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Can Science Ignore Plato?

Science has always held a great deal of interest for philosophers and has been discussed almost nonstop from the time of the Pre-Socratics to the present day. The issues surrounding induction and causality as well as the tenability of *a priori* scientific knowledge have not been resolved. The purpose of this paper is two-fold, first to show that the issues that Plato raised with regards to the process of natural science are valid and second to discuss the implications of these issues on how science functions as a knowledge acquiring discipline.

The practice of science is performed by members of a clique. Scientists are a very close knit almost fraternal order requiring a strict code of conduct and personal philosophy to gain membership. While this is not necessarily a hindrance to the task that science purports to accomplish, it does close itself off to the consideration of its foundations and limitations. Science attempts to make sense of the material world using careful measurement and observation to establish rules by which this world operates. Science has an uncanny ability to veil the underlying assumptions under which it must operate and behave as though all natural science was an entirely deductive endeavor. This influence can be felt across all disciplines and walks of life. The scientific approach to scholarship has permeated nearly every academic discipline, science is used as evidence in criminal cases, and more importantly it has become almost synonymous with religion in society. While most scientists are careful to point out that any speculation as to the cause of something is merely a theory and is not meant to be taken as firm proof of causality, society as a whole seems to have forgotten this caveat.

Science is fundamentally based around an empirical view of cause and effect. This view hinges upon the use of induction to establish theories as to the causes of phenomenon. Induction uses observed cases to attempt to establish a universal cause. For example: When a ball is dropped a thousand times it falls thus every time a ball is dropped it will fall. There is, however, a fundamental limitation (or flaw) to this line of reasoning. This flaw arises from the idea of induction itself. Due to the fact that science proceeds inductively, the next outcome is not necessarily guaranteed to be the same as the last 1000 times. A proof by induction requires knowing the outcome of every possible case. In mathematics a proof by induction involves showing that a particular equation (for example) holds for the first case, assume that it holds for some arbitrary case and show that it holds for the case immediately following the arbitrary case. Thus if the proposition holds for the initial case and it holds for the case immediately following the arbitrary case then it the proposition must be true. This is better illustrated a line of dominoes. The following proposition illustrates this very well

$$\frac{\begin{array}{c}\textit{The First Domino Falls}\\ \textit{When a Domino Falls the One After it Does Also}\end{array}}{\textit{All dominoes fall}}$$

There is something about this proof that is not readily apparent. If one knows all of the possible cases then there is no longer any induction and the proof becomes deductive, in other words, there is no generalization involved as every outcome is known. When one performs induction in the empirical sense observations are used as evidence to make a general claim. The more evidence that is collected the higher the likelihood that a given theory is able to effectively predict the phenomena of interest. However, this type of inquiry does not establish objective validity, but rather simply provides evidence that a particular theory is not incorrect. In order for one to establish the validity of a particular theory absolutely one must be able to observe all possible outcomes of the phenomena in question. It is not possible at present (and perhaps never will be) to know all of the possible outcomes of any event in the world. Thus science proceeds using induction because there is no other possible means for us to predict and understand our world. It is this final statement that is the largest contested issue surrounding science.

Plato is often criticized and trivialized because his criticism of science is often taken to mean that he thinks that science should not be done. In the Phaedo Socrates says "When I was a young man I was wonderfully keen on that wisdom that they call natural science, for I thought it splendid to know the causes of everything, why it comes to be, why it perishes, and why it exists" (96a7-96b1). One example Socrates uses is the question of why men grow, more specifically, what is the cause of a man's change in stature. Socrates is hinting that natural science is not the way to understand the causes of generation and destruction and in fact goes on to say just that, in line 96c3: "This investigation [the one from the point of view of natural science] made me quite blind even to those things that I thought I knew before." Throughout this entire section (the discussion of natural science) Socrates is showing that natural science cannot be used to understand the cause in which he is interested. The end result of the

investigation of the causes from the perspective of natural science is, for Socrates, the conclusion that men grow from the addition of muscle to muscle and bone to bone, namely that change arises from the addition of like materials(in this case food). Thus, addition is a candidate for the cause of generation.

This argument seems to be rather obvious at first glance and Cebes (the person to whom Socrates is talking) initially agrees with Socrates when he asks if this explanation of change is satisfactory. Socrates then proceeds to expound on the explanation giving another, clearer example of coming to be through addition. Socrates presents the example of eight becoming ten, "I thought that ten was more than eight because two had been added" (96e1-96e2). In response to a question from Cebes about the causes of the things investigated with natural science Socrates responds, "I am far, by Zeus from believing that I know the cause of any of these things" (96e6-96e7). This shows Socrates' opposition to the idea that he knows the cause of generation. Indeed, this is at first puzzling given his recent explanation that something comes to be through addition and he has not yet discredited this seemingly acceptable solution to the problem. The idea of addition as a cause is further elaborated by Socrates, "When each of them is separate from the other, each of them is one,…but that when they come near to one another, this is the cause of their becoming two, the coming together and being placed closer to one another" (97a3-97a6).

