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## Theoretical Entities and Their Existence in the World

The main argument from the first side of this debate is that theoretical entities, that is unobservable phenomena, exist on their own in the world rather than just in the minds of humans in order to make sense of the world. Jarrett Leplin, who focuses on this issue in Chapter Five of *Contemporary Debates in the Philosophy of Science*, takes a realist, or more specifically scientific realist stance in this argument. This issue is not to find whether all theoretical entities exist, but which ones exist in accordance with the theories that science currently accepts as most probable. The reason we do not take all theoretical entities into existence with this view is because many past theories have been falsified in science, and as we search for truth in this field, we should accept only the theoretical entities that are part of widely accepted theories that have wide predictive success (that is, many studies have been conducted on them and their existence, most if not all of which “prove” that it is true). Leplin sites the existence of electrons, fields, and gravity as some of the most widespread theoretical entities in the world. The realist argument for the existence (independent of minds) of unobservable entities that scientific theories posit follows this structure:

- 1) We observe that science is successful
- 2) There are 2 possible explanations here; realism and anti-realism
- 3) Realism is the better explanation
- 4) Therefore, realism is more likely to be true

It would be difficult to come across someone that would argue that gravity doesn't exist in the world, which is a stance that the scientific anti-realist would have to endorse as they hold that any entity that cannot be observed through the senses cannot exist alone in the world. Leplin even goes as far as to insist that "to reject realism... is to reject science itself." Leplin also brings up the fact that electron is a term that refers to something that has properties such as mass, charge, and spin, all of which do exist, so something with these properties must also exist in some physical sense, whether we can observe it or not. Overall, the realist's side of this argument is that with theories comes theoretical entities, and if a theory has been predicted successfully in scientific studies over and over again, whether we can observe them or not, then they must exist. Otherwise, we may have to throw away some of the longest lasting and most accepted theories in science today.

In the contrary argument, Andre Kukla and Joel Walmsley argue in *Contemporary Debates in the Philosophy of Science* that, no matter the success of a theory and its postulates, we cannot have any warranted belief in unobservable entities. Leplin's immediate argument against this anti-realist view is that it cannot account for the past and current successes of science. However, Kukla and Walmsley argue that having successful theories is not enough to tell us what part of the theory makes it successful. They also bring up that the realists' "A explains B" is vague, and does not tell us whether A is an explanation of B or is the explanation of B. In standard form, the anti-realists' argument from here on may look something like this:

- 1) Neither truth or truthlikeness (approximate truth) cannot explain the success of science, because the "true" theories of the past are no longer thought to be true (by most).
- 2) Many past theories have failed to be true or truelike

3) There must be some acceptable explanation for these past theories that are not the “truth”, or that success may sometimes have no real explanation.

4) Therefore, if true theories cannot account for scientific success, then how can true theories account for unobservable entities that may just be an explanation as opposed to the explanation. The authors bring up that the realist may fight back by saying those past theories may not have been fully true, but they were truelike. This strategy, according to the anti-realist, fails because it brings up the issue of how liberally do we say something is approximately true, and where is the line of what is not true and what is truelike. The realist can also say that theories of the past that are no longer true are also not scientifically successful. This, however, brings up the problem that at the time they were thought to be successful and that then we have no way of knowing that our theories now are actually successful if the same may happen to them in the future. The main argument of Kukla and Walmsley here is that it is silly for us to believe in unobservable entities that today’s true theories posit, regardless of scientific success, because truth is subjective to time and we have no way of knowing how the truth of these theories will hold as time goes on.

