only because it was produced from induction or empirical observations. Although this scientific freedom of creating hypotheses can be enriching, since no one is prohibited from creating new and revolutionary scientific theories, it causes, in a terrible contrast, abundance of illogical and absurd theories and hypotheses that reclaim the status of scientific theory: they are the famous "pseudo-sciences."

*6-**Popper and the Falsifiability Criterion***

The postulates and scientific methods described herein are adopted, if not explicitly, at least implicitly, by nearly all scientists and philosophers in science. However, they are yet not sufficient to accurately delimit what is scientific and what is not, or to separate science from pseudo-science.
We will take, as an illustrative example, the "Green Imp Theory" (GIT): "There is always a 'green devil' hovering over each person's shoulder, but whenever someone tries to look at it, or makes any attempt to detect it or record it somehow, it will get invisible and undetectable. " This example proposes a theory that does not go against any scientific postulate and is not inherently inconsistent, what could be enough reason to reject it, but nevertheless, we are unable to test this theory. So what do we do?

The first philosopher who tried to clearly demarcate what is science and what is not was Karl Popper (7/28/1902-9/17/1994) [1]. Popper delimited science by adding the following criteria to it [10]:

1-No scientific theory can be proved true.
2-A scientific theory can only be proved false.
3-A theory which cannot be refuted is not a scientific theory.

Thus, with this new set of postulates, Popper introduced the 'falsifiability' (or 'refutability') as the main criterion of distinction between scientific and unscientific theories. The 'refutability' of a theory means that, in principle, the theory is liable to be

distorted and thus be or not refuted (Modus-Tollens would be a way to refute a theory). For example, when analyzing the case of our ‘Green Imp Theory (GIT) above, we now realize it is not a scientific theory, since it is a theory that cannot be distorted neither directly or indirectly; therefore, it is not refutable and cannot be a scientific theory.

It is important to reinforce the idea that there is no "confirmation" of a scientific theory. If a theory passes the tests, it is said that the theory was corroborated by the tests; never confirmed by them (in the sense that it has been proved true). When a theory is corroborated, it only gains reliability, because by the criterion (1) above, no theory can be considered true:

"The science method consists of daring ingenious conjectures followed by rigorous attempts to falsify them." Only the aptest theories survive. It is impossible to legitimately say that a theory is true; one can say with optimism that it is the best available, better than the ones that already exist "[3]

In spite of the “popperian” ingenuity about delimiting science, the criticism was abundant.

6.1-Critique and Defenses on the 'Popperian Falcificacionism'

The main criticism to the "Popperian falsificationism" is that the tested theory is always inside an environment which conditions cannot always be fully controlled or evaluated. Thus, there can be a "false negative" in relation to its validation, and the theory can be prematurely discarded. For example, suppose we want to test the theory "All geese are white" and for that, we try to refute it by observing with binoculars, cameras and other observation paraphernalia, several geese spread over the world. Finally, an observer is able to shoot from far away, a brown goose flying along with his flock of white geese. Now that he has this evidence, it is possible for him to refute the theory. But what if the goose was only dirty with earth? Would we be prematurely dismissing a true theory?

This critique to the "Popperian falsificationism” is valid; however, it can be easily refuted with the following argument: if this theory was unfairly distorted by a misled or even fraudulent observation, this observation did not really act as a refutation of the theory. A false refutation is not a refutation. Likewise, we cannot invalidate the justice system simply because someone can present false evidence to condemn or acquit a defendant. If the rebuttal example is not valid, and the theory is unfairly rejected, this, as a single element, does not diminish the merit of the falsificationist criterion; it only states that we must be very careful with the tests and, moreover, it will always be possible to try to refute your own rebuttal. That being done, the theory can be "reborn" and reconsidered valid. If not, it should remain in the limbo of refuted theories waiting for a possible counter-rebuttal that might come in the future, if ever.

A second type of criticism, also widely used, is that "falsificationism" does not follow what the history of science has shown. If we analyze the evolution of science from its historical development, we will not find the rationality that Popper tries to impose to it. But this critique does not make any rational sense, because this would be like saying we should not create remedies in laboratories because if we study human evolution, mankind has always survived and evolved without any medicine. It is not rational to claim that we should keep a certain modus operandi simply because in the past it has always been so. However, despite the criticism to Popper is subject to refutation, there is in fact, as we will see next, a logical inconsistency in the “Popperian” criteria. And that is fatal to science and also to the "popperianism".

