On the Role of Predictive Power in the Demarcation of Non-Scientific Theories

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31/03/18

The criteria by which a *scientific* theory can be demarcated from a *non-scientific* theory has been under question for the past century. Some philosophers, among them Rudolf Carnap, hold that a theory is *scientific* if and only if it is *verifiable* in principle. Others, including Karl Popper, hold a different view, claiming that a theory is *scientific* if and only if it is *falsifiable* in principle. I claim that these two opposing standpoints are not mutually exclusive; in fact, I argue that *both* must be used in order to determine if a theory is *scientific* or not. Additionally, I claim that there is an additional criterion that must be satisfied before a theory can be called *scientific*; in particular, I claim that it must contain a degree of *predictive power*.

Popper claims that a theory can only be deemed *scientific* if it imposes restrictions on the set of all possible events. That is, the theory must divide the set of possible events into two classes: the class of *prohibited* events (which, if observed, will falsify the theory), and the class of *permitted* events (which, if observed, will corroborate the theory) [1]. Carnap, on the other hand, claims that a theory is *scientific* if and only if it is *cognitively meaningful*, and that a theory is meaningful only if it is empirically verifiable, or else it is a tautological statement. In this way, theories that are neither tautological nor empirically verifiable − such as the statements of metaphysics − are deemed *non-scientific* and thus carry no truth value [2].

Let us examine a historical example to allow me to better illustrate the non-exclusivity of Popper's and Carnap's views of demarcation. We will compare Charles Darwin's evolutionary theory with the religious belief of Creationism. To simplify our argument, we will use "Darwin's evolutionary theory" as a broad encompassing term to represent the theories derived from Darwin's explanation of variation in species (in particular, this term does *not* include the current evolutionary theory, which restricts events through statistics and gene expression). Additionally, for further simplification, we will adhere to the biblical creation narrative that God created the Universe, as well as all living beings (including the first man and woman), in six days [3]. Here, Creationism imposes restrictions on the set of all possible events (in the sense that, for example, if it was somehow determined that several living beings were created by God on the *seventh* day, the theory would be falsified). However, it can be argued that Darwin's evolutionary theory does not prohibit any events, for if an observation was made that was not consistent with Darwin's evolutionary theory, we would not say that it has been falsified. Rather, we would say our previous understanding of evolutionary mechanisms was not complete, and we would adjust our theory accordingly. Thus, according to Popper's view of demarcation, Darwin's evolutionary theory is *non-scientific*, while Creationism is *scientific*.

Now, it can easily be seen that Creationism cannot be verified, not even in principle, for one property of God is that he transcends all of time and space. There is no way his role in creation can be empirically verified, and thus Creationism is cognitively meaningless. Darwin's evolutionary theory, on the other hand, can feasibly be verified via observations. For example, we observe that human beings have numerous vestigial structures (consider, for instance, the coccyx, or tailbone [4]), so it is reasonable to conclude that our descendents were other primates or aquatic mammals [5]. Thus, according to Carnap's view of demarcation, Darwin's evolutionary theory is *scientific,* while Creationism is *non-scientific.*

From this, it appears (though, of course, I will elaborate further) that Carnap's views and Popper's views are irreconcilable. Carnap claims that Darwin's evolutionary theory is *scientific* and Creationism is *non-scientific.* Popper claims the opposite. Which one is correct, if even one of them is correct? At first thought, it may seem

as if Darwin's evolutionary theory is *scientific* (perhaps by reasoning that since it is (or was) accepted by the vast majority of the scientific community, it *must* be scientific), while Creationism is *non-scientific* (perhaps by, from the same line of thought, realizing that it is only taught in religious schools, or otherwise in extremely specific contexts). Thus, it may appear as if Carnap's demarcation criteria is more suitable, and we can at last lay the historical question to rest.

In fact, I argue that Popper's demarcation criteria must not be dismissed so quickly, since there are grounds for its existence. If a theory cannot be falsified, then how much worth does that theory have? If the theory does not prohibit any events from happening, or if it does prohibit events but cleverly includes a kind of "escape mechanism" in case such a prohibited event is observed, what use is that theory in the growth of knowledge? A theory, in order to be scientifically valuable (which I will hold is identical to saying that it is *scientific*), must somehow *inform us about the world*. It must say that "such-and-such is how the world behaves", "such-and-such is how the world does *not* behave", "such-and-such is *why* the world behaves the way it does", and "such-and-such is how the world will behave in the future". In other words, a *scientific* theory must be *both* verifiable and falsifiable (it must be *scientific* in the views of both Carnap and Popper). Additionally, the theory must hold both explanatory and, more importantly, predictive power (I also argue, though I will not attempt to justify it, that these predictions must be testable). Only then can the theory hold value in science and be considered *scientific*. If Darwin's evolutionary theory can only tell us what happened in the past, and additionally can be modified in a certain way to account for virtually any contradictory observation that may surface, how different is it from, say, history? I claim on these grounds that both Darwin's evolutionary theory and Creationism are *non-scientific*.

Let us first consider Darwin's evolutionary theory. As we had previously seen, this evolutionary theory is not falsifiable; if an observation were to arise that conflicts with our current understanding, scientists will simply modify the theory in a certain way in order to explain the anomaly, and leave it at that (consider, for instance, the popular "Precambrian rabbit" argument – if a fossilized rabbit was found that dated back to the Precambrian era, we would not immediately reject Darwin's evolutionary theory, but instead look for other ways to explain this prominent anomaly [6]). I argue that, in addition, Darwin's evolutionary theory does not provide us with any predictions about the future. For example, it is impossible to determine, or even speculate on, what kind of creatures will come into being, say, five million years from now. Though Darwin's evolutionary theory does have *explanatory power* (vestigial structures were a previously cited example), it does not have *predictive power*, and thus I claim it is not a *scientific* theory. The argument for Creationism has a similar conclusion – although it is falsifiable, it again does not have predictive power (in fact, I am hard-pressed to find even some degree of explanatory power within Creationism) nor is it verifiable, and thus it is also *non-scientific*.

Of course, this begs a question. Since Darwin's evolutionary theory and Creationism were both intended to explain how the forms of life on the Earth came into being, but they are both *non-scientific*, what would a *scientific* theory that explains the same phenomena and makes predictions about the future look like? For the sake of argument, instead of considering a completely new theory, I will examine modifications to Darwin's evolutionary theory. As we have seen, the explanations given by the theory are empirically verifiable but not falsifiable. Thus, adjustments must be made to the *scope* of the explanations provided by this evolutionary theory, and these changes must be accompanied by a willingness (or better yet, an eagerness) to dismiss the theory if an instance of "Precambrian rabbit" should arise. Otherwise, the theory will become *non-scientific*. It is more difficult to speculate on how Darwin's evolutionary theory can be modified to hold predictive power. The currently accepted evolutionary theory, which had been briefly mentioned prior, is one example of how this can be achieved. In

short, this theory presents a concept known as “genetic drift”, which is capable of predicting the gene expression of a species across generations. I claim that once evolutionary theory is able to make testable predictions about the future using this method, and the entire theory is falsifiable, then it will at last become a *scientific* theory.

In conclusion, Carnap’s demarcation criteria and Popper’s demarcation criteria are not mutually exclusive; in fact, both must be used in order to determine if a theory is *scientific*. A theory is *non-scientific* if *either* of them say it is *non-scientific* (that is, if the theory is not verifiable or not falsifiable). Furthermore, a *scientific* theory must have not only explanatory power, but predictive power as well. Due to these criteria, both Darwin’s evolutionary theory and Creationism are *non-scientific*.

Bibliography

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