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The Objectivity of Science

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ABSTRACT

The idea that science is objective, or able to achieve objectivity, is in large part responsible for the role that science plays within society. But what is objectivity? The idea of objectivity is ambiguous. This paper distinguishes between three basic forms of objectivity. The first form of objectivity is ontological objectivity: the world as it is in itself does not depend upon what we think about it; it is independent of human thought, language, conceptual activity or experience. The second form of objectivity is the objectivity of truth: truth does not depend upon what we believe or justifiably believe; truth depends upon the way reality itself is. The third form of objectivity is epistemic objectivity: this form of objectivity resides in the scientific method which ensures that subjective factors are excluded, and only epistemically relevant factors play a role in scientific inquiry. The paper considers two problems that arise for the notion of epistemic objectivity: the theory-dependence of observation and the variability of the methods of science. It is argued that the use of shared standard procedures ensures the objectivity of observation despite theory-dependence. It is argued that the variability of methods need not lead to an epistemic relativism about science. The paper concludes with the realist suggestion that the best explanation of the success of the sciences is that the methods employed in the sciences are highly reliable truth-conducive tools of inquiry. The objectivity of the methods of the sciences leads to the objective truth about the objective world.

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Introduction

We are accustomed to thinking of science and scientific inquiry as one of the foremost exemplifications of objectivity. When scientific inquiry is conducted according to appropriate methodological standards, the results of such inquiry are objective and are accordingly granted widespread acceptance throughout the scientific community. Within the broader community, science is greatly admired precisely because of the objectivity of its results and the processes that arrive at these results. Indeed, the role that science plays within society at large is for the most part due to the objectivity that it exemplifies.

But what is objectivity, and how is it exemplified by the sciences? On reflection, it is clear that the notion of objectivity is not an entirely univocal notion. Indeed, it is subject to a certain ambiguity. In this paper, I will distinguish three primary notions of objectivity that may be applied to the sciences. There is an ontological sense of objectivity which relates to the way in which the natural world exists independently of human thought. There is a semantic form of objectivity which relates to the nature of truth. And there is an epistemic notion of objectivity which relates to the methodological norms and procedures which are employed in the sciences, and the epistemic justification of beliefs and theories which are licensed by those norms and procedures. Ideally, these three forms of objectivity may be brought into conjunction. I will sketch how this might happen after explaining the three distinct kinds of objectivity.

1. Ontological objectivity

The first notion of objectivity occurs in the expression ‘objective reality’. It is the idea that the world or reality exists in and of itself. There is a way that the world is that does not depend on us. Nor does it depend on the way that we think the world is. Reality itself is independent of human belief, thought or experience. Its existence, nature and structure are entirely independent of human thought, language, conceptual activity and perceptual experience. The world in itself, as it is independent of all human contribution, is objective reality.

What role does objective reality play in the sciences? It is precisely objective reality itself that constitutes the object of study for scientific investigation. When scientists conduct scientific research, the aim of their research is to determine the nature of the objective reality in which we find ourselves. The aim of science is precisely to find out how things stand in the objective world that is the object of scientific study. It is to discover the nature of objective reality itself.

While there may be disagreement with respect to degree of epistemic access to the objective world, the major positions in the philosophy of science grant the existence of an objective reality. Reflecting an optimistic view of scientific inquiry, scientific realists hold that science has made, and continues to make, considerable progress in discovering the nature of reality at both the observational and the non-observational level (cf. Sankey 2015, ch. 3; 2016, 13). Constructive

empiricists, by contrast, hold that we should accept theories as empirically adequate (cf. van Fraassen 1980). That is to say, we should accept a theory as true with respect to all claims of an observational nature, while withholding judgement with respect to theoretical claims at the non-observable level. But it is entirely consistent with the constructive empiricist standpoint to hold that what we are withholding judgement about is the nature of unobservable aspects of objective reality itself. It is knowledge of objective reality, not its existence that is in question. In some of his more extravagant moments, Thomas Kuhn appeared to suggest that "when paradigms change, the world itself changes with them" (2012, 111). At first blush, this seems to entail that the world itself is not independent of thought, as it varies with the paradigm accepted by scientists. But a more careful reading along the lines of Paul Hoyningen-Huene's neo-Kantian reconstruction of Kuhn makes plain that an objective "world-in-itself" must play a role both in producing empirical anomalies and in constraining the paradigms which are proposed to resolve such anomalies (Hoyningen-Huene, 1993, 33-5, 227).

