

Limits of Scientific Method

Apologetics Note #5

The triumphs of the scientific enterprise are all around us. This is obvious in the technological marvels that are now commonplace, but the impressive technological achievements are based on equally impressive advances in our understanding of the world around us. From the interactions of sub-atomic particles to the formation of galaxies, our knowledge of the workings of the universe grows every day.

So impressive are the accomplishments of the sciences, especially the natural sciences, that many have embraced the opinion that science is the only reliable path to truth. Many people look at the perennial disagreements amongst philosophers and amongst proponents of the different religions of the world and conclude from this that philosophical and religious beliefs are mere opinion or perhaps just cultural tradition. In those domains there is no genuine knowledge; if one wants genuine knowledge, one needs to stick to the sciences.

What is one to make of such a claim? Is science the sole path to reliable knowledge? To address this question, one must look more closely at scientific method, for scientific method is the key to the success of the sciences.

What is scientific method? This is a topic around which there is considerable debate. For almost any set of data it is possible to come up with a variety of possible explanations for what has been observed, but the key to scientific advance is openness to experimental or observational testing. A person comes up with a hypothesis or theory and then asks, "How can I test the theory?" The method is to ask, "If the theory is true, then what consequences would one expect?" One either performs an experiment to see if a particular consequence occurs or sets out to look for the expected data. If one's theory leads to an expected outcome, then one has at least some confirmation of the theory. It may yet turn out to be false, but the testing procedure allows one to eliminate obviously incorrect theories. This is the key to the great success of the sciences.

Two points of clarification: First, observational testing rarely provides definitive refutation of a theory. The reason for this is that when one is testing and does not find what was predicted, one can still believe that the core of one's theory is correct. The problem may lie not in the core theory but in the particular way it was initially formulated. Hence, one can go back to the theory and make modifications. Alternatively, it is almost always possible that "failing" the test was due to a mistake in some "auxiliary hypothesis" that was involved in the prediction but was not integral to the theory being tested. Such an assumption might involve the experimental set up, or it might involve an additional theory on which the prediction relied. Hence, rather than throwing out a theory, it is usually possible to hold on to the theory in spite of negative experimental results. Such results are important, and as tests continue to mount against a theory its tenability does erode. The reason for raising this point about the methodology of hypothesis testing is that it is rarely ever possible either to falsify or to verify a theory with certitude. Hence the decision whether to continue to believe a theory to be true is, in part, a judgment call by the particular scientist.

Second, observational testing need not be performed in a laboratory, nor involve the observation of some future event, for it is possible with scientific method to investigate an event of the past. For

example, why it is that dinosaurs went extinct some 60 million years ago? One of the theories is that a huge meteorite hit the earth and created such a massive dust cloud that much of the sun's light was blocked and temperatures plummeted. This disrupted the food chain and the result was the extinction of the dinosaurs. One might think that scientific method could not be applied here, but indeed the event was of large enough scale it has been possible to infer consequences of the event that can be observed.¹ The point of this illustration is that scientific method can sometimes be applied to the investigation of non-repeatable events of the past.

Now we turn to the limitations of this method. Is it true in general that this method can be applied in all cases? Clearly not! The example of the demise of the dinosaurs was raised precisely because many historical events do not leave traces for which one can search many years later, or even shortly after their occurrence. Of course, if there is no evidence at all about a past event, then no rational judgment is possible. There are, however, lots of events in the past for which there is some evidence. The important thing to note here is that after one has gathered the evidence that is available there may be no further evidence that can be brought to bear on it. Alternatively, there may be further evidence but one may never discover that it exists or it may not be accessible. In such cases what one does if one is an historian is weigh the evidence that is available. Depending on the nature of the evidence, the historian either draws a conclusion or decides that the evidence is insufficient to draw a conclusion. If the evidence strongly enough supports a particular conclusion, that conclusion is the reasonable conclusion to draw. Indeed there are cases where it would be positively irrational not to draw the conclusion.

Now if scientific method were the only way of acquiring reliable knowledge, the historian would need to make some inference from the thesis or conclusion in question that could be experimentally or observationally tested. The thesis would then need to be confirmed by carrying out the experiment or seeking the relevant data.

This, however, is quite absurd as a requirement for obtaining reliable knowledge. For one, the evidence already available may be so strong that to carry out such a test would be superfluous. For another, such a test may not be possible. Above, we entertained the situation where the historian thinks that he or she has all the relevant evidence that is available. If this is so, does one say that no reasonable judgment can be made regardless of the nature of the evidence? Again, this would be quite absurd.