6.2 Refuting Popper

Although the historical criticism to the popperian “falsificationism" is refutable, since they do not really affect the falsificationist process logic, the postulates introduced by Popper are actually inconsistent. And the internal inconsistency in science is simply fatal. In order to prove that, we will consider the first two criteria proposed by Popper to demarcate a scientific theory:

i) No scientific theory can be proved true (confirmed).
ii) A scientific theory can only be proved false.

Taking the basic postulate that science seeks truth and not necessarily the usefulness in the theories, even because the "usefulness" of a theory is subjective, we should take the postulate (i) not as a condition for a theory to be scientific, but as an impossibility of proving it true.

If we interpreted the postulate (i) as a condition for a theory to be scientific, many theories that could be proved true would be considered anti-scientific in spite of science seeking the truth! That would be a complete nonsense. Therefore, we must interpret the postulate (i) not as a condition to which theories must obey to be considered scientific, but as an impossibility of being sure of what the ultimate essence of reality is. We cannot, for example, even prove that solipsism [14] is false: any information that reaches our consciousness could be only an imagination of a reality that actually does not exist. Could anyone, for example, prove we are not dreaming?

We do not need, however, to reach the limits of epistemology to understand why we cannot be absolutely sure of the veracity of a scientific theory: It is impossible to know whether we have, in fact, knowledge of every possible condition that influences the applicability of a theory. Without making these conditions explicit, the theory may not be valid in certain contexts in which the conditions cannot be verified. As an example, consider the theory "water boils at 100 degrees Celsius." This theory is valid only under conditions of adequate pressure (1 atm), otherwise it is false. Thus, a more correct theory would be: "Water boils at 100 degrees Celsius at 1 atm pressure." Do we have now all the necessary conditions? What if water is composed mostly of heavy hydrogen atoms (deuterium)?

Let us now change focus and show the inconsistency of the criteria (i) and (ii):

Consider the following theory: "This shoe box contains a frog."
This theory is not very useful but, for now, we are not concerned about the usefulness of theories, we are concerned about its veracity. If we open the shoes box and find a frog, what can we say? Can we consider the theory true? Would that refute Popper's postulate (i)? These matters are not trivial, since it is possible to say that what we see is not a frog but a toad, or that it could be an optical illusion or even a dream and therefore, we cannot claim that the box contains a frog or that the box exists. Indeed, these philosophical claims can keep the criterion (i) unharmed; however it contradicts the rule (ii) "A scientific theory can only be proved false". If not, see:
If a theory can be proven false, then it is also true that its contradiction can be proven true.

At the very same time a theory is proved false, the theory that denies it is being proved true. Here, the sense of the word "prove" has the same connotation as to prove a theory false or true. As an illustration, consider, for example, theory A: "All geese are white." If we can prove this theory false by presenting, for example, a red goose, we will be at the same time proving that theory B "Not all geese are white" is true!

However, if we philosophically accept the fact (i) to be true, that is, if we admit that we cannot be sure about the ultimate truth of reality, then, strictly speaking, we can never say that a theory can be proved false, because if a theory "T" can be proved false, the opposite theory "Non-T" (denial of "T") can be proved true, that is, we would have the theory "Non-T" as an absolute truth . Anyhow, we conclude that the "Popperian falsificationism" is intrinsically contradictory, and that makes it easier for a new theory about science to be elaborated.

*7 - **"Expanded Science " or "Ocanian Science "***

Science, just like philosophy, seeks the truth. It is then natural that they are unified, and this project aims to redefine science and unify it with philosophy in a knowledge area I called "Expanded Science" or "Ocanian Science".

As truth is the only goal of the "Expanded Science"(ES), it should not be restricted to the empirical sciences, although these are also part of the EC. However, the truth in the ES means all information compatible with reality, where reality is the set of events that happens or have happened. Propositions built on systems disconnected from reality do not matter to the ES.

If we take the words 'theory', 'hypothesis' or 'proposition' as synonyms, we can establish the following criteria to define the "Expanded Science, "Ocanian Science " or simply Science:

(i)-Only the propositions directly or indirectly linked to reality are objects of analysis for the Expanded Science .
(ii)-The propositions that most fit the "Occam's Razor" should be considered closer to reality than the others.

These two criteria compose the foundation of this new science. The criterion (i) intends to distinguish what is part of the expanded science and what is not. Criterion (ii) intends to classify the propositions in relation to their degree of veracity, that is, we must believe the best "ranked" theories are closer to reality than those that do not fulfill the *Occam's Razor* criteria.