Intriguing metaphysical conundrums arise with respect to the nature of objective reality. There is, for example, a question about the relationship between the world of common sense with which we interact at the level of ordinary human perception and activity, and the world of unobservable entities revealed to us by theoretical physics. Are observable physical objects such as tables and chairs strictly identical with the unobservable particles that make them up? If so, does removing a number of particles from the surface of a table or chair turn it into another object, since it is no longer the same collection of particles as before (cf. my 2015, 161-2; for related discussion, see Kornblith 1993, 54-5)? Equally, there are problems that arise in relation to mind-independence. What if there are properties of objects that are not fully independent of us? It may appear to be the case that colour is an intrinsic property of objects, so that objects have whatever colour they have as an objective matter of fact, independently of us. But, even though colour may appear to be an intrinsic property of objects, science tells us that our experience of colour emerges from an interaction between our eyes, waves of light and the surfaces of objects which we perceive as being coloured. The property of being red, for example, does not reside in the surface of an object that we perceive as being red (see, for example, Putnam 1987, 4 -8). Such issues as these constitute interesting metaphysical questions to pursue about the nature of objective reality. They do not constitute objections to the idea of objective reality itself.

2. The Objectivity of Truth

The second notion of objectivity relates to truth. It is found in the expression 'objective truth'. Truth is objective in the sense that it does not depend on what we believe. Truth depends on the

way the world is.[1] A true belief is one that gets the world right. The truth about the world need not be how we believe or wish the world to be. Truth has nothing to do with what we believe. It has everything to do with how the world is.

It is an important feature of belief that beliefs are the kind of thing that are capable of being true or false. Even though what we believe in believing a proposition is that it is true, it is possible for a belief to be false (cf. Sankey 2019). Believing the world to be a certain way does not make the world that way. Not only does the way the world is not depend on what we believe. It does not even depend on what we are justified in believing. Not only may belief be false, but justified belief may be false. Moreover, a proposition does not even need to be believed to be true (or false). A proposition that nobody believes, and for which nobody has any evidence, may nevertheless be true.

One traditional way to explain the objective nature of truth brings the objectivity of truth into relation with ontological objectivity. This traditional idea is that truth is a correspondence relation. On this view, truth is a relation of correspondence that obtains between a belief or proposition and a fact or state of affairs. A proposition is true if and only if it corresponds to an objectively existing state of affairs, whether or not we believe that the state of affairs exists. In this way, truth is objective because it consists in correspondence to objective reality. It is because objective reality is a certain way that a proposition is true. The world being objectively that way is what makes the proposition true.

The correspondence view of truth is a non-epistemic theory of truth because it takes truth to be independent of epistemic notions such as warrant or justification. By contrast, epistemic theories of truth consider truth to be an epistemic property which accrues to belief in virtue of some epistemic property being realized. Epistemic theories of truth such as the coherence theory run the risk of undermining the objective nature of truth, since truth in an epistemic sense may depend on variable systems of belief rather than on something fixed and stable outside of belief.[2]

Two anti-objectivist approaches to truth are particularly worthy of note. One sometimes encounters the view that truth is subjective. For the subjectivist, truth is whatever an individual

[1] This may require qualification. To say that truth depends on the way the world is applies most obviously to synthetic propositions. Analytic propositions do not so obviously depend on the way the world is. But there is a sense in which analytic propositions do depend on the way the world is. E.g. 'All bachelors are unmarried men' is made true by the fact that all bachelors are unmarried. Bachelors being unmarried is what makes the proposition true. Even though we may know that the proposition is true without having to observe the world, its truth still depends on the way the world is.

[2] The risk is greatest if truth is simply identified with coherence of belief, since there are any number of internally coherent sets of beliefs which would thereby be true regardless of their relation to external reality. All it would take for truth is for beliefs to cohere rather than reflect the way the world is. The risk may be reduced if truth is taken to be idealized coherence (e.g. Putnam 1981, 50), since in that case truth would be subject to greater constraints than mere internal coherence.

subject happens to believe. It is what an individual subject takes to be the case. It is not an objective matter, but a simple matter of subjective opinion. This position rests on a confusion between the ideas that to believe is to believe true and the idea that to be believed is to be true. The subjectivist view of truth is one that is difficult to reconcile with the cold hard facts of reality. The most effective response to the subjectivist is the pragmatic point that belief may not give rise to successful action if it fails to coincide with the way the world in fact is. If someone believes they have the ability to fly by flapping their arms, they should be advised to consider the folly of their ways before stepping from atop a high building.