However, Socrates then sets the stage for the undoing of addition as a cause when he introduces division as a cause. He says "when one thing is divided the division is the cause of its becoming two" (96a6-96a7). So far, the explanation that Socrates is developing is that addition is the cause of generation and division is the cause of destruction. While this may seem a powerful and elegant solution, Socrates renders it useless with a simple observation. Earlier in the dialogue Socrates explained generation by giving the example of eight becoming ten from the addition of two, this example can be reduced to its simplest form, namely that one becomes two from the addition of one. If one then considers the cause of two, from the perspective of division, then the division of one thing is the cause of it becoming two. Rather than being the destruction of two into one through the undoing of addition, division is the opposite and is another cause of two Socrates says this, “At that time it was their coming close together and one was added to another, but now it is because one is taken and separated from the other” (97b2-97b4). Socrates has just shown that both addition and division can result in making two. The conclusion is that both addition and not addition (division) are the cause of generation (and destruction). This explanation covers all instances of generation of two and thus is a worthless explanation as we are no closer to an explanation then when we started the inquiry (except of course to exclude addition and division as the root cause of generation). The dialogue continues in this manner with the ultimate conclusion that the causes of generation and corruption can only be discerned by recollecting their forms.

This passage is one that could easily be taken to mean that Plato believes that natural science is useless. It should be noted; however, that this passage is merely pointing out the fundamental problem with the way in which natural science proceeds. In line 96c3 Socrates says: “This investigation [the one from the point of view of natural science] made me quite blind even to those things that I thought I knew before.”). That is not to say that science should be shunned or ignored as an imperfect or useless

endeavor. Science shows us the way in which the world appears to us (with our current level of knowledge) and allows for the prediction and manipulation of the world around us in meaningful ways. The issue here is one of philosophical principle and not scientific mechanics.

Plato describes true opinion in the *Meno*. True opinions are those things that are true but that do not have a causal link. For example one could say that it is raining in Toledo and be correct; however, without actually going to Toledo or speaking with someone who is in Toledo it is still simply an opinion. Plato writes, “So true opinion is in no way a worse guide for correct action than knowledge. It is this that we omitted…when we said that only knowledge can guide correct action, for true opinion can do so also” (97b8-c2). In this case the opinion is true, but one proceeds with trepidation when it comes to true opinion. When one tells their friend that it is raining in Toledo they will most likely ask how one knows that it is raining in Toledo. It is precisely this question that makes true opinion so fleeting. Socrates likens true opinions to statues created by Daedalus (known for his extremely lifelike statues) that appear as if they would run away. Socrates argues that these statues (true opinion) are fleeting unless they are anchored.

> For true opinions, as long as they remain, are a fine thing and all they do is good, but they are not willing to remain long, and they escape from a man’s mind, so that they are not worth much until one ties them down by an account of the reason why…After they are tied down they become knowledge, and then they remain in place. That is why knowledge is prized higher than correct opinion, and knowledge differs from correct opinion in being tied down (*Meno* 97e5-98a7).

For Plato, there is not only a fundamental difference between using true opinion and knowledge, it is the case that one must use knowledge and not true opinion to move forward in one's understanding of the world. What is interesting to note is that Plato does not condemn the man who proceeds using true opinion but rather points out the problem with doing so. This problem has been present since the earliest philosophers, as is illustrated by this account. For Plato the solution to this problem is the Forms, or things in themselves that one can know *a priori* through recollection because one's soul is immortal. This solution, however, has little to do with the issue at hand. Rather the important thing to note about Plato is that he has pointed out one of the largest philosophical issues in the philosophy of science.

This picture is useful when examining science. If science proceeds according to the model put forward by Van Fraassen, then it is merely a collection of Daedalus statues tied only to one another. Thus, Plato would call science performed this way a collection of true opinions. While it may be less likely that the group of statues that are chained together would wander off, it is nonetheless a distinct possibility. Without anchoring a single statue to something concrete all that remains of science is a collection of true opinions. Consider as an example a man who gets a headache every time it rains and only when it rains. Thus it would be a true opinion that every time it rains this man gets a headache. The next logical step would be to theorize that rain causes this man's headache. This theory does explain and is able to predict his headaches but it could also be the case that he gets headaches that are caused by a hereditary condition and that they only happen to fall on days when it rains. Perhaps

this is the way that science is doomed to proceed and perhaps it is not necessarily a bad thing.

