PARADIGM WARS: COMPETING MODELS OF UNDERSTANDING

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Summary

Humans crave understanding. Science tries to deliver. But is it successful? What are the conditions that make it so? This is a hotly debated issue within the philosophy of science. Kuhn and others provide answers, but there is no consensus. Some assert while others deny that only naturalistic answers could be acceptable. Within any theory and within any philosophical camp there are numerous debates over the details of methodology. It is widely acknowledged that methodology evolves, but what drives it along? Do social and political factors play a role, and if so, must they undermine the ideals of objectivity? If so, what is left of our craving for understanding? These are some of the issues discussed in this chapter.

1. Introduction

We crave understanding. It may not be as strong as the craving for food, sex, or social status, but it ranks high in the list of things that motivate us. And when the aim of understanding is truth, then it is usually taken to be among our noblest impulses, along with the craving for beauty and goodness. But what is this thing, understanding, that we desire so much, and when is the craving for it satisfied? These are timeless philosophical questions.

We want to know, for instance, where we came from, how did life begin? One person reads the account in *Genesis* and comes to believe that God created the universe and all living things in six days. He finds this a believable account. He now understands and his craving is satisfied. Another reads Darwin's *Origin of Species* and comes to believe that humans evolved from very basic organisms over a very long period of time. She finds this account believable. She now understands and her craving is satisfied.

Two questions naturally arise: First, what is it about a particular theory or account of how things are that leads to a satisfying sense of understanding? And, second, since no account is satisfying if it is not believable, what makes an account a reasonable thing to believe? Before addressing these questions, a few remarks are in order about the very possibility of what we seek. It may not always be attainable.

2. The Possibility of Understanding

There are situations where understanding may be impossible. They can arise in the most exacting of the sciences and in the most anguished moments of normal life. For instance, a radioactive atom decays at precisely time *t*. Why then? According to quantum mechanics, there is no answer to this question. It is not that there is an answer and we don't know it. Rather, there is no answer. Nature, according to the current consensus, is irreducibly statistical; it is non-deterministic. There is a given probability that the atom would decay at various times, but no particular time of decay is inevitable. Not everyone, however, has joined the consensus. Einstein rebelled, claiming, "God does not play dice." But scientists, for the most part, have learned to live with this and have given up any hope of understanding why. That's just how things are — nothing more can be said on the subject. We may have to live with a craving that is unsatisfiable in principle.

The tragedies of life often leave us with a frustrating lack of understanding. A child dies from cancer. Why? The question is not a request for biological understanding of a disease, but a demand to know the meaning or purpose of the death. The religious might find some sort of satisfactory understanding in terms of God's plans. No-believers must cope with the fact that they will find no answer at all — the universe, very likely, is utterly without purpose.

Important as they are, we will set these cases aside and focus on those for which we do have some understanding or at least some hope of attaining it.

3. Naturalism

One of the most popular current philosophical outlooks is called naturalism. This is the doctrine that all facts are natural facts and that science is the one and only way to know them. It deliberately and explicitly rules out other alleged forms of understanding such as religious or aesthetic.

In detail, there is a spectrum of naturalist views, but there is also a reasonable consensus on a few key points. Natural facts are usually understood to mean facts about material objects inside space and time. It's perhaps easiest to understand this in terms of what it rules out. Moral facts, for instance, are highly problematic for any naturalist. So ethics

usually is understood in some other way, for instance, as a set of rules that we have adopted because they are useful to us, not because they are intrinsically right. Or perhaps, morality is a set of beliefs and attitudes that are hard-wired in us, as a result of their survival value in the evolutionary process.

The epistemology that goes along with naturalism's ontology is invariably empiricism. The one and only source of knowledge is sensory experience. All other alleged forms of knowing are denied. Religious experience, authority and tradition, moral or mathematical intuitions, extrasensory experiences, and so on are all dismissed as groundless illusions. Of course, we can go beyond the experiences themselves. For instance, we have justified beliefs in electrons, even though we have not perceived them. What we do perceive is streaks in cloud chambers and we offer explanations for these. The electron hypothesis is the best explanation for them, so the belief in electrons is justified in this indirect way. Even though we do not directly see electrons, our belief in their existence is grounded in experience, nevertheless.

Naturalism, of course, does not say what science is exactly, but there is an implicit understanding that true science is pretty much like current science. If the right science turned out to be Aristotle's (filled with purposes) or Descartes's (which allows *a priori* knowledge), then the spirit of naturalism would surely be violated. This should not be seen as a weakness of naturalism, but a virtue. It means that the philosophical doctrine of naturalism is itself a conjecture that is open to empirical refutation just like any other legitimate science.

Understanding is now straight-forward. To understand X is to explain it by means of a (purportedly) true scientific theory. Why was there an eclipse yesterday? Why did the bridge fall down? How does a disease spread? Why are protons heavier than electron? Why is unemployment rising? We understand the phenomena involved in each of these by seeing how it is explained. We understand yesterday's eclipse when we are told about the motion of the moon, how it was located between us and the sun casting a shadow, and so on. There is nothing more to understanding than that, provided the explanation is true. Suppose someone says, "Yes, yes, I know all about the moon casting a shadow, but I want to know why, what's the purpose of the eclipse, what's its meaning?" Then the naturalist replies that according to current science (which we take as true), there are no purposes or meanings in nature, so there is no answer. It is a meaningless question and should not be asked.