The second approach is not to say that truth is subjective but that it is relative. To put the point in Kuhnian terms, truth is relative to paradigm. For example, "Phlogiston is released by burning substances" is true within the paradigm of phlogistic chemistry. But it is false within the paradigm of oxygen-based chemistry. This view of truth has been traditionally dismissed as incoherent, since it leads straight to a contradiction, though it has to be admitted that if objective reality is denied there may be some hope for the position.

3. Epistemic objectivity

The third notion of objectivity is an epistemic one. On a traditional way of thinking about science, the epistemic notion of objectivity has a close connection with the idea of a scientific method. On this way of thinking, science is characterized by the possession and employment of a special method, the scientific method. It is possession of the method, as well as its employment, which distinguishes science from non-science and pseudo-science. The method of science serves as a criterion of demarcation between science, non-science and pseudo-science (cf. Popper 1963, 255).

On this approach, the scientific method is employed throughout the sciences. It is shared by all scientists and is invariant across the sciences. Indeed, it has been employed throughout the history of science. Use of the method guarantees that subjective factors, such as bias, personal interest and political orientation, are excluded from scientific research. It ensures that the only factors taken into account in scientific inquiry are epistemically relevant factors (e.g., empirical evidence) which contribute to the search for scientific knowledge. As such, the use of the scientific method promotes the epistemic objectivity of science by excluding subjective factors in favour of epistemically relevant factors.

Scientific inquiry is characterized by widespread consensus among scientists. Disagreement, where it occurs in science, is short-lived. The reason that science is characterized by consensus is precisely due to epistemic objectivity and the role played by the scientific method in ensuring such objectivity. It is because scientists employ a shared scientific method that they come to agree with each other. The shared scientific method ensures epistemic objectivity, and thereby promotes the formation of consensus among scientists.

But what is the scientific method and how does it produce consensus? According to a traditional empiricist philosophy of science, the method of science consists of two key elements: observation and inference. Observation itself is objective because human observers are endowed with a common perceptual apparatus which provides them with shared perceptual access to the unique, publicly accessible objective world. Inference – whether inductive or deductive – has a shared logical structure, so that all scientists draw the same conclusions from the same empirical data. [1] In this way, the fact that scientists all employ the same scientific method is what gives rise to the widespread consensus that characterizes the sciences.[2]

4. Two Problems

The conception of epistemic objectivity outlined in the previous section is one familiar from the empiricist tradition in the philosophy of science. It may well resonate with the public perception of the nature of science. But, for the past half century, this conception has been taken to be highly problematic within the history and philosophy of science. This is for two main reasons: the theory-dependence of observation and the variability of the methods of science.

Theory-dependence of observation: There are a number of ways in which it has been thought that scientific observation depends upon theory. First, since it is impossible to observe everything, and not everything is of equal importance, observation is primarily directed to facts that are deemed to be relevant or significant to a specific investigation. But judgements of relevance and significance must draw upon prior knowledge, including theoretical knowledge. As a result, much scientific observation is guided by theory. Second, scientists frequently employ instruments to detect entities and processes which are not detectable by the human senses unaided. But instrumentation is designed and built on the basis of theoretical knowledge, and its results must be interpreted in light of theoretical knowledge about the workings of the instrumentation and the entities and processes that the instrumentation is employed to observe. Third, there is no pure "given" in experience which scientists interpret in light of theory. Experience itself may be

[1] The idea that scientists who employ the same method will arrive at the same conclusions from the same data may be made especially compelling if we make a simplifying assumption about the nature of the inference from data to conclusion. If we assume that the inference is an enumerative induction from premises which employ observational vocabulary to an empirical generalization which employs the same vocabulary, then all scientists who reason on the basis of such induction will arrive at the same conclusion (e.g., "All observed ravens have been black, therefore all ravens are black"). Unfortunately, this is an over-simplification, since induction may fail to be enumerative, and scientific inference is not restricted to conclusions couched in observational vocabulary.

[2] In saying that the method of science involves the use of inference, without specifying whether the inference is inductive or deductive, I set aside the substantive dispute about the logical structure of scientific inference. Karl Popper, for example, held that there is no such thing as inductive inference, and that the only form of inference required by his falsificationist account of method is deduction (e.g. Popper 1963). Critics of Popper such as Wesley Salmon argued that even Popper's falsificationist method must resort to induction (Salmon 1981).

influenced by the theories which scientists accept. Fourth, and finally, even the language which scientists employ to describe observed phenomena may derive from and depend semantically on the theories which are employed to explain the phenomena.[1]

In light of the theory-dependence of observation, it may be tempting to conclude that the objectivity of science is a myth, at least with regard to observation. For, if observation is theory-dependent, it will not be possible to conduct neutral empirical tests or appeal to objective empirical data in order to evaluate scientific theories. This would, however, be a mistaken conclusion to draw. What the theory-dependence of observation shows, if it shows anything, is that observation is fallible. Theory may lead scientists to overlook relevant data, instruments may produce mistaken data, perception may be influenced by false theory, and theory-laden observation reports may themselves be mistaken. In sum, theory-dependent observation is fallible, not subjective.

