PHIL2057 Final Essay

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Question

A. Alan Chalmers presents an apparent counterexample to the view that observation plays a privileged role in settling scientific disputes. Is this counterexample successful?

In the following essay, I will examine several potential problems that observation faces in conclusively determining between scientific theories. I will first introduce a definition for an ideal observation and what it can apply to. I will then show how it is impossible to separate such observations from cognitive interpretation given the current standing of philosophy. Following from this, I will demonstrate how this leads to theory laden observation and outline the problems this creates for objective observation. I will then unpack Chalmers' counterexample and show by its very nature that it is successful in some part. Finally, I will propose a view on why all of the above does not debunk observation as the most successful determinant between scientific enquiries.

The Oxford English Dictionary defines the scientific method as "a method or procedure ... consisting [of] systematic observation, measurement, and experiment" [6]. It is clear then that common belief holds that observation is the major tool used by scientists to differentiate between competing hypotheses. Hence we need to plot a generally accepted definition of what an observation or scientific fact would be. Chalmers suggests that an observation must satisfy three criteria;

a) Observations come from careful and measured instances that have been perceived by the senses of an observer,

b) Observations exist independent of any theory to which they are applied,

c) Observations constitute a firm and reliable method for differentiating between scientific theories [3].

Furthermore, the commonplace thought is that beliefs which are affixed through observational facts are more secure than those affixed through theoretical implications, even if those theories were affixed by other observations. That is, belief based on observation attains the status of purely objective whilst mostly everything else remains subjective and open to interpretation. However Chalmers and others demonstrate that this is not the case.

1 Semantics of Observation

The initial problem arises from section a), where does observation stop and interpretation start? The first step is to pin down the physical process of taking an observation. When I observe Figure 1, several processes occur. Certain photons enter my iris and impact on my retina exciting the photoreceptors there. Then a series of electrochemical signals transfer the image to my neurons where the recognition of a specific conglomeration of colours is formed. Other neurons interpret this image as an image of a bird, more specifically an Indian Myna. Further neurons then fire linking this image to the problems the bird causes as an introduced pest and the moral qualms of trapping them to be put down. However this process does not form in such distinct steps, it happens instantaneously and in fact it seems unlikely we can isolate single neuron chains as human thought is a very dynamic and connected experience.

Figure 1: The infamous Indian Myna.

This is precisely the problem Norwood R. Hanson [5] examines, however it may very well be insoluble. A large number of examples are provided by Hanson in an attempt to identify exactly what stage observation occurs at but there is nothing objectively inconsistent with each different interpretation and he can provide no evidence other than examples to prove one way or the other. What we know is that photons enter the iris and then a sensation is experienced which is associated with relevant thoughts and feelings. Through assumptions on causation we gather that the two events are connected and it seems logical that they should be. However we are unsure as to whether the physicalist is correct in saying that the physical state of retina excitation is the entire action of seeing or whether extensive interpretation supervenes on the retinal image and this is because we are still uncertain about how our brain works. Hence it is practically impossible to settle on a definition because there is not enough objective evidence to differentiate between the system of observation.

What I have established is that we cannot isolate the stage of observation as either a unique cognitive reaction or a uniform physical state due to the complexities of the mind-body interaction. Hence we are forced to consider point a) as referring to the entire experience, from photon to cognitive experience, which leaves includes many opportunities for different interpretations.

2 Theory Laden Observation

If observation includes interpretation, then it seems obvious that theoretical commitments will alter the observational outcome which looks to threaten statement b). The following is an example of this, where interpretation yields two very different results.

Consider Figure 2. A builder who has limited experience with physics would view this apparatus as a boring glass boat with a paddle in the middle (although he might appreciate the finesse in its construction). However a trained physicist sees it as the famous paddle wheel cathode ray tube which determined cathode rays had momentum and led to their identification as electrons opening the door to atomic physics. Both parties perceive the same photons entering the iris but have very different cognitive experiences, one of mild confusion/boredom and one of potential intrigue/awe. We started with the assumption that observation should be objective and yet we have two different perceptions of the same object under the same conditions.

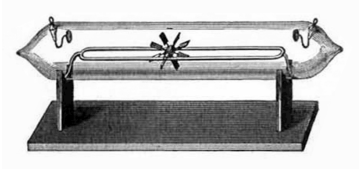

Figure 2: The paddle wheel cathode ray tube.

This phenomena is known as theory laden observation or cognitive penetration [7]. The strongest account of theory laden observation attests that the physicist and the builder see two different situations given their differing background knowledge on the object. The sensation that they communicate upon viewing the object is a distinctly different sensation so they cannot be observing the same thing [1]. Hence we conclude that observation is influenced by their corresponding theoretical commitments. This is particularly undesirable as it implies observational evidence contains an inherent confirmation bias that would conclusively rule out the possibility that it could settle scientific disputes. I shall attend to a solution in section 4.

3 The Fallibility of Observation

The final major problem for observational theory threatens point c) and involves the problem in securing validity in an observation. Chalmers' counterexample deals with the fallibility of observation. Roughly sketched, Chalmers notes that when Copernicus first proposed his theory, one crucial prediction was that Venus and Mars should appear to change in size appreciably during the year by a factor of eight and six respectively. This was before telescopes however so only unaided observations were possible. What these unaided observations returned was the Venus did not change in size and that Mars changed by only a factor of two. According to Osiander, these observations were consistent with the experience of every age and hence Copernican Heliocentrism was rejected. However when Galileo invented the telescope, he was able to prove that Venus and Mars did in fact change by the appropriate factors and hence confirm heliocentrism. We know now that the naked eye is particularly poor at making observations about small bright objects on dark backgrounds and hence we can account for the incorrectness of the observation, however at the time there was no way to realise this inaccuracy and there was no other available method for observation so geocentrism was supposedly confirmed by the science of the day [3].