Plato describes true opinion as something that is good and potentially useful as long as one is aware that it is still just opinion. It seems that science often produces theories from true opinion. It is not the case that all theories formed from true opinion are correct. Quantum physics is an excellent example of this. Quantum theory is built almost entirely around the single fact that discrete mathematical equations predict the behaviors of molecules accurately. When one looks at the implications of the mathematical equations the conclusions that are drawn from this predictive model are perplexing. For example, it makes no sense to expect that electrons will go from one discrete state to the other without passing anywhere in between. This is akin to a person existing either at their desk or in their car and freely transitioning between the two but during their transitions never passing through any point between their desk and their car. While the explanation of the quantized energy of atoms does not seem to make much sense on a conceptual level, the beauty of science is apparent. It does not require that one knows exactly how the quantized energy levels change in the molecule but rather, it only requires that the theory that is provided predicts the data. In this case the data is predicted very nicely. It is this beauty that makes science so appealing. It is quite useful to be able to provide a plausible theory as long as it fits the data and as long as this criterion is met one is never wrong (at least until the data is no longer predicted by the theory). Granted this activity must be qualified with the stipulation that theories must be at least partially grounded in the current body of science as it would seem absurd to claim that aliens were responsible for quantum physics.

Scientists are wont to describe their fields as simply collections of true opinions and proceed as if their collections of statues are anchored to a concrete and fixed point. What exactly the statues are anchored to is not clear. It may not be possible to, and indeed it is most likely that it is not possible, to find a solid anchor for science using its own methods. In order for science to have a firm anchor as a starting point there must be some way of acquiring this starting point without using science.

In his book *On the Structure of Scientific Revolutions*, Thomas Kuhn advocates that science proceeds in its present state until it has cause to change directions. These changes in direction are called paradigm shifts. These shifts are brought about each time a body of experimental evidence arises that does not support the currently established theory. Each of these paradigm shifts requires a "revolution" in the sense that the new paradigm must displace the old one. This replacement is not always smooth and as such it is often required that the current paradigm must be forcibly removed so that the new paradigm can take the place of the old. In this regard, according to Kuhn, science functions much like a hermit crab. Science lives in one shell until the conditions of that shell can no longer accommodate it and it moves to a new one. The major problem with this model of science is that science has no metric for determining if the shell (paradigm) that it has moved to is the one that is perfect, only whether or not the shell can contain the crab.

This is not an issue that contemporary science seems to concern itself with. For the most part scientists are content to use the theory that most correctly predicts the data. However, it is oddly contradictory that most scientists will tell one that the goal of science is to find the causal links in the natural world. This issue has resulted in several

views on how exactly science can proceed. The view that seems to be the most accepted is that of Bas C. Van Fraassen. His view is that science does not really care whether or not a given explanation is correct or not as the explanation is simply a theory. For Van Fraassen the measure of a theory's worth is how well it is able to predict real world data. In his book *The Scientific Image,* Van Fraassen writes:

> To develop an empiricist account of science is to depict it as involving a search for truth only about the empirical world, about what is actual and observable.... It must involve throughout a resolute rejection of the demand for an explanation of the regularities in the observable course of nature, by means of truths concerning a reality beyond what is actual and observable, as a demand which plays no role in the scientific enterprise (203).

This is a near perfect explanation of his views on how science should operate. The first point that he makes is that science should only concern itself with the truth as is relates to the world. In other words, science should only be interested in observations. Then he goes on to assert that science should not concern itself with the objective validity of its project, but rather reject any necessity for explanations that exist outside what can be observed. This is a very elegant way of dealing with the problem of objective validity. If one simply declares that science is not in the business of dealing with objective validity the problems associated with determining that validity simply do not exist. It seems like the most plausible way to proceed in regard to the problems mentioned before.

In a discipline that is designed to do just that, namely predict real world outcomes, this does seem as though it would be a very useful way of approaching the issue. This view comes with the caveat that in the event that multiple theories exist to explain the same data that the more plausible and less complex (*a priori*) theory is the best one. This does not explain science's love affair with causality, but it does serve to provide a useful means for continuing progress in scientific endeavors. This view is an incredibly pragmatic description of science and, while it indeed may offer a useful means for the progression of scientific inquiry, does not seem to provide any measure of accomplishment to the scientist. If one were to ask (almost) any scientist what they were trying to do they would most likely say that they are trying to prove something (i.e. prove that x exists or that y is the cause of z). While this may seem like an unimportant comment, science does purport to deal with causality. If one were to proceed as Van Fraassen would have it, then the purpose of science is no longer to discover the causal links in the natural world, but rather to simply provide the best possible system for predicting outcomes in this natural world. Science does attempt to do just that but it seems to be much more than that.