It is a mistake to think objectivity in observation requires absence of theory. What is required for the objectivity of observation is that there be standard and shared procedures that enable scientists to arrive at uniform results. Standard procedures for the use of instruments as well as for the recording of observed data mean that measurements and data reports are not dependent on the subjective states of individual observers. With shared and standard procedures, observation may be objective even if it is influenced in various ways by theory. As Alan Chalmers has suggested, "Objectivity is a practical achievement" (1990, 49). Scientists must develop and adopt shared practices and procedures in order to ensure objectivity at the level of observation and experiment.[2]

Variability of the methods of science: Against the idea of a fixed and stable scientific method, it has been argued that the method of science is subject to variation both across the sciences and over the course of the history of science. At a suitably general level of description – say the idea that the method consists of observation and inference – there can be no serious suggestion that the method of science has undergone significant change. But to say that the method of science consists in the employment of observation and inference is too coarse-grained a level of description. Such a coarse-grained description would be unable to distinguish science from ordinary common sense, or, indeed from non-scientific and pseudo-scientific disciplines or pursuits.

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[1] The *locus classicus* for the theory-dependence of observation is Hanson (1958). The point that observation requires the guidance of theory is emphasized by Popper (1963, 46). Feyerabend argues for the semantic dependence of observational vocabulary on theory in his (1981). The role of theoretical knowledge in the use of instrumentation is illustrated by Giere's discussion of the Indiana University cyclotron (e.g. 1988, ch. 5)

[2] One concern that is sometimes raised about theory-dependence is that observation can provide theory with no epistemic support if the theory on which the observation depends is the very same theory that the observation is meant to test. But unless the observation is completely invented, it will be an observation of phenomena which occur independently of theory. Moreover, in most, if not all cases, the theory under test is not the theory on which observation depends. For example, the optical theory of the telescope is a different theory from the astronomical theory for which telescopic observation of the moon's surface provides relevant evidence.

Once a more fine-grained level of description is adopted, we find variation between the sciences and throughout the history of science. The method of hypothesis was adopted in theoretical physics as physicists increasingly speculated about the unobservable causes of observed phenomena. Principles of experimental design were refined, as, for example, double blind trials were adopted in place of single blind or unblinded trials. Criteria of acceptable explanation have undergone variation as non-circular motion was allowed by astronomy and causal relations were taken to be mechanistic or non-deterministic.[1]

Once the possibility of different and varying methods of science is recognized, the picture of scientific objectivity and consensus as based on a shared method breaks down. For if there is variation in the methodological standards of science, then it becomes possible for scientists to disagree based on their adoption of divergent sets of standards. Without a common set of methodological procedures, no mechanism exists which might guarantee consensus-formation within the sciences. The upshot of the idea that method is subject to variation is a relativistic denial of the objectivity of science. In the absence of shared standards, scientists are free to appeal to competing sets of standards to justify their acceptance of opposing theoretical viewpoints. Without some commonly agreed set of standards and procedures, there is no objective basis for scientific theory-acceptance. The special epistemic standing of the sciences may no longer be defended by appeal to the objectivity of its method.

But it is a mistake to infer relativism from the variability of method. The purported fact that the methods of science vary does not suffice to draw the relativistic conclusion. The reason is simply that not all methods are equal. Some methods are better than others. Indeed, some are objectively better than others. It is possible to develop and refine the methods of the sciences, so that faulty methods are replaced by improved ones. The process of the development and improvement of the methods of science is itself an empirical one that is a part of the scientific process itself. Scientists have discovered that the restriction of astronomical explanation to circular motion is mistaken just as they have discovered that for many purposes double blind trials are to be preferred to unblinded trials.