An example may help illustrate this. Consider the following question: Why did Robert E. Lee at the battle of Gettysburg order the fateful charge which was so disastrous for the cause of the South? (This may well be a question for which historians have a clear answer, but this does not matter for the illustration.) An historian will gather whatever relevant evidence she can locate: Lee's diary, letters from those who were close to Lee who talk about the event, etc. Once having done that she will see whether it is possible to draw a clear answer to the question. Now, suppose that the historian decides that the evidence supports a particular hypothesis (although most likely she would conclude that a variety of factors had an influence). Suppose that she considers one factor to have been particularly

¹It turns out that meteorites have a different chemical composition than one finds in the crust of the earth. If a huge meteorite hit the earth, then it would have left a layer of meteorite dust which would have encompassed the earth. Therefore, one way of testing the theory is to drill core samples in the earth's crust at various places around the globe, and then do a chemical analysis on that layer which (through other dating means) corresponds with the period of the dinosaurs' extinction. If the meteorite theory is correct, then one should find the distinctive chemical composition of a meteorite. This set of tests has indeed been performed and meteorite material was found. This does not prove that this was cause of the dinosaurs' demise (or the only cause—other explanations are possible), but it does provide strong support for the meteorite theory.

influential; say, that Lee's past successes made him think that the union soldiers would panic and run. How is she going to apply the method of experimental/observational test? She might look for diary entries or letters in the weeks or months preceding the battle that have derogatory comments about the union troops suggesting that they had no determination to fight. This would, of course, be a good thing to do, but if the historian has studied the American Civil War for some time, she may already know about such comments. However, for an experimental/observational test, she would have to find data which was previously unknown to her. A novice historian would be better able to be "scientific" in this case. Would the novice have more reliable knowledge than the expert? Certainly not.

By this point it should be clear to anyone who reflects on the case of historical investigation that good historical investigation does not require use of experimental/observational testing, as helpful as that may be when it can be done. Not only is this true of the field of historical investigation, it is true of almost any area of inquiry where various alternative hypotheses are being deliberated: politics, economics, sociology, engineering, etc. Where experimental/observational testing is possible, it can be very useful, but the successful application of human reason is not restricted to situations where such testing is possible.

Indeed, if one examines more closely the work of science itself, one finds that the reasoning processes employed include much more than the experimental/observational testing of hypotheses, and one finds that the value of such reasoning processes does not depend on such testing. When one seeks to come up with a plausible theory, one must take seriously the "hunches" that one has on given matters, and one must rely on considerations of explanatory power, simplicity, and coherence with currently accepted theories. If problem solving and theory formation in science involved mere random selection of hypotheses, it would never have made the progress that it has. Experimental/observational testing may be what distinguishes scientific enquiry, but scientists are continually employing modes of reasoning which are not dependent on such testing.

Finally, it is important to see that the modes of reasoning used in the sciences are the same kinds of reasoning processes that get employed in every other domain of inquiry. To suggest that these reasoning processes work when employed in the sciences but ought not to be relied on elsewhere is both arbitrary and absurd, for we all use such modes of reasoning elsewhere every day.

Science and the Christian Faith

At this juncture it is worth asking what reasons Christians have typically had for thinking that the Christian faith is true, and then to reflect on the relevance, or lack thereof, of scientific method. What, for instance, were Apostle Paul's reasons for thinking that Jesus had risen from the dead and that the Christian faith is true?² The following reasons are evident from his letters: 1. There was his own experience, experience that included (a) meeting the resurrected Jesus³ on the road to Damascus, (b) being healed by the power of God,⁴ (c) seeing miraculous healing take place in the others (d) seeing lives change as they came to believe in Jesus, and (e) experiencing God's guidance in his life in the form of visions with remarkable results. 2. There was Jesus' fulfillment of the messianic hopes and predictions present in the Old Testament. 3. There was the testimony of the apostles and of others who had seen and interacted with Jesus after his resurrection and with whom Paul interacted in Jerusalem.

² As Paul states it, "And if Christ has not been raised, our preaching is useless and so is your faith." I Corinthians 15:14,19

³ After the resurrection, Jesus appeared to his disciples and groups of up to five hundred people, including Paul. See Acts 9:1-19 and I Corinthians 15:1-11.

⁴ This also refers to Acts 9:1-19.

How much of this is open to testing which draws an inference from a hypothesis, then checks to see whether the inference was correct? In other words, how much of this evidence is open to experimental/observational testing?⁵ Hardly any of it! The reasons Paul had for embracing the Christian faith were predominantly historical and experiential, and evidence of this sort frequently is not open to experimental/observational confirmation.

Paul is not an anomaly here. These factors were also the key factors for most of the early Christians. There have been times when arguments from science or from philosophy were quite popular, but historically the primary reasons to which Christians have appealed in defending the truth of the faith have been the ways in which God has revealed himself in human history and the ways in which personal experience has born out its truth. Again, reasons of this sort are not typically amenable to the scientific method of testing, but this does not disqualify them from being good reasons.

To conclude, consider the following analogy. Suppose that you are fishing in a lake and are using a net, a net with a three-inch grid. Suppose you have fished for many days and have caught quite a few fish, but suddenly it dawns on you that you have not caught any fish shorter than three inches. What do you conclude from this? Do you conclude that there must not be any fish in the lake shorter than three inches? Of course not! You realize that the net you are using cannot catch fish which are shorter than three inches. In a similar way, a person ought not to be surprised that the net of scientific method has not "caught" God, nor has it demonstrated the truth of the Christian faith. (Of course, neither has it demonstrated that God does not exist, nor has it demonstrated that the Christian faith is false.) The net of scientific method, namely the net of hypothesis and experimental/observational test, is unable to demonstrate either the truth or the falsity of the Christian faith, for it is simply the wrong kind of net to capture what is relevant. To conclude that God does not exist because scientific method is unable to demonstrate his existence is as foolish as concluding that there are no fish shorter than three inches merely on the grounds that one's three-inch grid net hasn't caught any.

⁵ Archeological discoveries confirm the claims of the early Christians, but these discoveries rarely come about because of scientific tests.