We can observe that there is no longer the criterion of distortion, precisely because, strictly speaking, we cannot prove anything in terms of absolute truth (that is implicit in the criterion (ii)), and of course, we cannot even prove that something is false. Nevertheless, we can give a new meaning to the words "Proof" or "Rebuttal" if we understand them as related to the Occam's Razor.

Take the following illustrative example:
We find a shoe box and we notice there is a brick inside. What can we say about the theory: "Inside this box there is a brick"?
When we look inside, and notice a brick, would that be perfect evidence of its absolute truth? Incredible as it may seem, no! Actually, there are innumerable hypotheses which in principle could be true and would deny the proposition that inside that box there is a brick. We will consider some of them:

- The volume was actually of a battery radio imitating a brick.
- The volume was something that resembled a brick, but it was not a brick.
- That was not a brick because you are in a dream, imagining it.
- A momentary short circuit in your brain made you imagine a brick in an empty box.
- A new weapon with alpha waves was tested on you so you would imagine the brick.
- Someone created a holographic image of the brick so that you would think it was real.
- There are no bricks, since this universe is an imagination of a great consciousness.
- Etc.

Thus, we cannot undoubtedly prove that any statement about reality, as obvious as it may seem, is in fact, reality. However, by the criteria of the "Ocanian Science", we can use the Occam's Razor and give preference to the more plausible theories in terms of the "razor" and, that way, consider the proposition "the shoe box contains a brick" as the most appropriate of them, the closest to reality.

It is interesting to note that the "theory of the green imp" (TGI) cited at the beginning of this essay, which previously could not be approached by the Popperian science, since it could not be tested or falsified, now can be easily approached by the "expanded science": the theory of the green imp must be considered less true in relation to the

theory that there is no such imp, since the latter is more appropriate in terms of the Occam's Razor.

7.1- Some considerations on the "Occam's Razor"

The "Occam's Razor" establishes that we should not put unnecessary hypotheses in a theory. The term "unnecessary" is the key of the Occam's Razor: If we can explain a fact with fewer hypotheses, then it must be done. Extra hypothesis must be discarded. If several theories explain the same phenomena, we should give preference to the theory with the smaller subset of hypotheses. It is possible to show that the accretion of unnecessary hypothesis to a theory makes it become less likely to be true [11]. Thus, we can understand the Occam's Razor as a criterion of classification of the most likely theories. The theories that suit the Occam's Razor the most are more likely to be true.

Many refer to the Occam's Razor as the "simplicity" criterion, but this is dangerous. The "simplicity" in Occam's razor does not refer to what is simplest to understand, but to what is most likely to happen. For example: for some, saying that life on Earth was promoted by aliens may be much easier to understand than an explanation that uses random and unlikely shocks of molecules, but not more likely to happen, since the alien hypothesis would imply that it would be also necessary to explain the origin of these aliens' life added to explanations on how they would have acquired technology enough to get to our planet..That is, the apparent "simplicity" of the hypotheses of life being planted on Earth by aliens, contains, in fact, the complexity of the origin of extraterrestrial life, added to the complexity of an evolution faster than ours.

7.2-The Role of Evidence and the Classificatory List

We can define evidence as a fact in favor of a theory, as an event that corroborates a theory. Obviously, a piece of evidence may eventually also corroborate rival theories. A white goose, for example, may corroborate the theory "all geese are not black" as well as the theory "all geese are not red." The more restrictive the evidence, in the sense of not corroborating rival theories, the lower the chances of the rival theories being true and the higher the chances of the theory corroborated by the evidence being true. If, for example, we notice a brick inside a shoebox, this brick corroborates the theory "a shoe box is not empty" much more than the theory "the shoe box is empty", since the extra hypothesis needed for the box to be really empty, while we notice a brick inside, are quite unlikely (although they may be true). Note that there is no longer an explicit rebuttal of the theories that were not corroborated by evidence; they are only moved to the end of the "Classificatory List" of the theories more likely to be true. Nevertheless, we can still use the word "rebuttal" or "distortion", if we understand them in a relative meaning, that is, a theory refuted by evidence is just a theory less likely to be true.

7.3-The Role of Logic and Scientific Methodology

All the evidence we have since we understand ourselves as human beings indicates that the universe follows the Aristotelian logic. Thus, if any theory, hypothesis, or proposition violates the logic, it will be going against this enormous and extraordinary "history of evidence" and should therefore be placed in the last positions in the "Classificatory List ". In practice, this is equivalent to a rebuttal. However, we can maintain the word "REFUTE" not in the absolute sense of the word - rejecting a theory forever - but to understand it as highly unlikely to be true. Therefore, we must consider our logical Universe the largest set of evidence we have, and then we can continue to use the Deductive Method (3.1) and Hypothetical Deductive Method (3.2) in the same way we were using before, except that the conclusions we reach cannot be considered absolute truths (simply because the premises used in the methods also cannot be considered absolute truths).