But while the point that not all methods are equal suffices to defeat relativism, it remains the case that variation of method does allow for divergence of opinion among scientists who adopt different methods. Here, I think that the right attitude is simply to allow that there is a certain pluralism that obtains in the sciences. Scientists may disagree on a rational basis. Because they may base their divergent views on methodological considerations, their rational disagreement may have an objective basis. But this is not the end of the matter. Disagreement is a problem that

[1] For the method of hypothesis, see Laudan (1981). For variation of method generally, see Feyerabend (1975), Kuhn (2012) and Laudan (1984). For an introductory overview, see Chalmers (2013, ch. 11).

requires resolution. But the fact that, as Thomas Kuhn put it, there is no "algorithm for theory-choice" (2012, 198) does not mean that scientific disputes must remain forever unresolved. To quote more extensively from Kuhn, "Because scientists are reasonable men, one or another argument will ultimately persuade many of them. But there is no single argument that can or should persuade them all" (2012, 157). Over the course of time, scientific disputes tend to be resolved. But not all disputes are resolved on the same grounds. Nor do all scientists alter their views on the same basis.[1]

5. A Plea for Realism

In the foregoing, I have distinguished between three forms of objectivity, ontological objectivity, the objectivity of truth and epistemic objectivity. But how are these three notions related? I have already indicated how the objectivity of truth may be seen to have a certain dependence, via correspondence, on ontological objectivity. Let us now ask how epistemic objectivity is related to the other two notions.

Here, ideally, is the way I think that the matter stands. The reason that we value and indeed should seek to ensure and maintain epistemically objective methods is precisely in virtue of the relationship that this form of objectivity bears to the other forms of objectivity. It is because we employ methods of scientific inquiry which function to exclude subjective factors and to incorporate only genuinely epistemic factors that the results and theories of the sciences should be accepted. They should be accepted because by employing such methods we have the best chance of arriving at true beliefs about the nature of reality. In short, it is the epistemic objectivity of the methods of science that leads us to the objective truth about the objective world.

How can we be certain of this? I do not think there is any certainty to be had. But we are nevertheless presented with the immense empirical and practical success of the sciences. The best explanation that may be proposed of such success is precisely that the methods that are employed in scientific inquiry contribute substantively to the success of its outputs. Why is this? It is in my view because the methods of the sciences are highly reliable truth-conducive tools of inquiry that the sciences lead so regularly to successful interactions with the world. It would be nothing short of a miracle were science to be so successful, and for our methods of scientific inquiry not to lead to the truth.[2]

[1] For further development of the points about methodological variation, relativism and rationality, see my (2015, chs. 2, 4).

[2] My mention here of miracles owes an evident debt to Putnam (e.g. 1975, 73), and the work of Boyd (e.g. 1984). For further development of the position, see my (2015, ch. 4; 2016, chs. 6 and 7).

References

Boyd, R. (1984). The Current Status of Scientific Realism, in J. Leplin (ed.), pp. 41-82, *Scientific Realism*, University of California Press.

Chalmers, A. (1990). *Science and its Fabrication*, Open University Press.

Chalmers, A. (2013). *What is this thing called science?* (4th ed.), University of Queensland Press.

Feyerabend, P. K. (1975). *Against Method*, New Left Books.

Feyerabend, P. K. (1981). Explanation, Reduction and Empiricism, in his *Realism, Rationalism and Scientific Method: Philosophical Papers*, Vol. 1, pp. 44-96, Cambridge University Press.

Giere, R. N. (1988). *Explaining Science: A Cognitive Approach*, University of Chicago Press.

Hanson, N. R. (1958). *Patterns of Discovery*, Cambridge University Press.

Hoyningen-Huene, P. (1993). *Reconstructing Scientific Revolutions: Thomas S. Kuhn's Philosophy of Science*, University of Chicago Press.

Kornblith, H. (1993). *Inductive Inference and Its Natural Ground*, MIT Press.

Kuhn, T. S. (2012). *The Structure of Scientific Revolutions*, 4th ed., University of Chicago Press.

Laudan, L. (1981). *Science and Hypothesis*, Reidel.

Laudan, L. (1984). *Science and Values*, University of California Press.

Popper, K. R. (1963). *Conjectures and Refutations*, Routledge.

Putnam, H. (1975). What is Mathematical Truth? in his *Mathematics, Matter and Method: Philosophical Papers*, Vol. 1, pp. 60-78, Cambridge University Press.

Putnam, H. (1981). *Reason, Truth and History*, Cambridge University Press.

Putnam, H. (1987). *The Many Faces of Realism*, Open Court: La Salle.

Salmon, W. (1981). Rational Prediction', *British Journal for the Philosophy of Science* 32, pp. 115-125.

Sankey, H. (2015). *Ciencia, Realidad y Racionalidad*, Editorial Universidad Del Cauca.

Sankey, H. (2016). *Scientific Realism and the Rationality of Science*, Routledge

Sankey, H. (2019). To Believe Is to Believe True, *Principia*, 23(1), 131-136.

Van Fraassen, B. (1980). *The Scientific Image*, Oxford University Press.