4. Opposition to Naturalism

Naturalism is not new. Philosophers as diverse as the Greek atomists, British empiricists, and Karl Marx would find themselves at home with much of current naturalism. As an account of our scientific knowledge, it seems quite plausible. The greatest opposition comes from outside scientific considerations. What about moral knowledge, mathematical knowledge, and aesthetic knowledge, to name but a few? Mathematical knowledge, for instance, does not seem to be about material objects in space and time. And we do not seem to acquire knowledge of numbers, by sense perception. Of course, we can prove theorems by means of logic, but where do the axioms come from that we need to prove the theorems? Kurt Gödel claimed that we have mathematical intuitions, a

non-sensory form of perception that allows us to somehow grasp mathematical objects and mathematical facts that exist outside of space and time. Gödel's view is the antithesis of mathematical naturalism. G.E. Moore claimed that ethics is about non-natural facts and that we can have moral intuitions concerning these facts. Moore's view is the antithesis of ethical naturalism.

It is easy to imagine taking a step back form hard-core naturalism and adopt a fairly liberal version of it. It would amount, more or less, to the Western intellectual tradition and would include most of the great philosophers and scientists of the past two and half thousand years. It would include a liberal empiricism and a distain for (if not a rejection of) abstract entities. It would also include such Enlightenment principles as: Knowledge cannot be based on the authority of any person or any sacred text; nor can it be based on revelations given to a single person or small group of people. The evidence for any knowledge claim must be available, at least in principle, to all.

For the most part, educated people throughout the world accept something along these lines— but not all. In recent polls, half the adult population of the US believes that Darwinian evolution is false and that the *Genesis* account of human origins is correct. To uphold such a belief, one must set aside normal cannons of evidence and take sacred writings to have pride of place in forming beliefs. But even here things are not always straight-forward. Many opponents of evolution by natural selection claim to base their rejection of Darwin on scientific evidence as evidence is normally understood. They propose "Intelligent Design" (known as ID) in its place, claiming, among other things, that there is an irreducible complexity to some biological processes that could not be explained, except by appeal to something like conscious design.

Cases such as this show that it is quite hard, if not impossible, to draw sharp boundaries between science and non-science. However, let the author quickly add that the non-existence of this boundary does not imply the non-existence of a distinction between rational and irrational beliefs. Ptolemaic astronomy and caloric chemistry are both unquestionably science. In fact, they were wonderful theories in their day. But they have now been decisively refuted and anyone who believes them today is not just wrong, but downright irrational.

A great deal of debate in the US focuses on the question, "Is ID a genuine science"? An affirmative answer is taken to be license to teach it alongside Darwinian evolution in the public schools. The proper question should be, "Is ID sufficiently plausible, given available evidence, to justify teaching it in the public schools?" After all, the fact that Ptolemy's earth-centered astronomy is a science is no reason to teach it. Whether ID is genuine science or religion posing as science does not really matter. All available evidence counts heavily against it.

5. Methodological Debates

Very often debates about particular theories turn on differences at the level of methodology. By methodology, it is meant here the set of rules and procedures that are used to create and test theories. Scientists and the public often refer to this confidently as *the* scientific method, as if it were an obvious and well-understood thing. Not so. It is

highly controversial. Of course, there are some precepts on which there is a consensus, e.g., "Don't believe a self-contradictory theory." But aside from a few simple rules such as this, there is little agreement.

Karl Popper claims that science proceeds by a method of conjecture and refutation. It is impossible, he says, to ever confirm a theory, since any theory actually implies infinitely many things and there is no hope of us checking each to see if it's true. We could, however, find a single counter-example, and that would refute the theory. This simple logical point is the basis of his claim that *falsification* is the right method for the sciences and that any attempt to confirm a theory is misguided.

Popper's views are not widely shared, even though there is much to be said for the "critical spirit" that they embody. "Is it falsifiable?" are words that are intended to strike fear in the heart of any pseudo-scientist. And yet, the principle may be too strong. Good scientists do not throw out their theories at the first sign of trouble. They modify, they explain away, they put the blame elsewhere. And often this strategy works. It can, as Lakatos so often stressed, lead to a degenerating research program, but it can also bear fruit in the long run. Progressive science is not constantly revolutionary, which it would be if scientists followed Popper's injunctions at every turn.

There are a great cluster of views that stand in opposition to Popper's falsificationism. They champion some form of induction. A method known as *inference to the best explanation* says we should adopt the theory that out of a set of rivals is the best overall explanation of some set of phenomena. Another known as *Bayseanism* bases its form of inductive reasoning on Bayes's theorem, a result in standard probability theory. It offers a method in which the evaluation of the probable truth of a theory is based on the previously unknown probability of some event that turns out to be true. A new theory won't pick up much evidential support from its correct prediction that the sun will rise tomorrow. But if it successfully predicts the return of a comet several years hence (as Halley did using Newton's theory), then our degree of rational belief in the truth of that theory is greatly increased.

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