Although the definition of success in science is an argument of its own, for the purposes of this paper I will be defining success in terms of four different concepts; predictive power, productivity, coherence with other accepted theories, and parsimony. Not every theory that is scientifically successful will meet all four of these criteria, however most will meet at least more than one. The no miracles argument, given in standard form earlier in this paper, is one of the main arguments given by the realist in support of the existence of theoretical entities. Although this is the side of the argument at hand that I am sympathetic with, I can understand where within these premises one could see possible concerns. Premise one relies heavily upon the fact that

science is indeed successful for the rest of the argument to be sound, however some anti-realists may argue that the science we observe today may not be successful. Scientific theories of the past that were once considered successful are often no longer considered to be so, so how can we differentiate if currently successful theories are any different? Can we know for sure that our current successful theories will still be successful in 100 years, and if not, should they even be considered successful now? Suppose we still assume that the science that we observe today is successful, from here it follows that realism is the better explanation. The realist's reasoning for this is that if the anti-realist view were true, then all of science's successes would be coincidence (i.e. a miracle), and that this is obviously a bad explanation for science's continued successes. How could so many seemingly successful scientists and philosophers from across time posit a common idea that doesn't exist? Rather than believing in miracles, realism gives us a way to explain the unexplainable scientifically and in a way that follows the traditions of science since early on. Theoretical entities have been common ideas in science since ancient Greece, and the realist may argue that these entities would not be a naturally recurring idea in science if they didn't exist. However, we know now that many of the theoretical ideas posited in ancient Greek thought do not exist, and the belief of something throughout history (for example, religion) does not prove its existence independently of the mind. Overall, although the realist may have historical backing as a valid explanation for scientific success, the anti-realist view has parsimony and observation on its side, two things that the realist view lacks. Still, even if realism is more likely to be true, that does not say explicitly that it is the true explanation, even if it seems better to some. Underdetermination says that the evidence that you have is not enough to eliminate all but one theory, and I feel that this idea is a fair critique of realism and the no

miracles argument because of the underlying possibility that realism being a “better” theory is not enough for it to be the only theory. This idea brings down premise 3 of the realist argument, as “better” can be objective, and if two theories each meet a different two out of four of the criteria for a theory to be successful, how do we decipher which is better? Realism being a better explanation relies heavily on everyone having a universal meaning of what is “better”, which seems unlikely. I could hold a parsimonious theory much more dearly than a theory with predictive power, but that may not be the case for another scientist. Underdetermination seems to break apart the notion that any one theory can be simply “better” than another. Although I do find this idea challenging to the realist view, if the realist could somehow retaliate with how they define better and why exactly realism is better, I think this view does still hold a chance.

The anti-realist does awake valid skepticism of realism, however there are impurities in the anti-realist argument as well. My main critique is with premise two for similar reasons that I critique premise 3 of the realist argument, and that is how vague the terms true and truelike seem to be in the case of scientific success. While science progresses, how wrong or not “truthlike” do the theories of the past have to have been to be considered unimportant? It seems to me like, even if the scientific theories of the past are no longer true, if they helped us to progress science to the point that it is at today then they were still helpful or in some way scientifically successful. Have these theoretical entities of the past been instrumental in forming a basis of today’s theoretical entities? If theoretical entities don’t exist, and those theories from the past are truly not successful, it seems as though it would follow that we would no longer use theoretical entities in understanding theories if they have such a history of being a part of unsuccessful theories. If every theory is an improvement from the last, it seems as though these theoretical

entities have been successful in progressing scientific discovery. The anti-realist believes that theories of the past that posit theoretical entities are not true or truthlike, however it seems as though if they were predecessors for more advanced and successful theories, that they held some sort of truth to them.

Overall, there are some problems to be worked out in both the realist and anti-realist arguments regarding the existence of theoretical entities, however, based on my critique of both sides, the existence of theoretical entities still seems more likely than not. With the backing of history and the progression of science to continue including these entities into their theories, it seems as though if they didn't exist at all they would have been removed from successful science by now. Although the anti-realist brings up reasonable concerns about the truth of past entities, it seems likely that on a spectrum of truth, these entities lean more towards that side based on their helpfulness to progressing science and their continuing to exist this far into the future. After evaluating both sides, it seems to me, still, that theoretical entities do exist and that their belief is warranted.

## References

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