The moral of Chalmers' counterexample is that there is no way to rule out the possibility that our observation might be systematically flawed in a way we are unaware of. In the example above, the best available evidence at the time was fundamentally wrong in ways that seem apparent with hindsight but were not recognised at the time.

What is to say that current science is not struck by the same fallibility as Copernicus faced? It appears we must accept that any observation has an inherent possibility of being incorrect.

Crucially, I don't believe there is any way to disprove this counterexample because there is no evidence I could call upon to even address it in the negative. We cannot know the future and by the definition of the problem, we cannot address it with current evidence without resorting to recursive justification. By their nature, such broad overarching uncertainties with their infinite variety fall into the category of things 'we don't know that we don't know.' Hence it seems we have no choice but to accept the fallibility of observation.

4 Observational Multiplicity

The problems presented above however are not altogether the end of the world for observation. In Chalmers' counterexample, Galileo did eventually prove heliocentrism and provided appropriately conclusive evidence. So whilst any given piece of evidence or any particular observation may be fallible, Chalmers doesn't secure that the entirety of evidential support for a given statement is fallible.

On top of this, theory ladenness also has a finite scope. It does not suggest that two people will look at a duck and one will see a majestic pelican whilst the other will see a rampant feathered dinosaur, some interpretations are implausible if we take any two functional observers. So it would seem that careful observations of ANU ducks would be able to differentiate between two theories that proposed ducks were actually small pelicans vs ducks were modern day dinosaurs. Hence some observation can be theory-neutral, theory ladenness only claims that not all can be.

What I propose is that although we appear unable to provide evidence that a single observation can differentiate between competing theories, a larger body of observations will be able to differentiate. It is evident from the implications of theory laden observation that a single observation can be interpreted many ways. However if enough different pieces of evidence are collected, the scope for different interpretations begins to shrink until a critical mass is reached upon which the evidence will be able to differentiate between theory. That is, whilst a single piece of evidence may have trouble differentiating between theories, the scientific method never proposed that a single observation should! A theory requires a large body of evidence attributed to it before scientists will take it seriously. On top of this, evidence can be of good or bad quality. Good evidence aims to minimise the subjectivity and error in the observations. This is a concept that science has been dealing with for a long time so it comes as no surprise that some evidence is better than others. So whilst individual instances may be disputed, a 'statistically significant result' is still possible by considering more evidence.

You might say "consider phlogiston and oxidation. Becher and Lavoisier were unable to distinguish the two in their combustion experiments. What if all the data is appropriately theory laden?" I contend that if all the data is theory laden, every last scrap, then either theory works and we need to turn to Occam's razor. It is commonplace in science

to have multiple ways to analyse a situation. Newtonian Mechanics, General Relativity, and Action Principles all analyse Classical Mechanics using different methodology but give the same predictions and are equally well supported by the evidence. So this proposition does not seem to pose a problem.

However Chalmers' counterexample still poses a threat. What is there to prevent every single observation we take being false due to some unknown limitation? There is no conceivable way to secure against this possibility. However, it is reasonable to propose that with each new piece of evidence we gather, the chance of the set being fallible decreases. Science has already accepted this reality, at any stage we can only increase our confidence in a theory. Scientific theories are never proven because of the inevitable possibility of the fallibility of evidence. However the larger and more diverse the evidence set, the less likely the evidence could be fallible.

To conclude, we cannot as of yet separate observation from interpretation and hence we are forced to deal with the problem of theory loading. Although this poses significant difficulty to the role of single observations differentiating between scientific theories, it poses no threat to the scientific method more broadly, observation still has unprecedented power. However Chalmers' counterexample provides a more serious problem. Chalmers shows that there is no way to rule out the fallibility of observation and hence observation can never conclusively settle scientific disputes. However the scientific method has already adapted to this possibility and deals in probabilistic confidence values. Hence although both theory laden observation and Chalmers' counterexample provide serious and real threats to observation's privileged role in settling scientific disputes, both have been adapted such that observation maintains its position.

References

[1] Bogen, J. 2014. "Theory and Observation in Science." *The Stanford Encyclopedia of Philosophy.* Zalta E. (ed.).
http://plato.stanford.edu/archives/sum2014/entries/science-theory-observation/.

[2] Briggs, R. 2014. *PHIL2057 Philosophy of Science, lecture 11, 12, Observation and Theory.* Lecture Powerpoint slides and recording, viewed 9 November 2014. http://wattlecourses.anu.edu.au.

[3] Chalmers, A. 1999. *What is This Thing Called Science?*(3rd Ed.). University of Queensland Press, St. Lucia, Queensland.

[4] Fodor, J. 1984. "Observation Reconsidered." *Philosophy of Science.* Vol. 51, No. 1, pp. 23-43.

[5] Hanson, N.R. 1958. *Patterns of Discovery: An Inquiry into the Conceptual Foundations of Science.* Cambridge University Press, Cambridge.

[6] "Scientific Method." *The Oxford English Dictionary.* Oxford University Press, n.d. Web. 10 November 2014.
http://www.oxforddictionaries.com/definition/english/scientific-method.

[7] Stokes, D. 2013. "Cognitive Penetrability of Perception." *Philosophy Compass*, Vol. 8, No. 7, pp. 646663.