7.4-The Old Popperian Science

The Popperian criterion (i) "No scientific theory can be proved true" was kept, and is embedded in the criterion (ii) of "The Expanded Science "(ES), as this only refers to the degree of proximity to reality. The "Falsifiability" is clearly disposed in item (i) of the ES, since all propositions related to reality are addressed, not only those that can be falsifiable. However, the popperian "rebuttable evidence" still has a high level of relevance in the ES, precisely because it obliges the theories to put unlikely propositions - thus contradicting the Occam's Razor - in order to be coherent with the observed facts. For example: the theory "the shoe box is empty" needs some unlikely hypothesis to remain valid (as a brain 'short circuit'), if related to the evidence that we observed a brick inside the box. Thus, "rebuttable evidence" is still valid to throw the refuted theory to the last positions in the list of theories that are closer to reality.

7.5-Religions

If we define the universe as the set of all that exists, religions are also objects of the ES, since they refer to aspects of reality. Thus, they are also subject to classification by the Expanded Science, according to the Occam's Razor.

The 7.6- Solipsism

The solipsistic idea is that everything we observe, feel and believe is nothing more than an illusion of some consciousness (I) and, therefore, this reality we observe is false, it does not exist. As solipsism makes references to reality, it is subject to the Expanded Science analysis:
The hypothesis that the universe developed from a few physical laws and a finite amount of elementary particles that led it to produce intelligent life with consciousness requires much less hypothesis (and simpler ones) than those required for the existence of such a being that would be able to imagine and relate every single detail of our imaginary world. Moreover, we would also have to solve the problem of the origin of a

being with such complexity [13]. Therefore, by the Occam's Razor, solipsism must be pretermitted in relation to a universe that is not imagined or virtual. That is, now and not before, we can scientifically "discard" the solipsistic hypothesis.

7.7-The Jocaxian Nothingness

The hypothesis that the universe, including the laws of physics, was generated from the Jocaxian Nothingness (JN) [12] (a nothingness without physical elements or laws) is now considered a scientific hypothesis, since it refers to our reality: the origin of our universe. As the JN is the simplest hypothesis about the origin of the universe that respects the Kalam's Argument [13] ("An infinite time in the past could never lead to our present, since it would take an infinite time" = never), it should be one of the theories that are closest to reality according to the Occam's Razor.

7.8-The Philosophy

As Philosophy seeks the truth dealing with ideas and concepts, ultimately, related to reality, it is also part of the Expanded Science.
Thus, we propose the unification of Science and Philosophy, in this new branch of knowledge: The Expanded Science.

Appendix A

Evidence that contradictory premises imply that any conclusion is true, even that "the universe does not exist":

1) Premise 1: "A" ('A' is true)
2) Premise 2: "~ A" ('Not A' is true)
But: "A ^ (~ A) => FALSE '('A and not A imply False', Logical Tautology *)
So, we can conclude from 1 and 2 (by modus ponens):
3) "False" (concluded 'false')
But: "False => Anything" ("False implies X ', X is any proposition; it is a Logical Tautology)
Assigning 'X' (or 'Anything') the proposition "he Universe does not exist," We have:
4) "False => The universe does not exist"
From 3 and 4, we can finally conclude by modus ponens:
5) "The universe does not exist"

That is an absurd.
This example shows that from contradictory premises we can prove any absurdity.

(* Tautology is an absolute logical truth; that is, a truth that does not depend on the

value of variables.)

Appendix B
Some definitions of science found on the Internet
Science:

* Rational investigation or study of nature directed to the discovery of the truth. Such investigation is generally methodical, or according to the scientific method, a process for evaluating empirical knowledge.
* The organized collection of knowledge acquired through such investigation.

Science is knowledge or a system of knowledge that covers general truths or the operation of general laws especially obtained and tested through scientific method. Scientific knowledge depends upon logic [2].

The scientific method is a set of basic rules for a scientist to develop an experiment in order to produce knowledge, as well as correcting and integrating pre-existing knowledge. It is based on gathering observable, empirical and measurable evidence, based on the use of reason [6].

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Portuguese version: http://stoa.usp.br/cienciaexpandida/forum/39474.html