It is common to argue that only things that can be tested can be added to the collection of scientific theories; however, that argument breaks down rather rapidly when one considers the foundation that science rest upon. Matter is often touted as the anchor upon which science can tie its network of statues. If matter has always existed then one can use observations of this matter to begin to form an account of the natural world. This account would be able to proceed in a way that does not require the use of true opinion, or at the very least allows for a solid starting point. However, it is impossible at the present to provide an account for the existence of matter. It is also impossible to show that matter must have necessarily existed for all time. Nonetheless this assumption forms the basis for all science. This requires a leap of faith in exactly

the same way that religion does. If in fact matter has not always existed then science struggles to show why it has any validity. Rather in this case its theories are exactly like the man whose headaches occur every time it rains.

In other words, science must be anchored to something that must be necessarily true *a priori*. Science cannot anchor itself (unless one were able to show all possible outcomes of said anchor) given the problem of induction. Therefore the anchor must be found via a deductive argument. For Socrates the forms provide a plausible anchor for the conduct of natural science. These forms allow one to talk about things in themselves and not simply instantiations of a particular object. For example one is able to say that something is a table because it participates in the Form of table, or what it means to be a table. Thus the form of an object is the cause by which it exists and it also contains the necessary information to predict the outcomes of an object in the natural world. One is able to use forms which are by definition *a priori* to establish a plausible starting point. The part that is the most difficult for scientist to swallow is that these forms stem from the soul and that we discover these forms through recollection. Whether or not one agrees with Socrates about the existence of the immortal soul or forms, it is clear that he is correct in pointing out that there are consequences for precipitously plunging into an empirical view of science.

Science functions in a very narrow perspective. Too often scientist lose sight of the fact that they are not in fact doing what they think they are doing, namely discovering causal relationships in the natural world. Irrespective of the value judgments pertaining to the schools of thought regarding the procession of science, one must maintain a perspective on the work they are performing. Scientists are wont to discuss cause, effect, and verity in relation to the work that they are performing. As it stands, science behaves like a group of people attempting to put together a puzzle from pieces without looking at a finished image. To further complicate their task, the various pieces can fit together in multiple ways, only one of which is the right way. Perhaps someday all of the pieces may fit together but there is no guarantee that the finished image is the actual picture or if it is merely a collection of pieces that happened to fit together.

Perhaps, a completed puzzle is a necessary goal for science to achieve and, as such, the actual picture is an unnecessary element of knowledge. It would seem logical that science should strive to not only complete the puzzle, but to end with the proper picture at the end. It is also possible that science will never be able to discern if its collection of true opinions are actually facts. To simply continue advancing empirically without knowledge of the potential problems of science is short sighted, and leaves one with a sour taste in their mouth. It is better to know that one has only a collection of true opinions that allow one to predict the outcomes of the natural world than to treat that collection as fact. Indeed there is very little difference between performing science in the latter way, and religion. The result is the same; both require faith in their origins and also each requires belief in their respective fields.

Science provides an excellent way of predicting the outcomes of the natural world, but that is the only thing that it is able to do. This is what makes it incredibly useful to its practitioners and, indeed, to everyone else. On some level it must be true that what we observe relates to *a priori* cause and effect. It would be very difficult to imagine a world where every theory that science proposed and used to predict

outcomes in the natural world was objectively false. It would also seem to be fruitless to consider a world where there was absolutely no causal links and it just happened to be the case that entirely random phenomena happened in such a way as to convey a deeply structured and causally related set of events. It seems absurd that either of these possibilities exists and on some level this is true; however, one must bear in mind that it is nonetheless a possibility. One might wake up tomorrow and find that colors have inverted and all of the objects are floating up. While it may in fact sound ridiculous, even science must admit that it is possible.

The reason that science exists and proceeds in the manner that it does is on some level due to the fact that humanity can function, manipulate, and predict their environment in no other way. While it may seem that the problems relating to science should prevent its use, this is not the case. Rather one can look at science as a sort of over-arching paradigm. This is a particularly useful parallel as one can and should use science in its current form until something better comes along (it may not). If the overarching paradigm of science were to shift it would still be science, it would just look different. That is not to say that science is fundamentally flawed in any sense, but rather it must be noted that there are assumptions and opinions that must be accepted in order for its practice to be adopted.

Science is the epitome of a pragmatic approach to discovery in the natural world and will continue to be so. What is argued here is not done so in an attempt to undermine or destroy the practice of science. The goal is rather to point out the potential shortcomings and the premises that must be accepted in order for it to exist. A greater understanding of the benefits and problems associated with science makes for better practitioners. The more knowledge that the practitioners of science have with regard to their discipline, the more likely they are to avoid potential problems when they are performing their task.

Thus scientists must keep an open mind when it comes to arguments for the objective validity of their conclusions. They cannot discount the problems posed by Plato. While they cannot discount these problems, that by no means precludes them from proceeding with their project. Indeed science should continue to search for effective means to predict the outcomes of the natural world and attempt to provide plausible explanations for these events and perhaps one day can give an objectively valid account of the natural world or at the very least allow for the accurate prediction of its occurrences.

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