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Realism and the Epistemic Objectivity of Science

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Abstract: The paper presents a realist account of the epistemic objectivity of science. Epistemic objectivity is distinguished from ontological objectivity and the objectivity of truth. As background, T.S. Kuhn's idea that scientific theory-choice is based on shared scientific values with a role for both objective and subjective factors is discussed. Kuhn's values are epistemologically ungrounded, hence provide a minimal sense of objectivity. A robust account of epistemic objectivity on which methodological norms are reliable means of arriving at the truth is presented. The problem remains that deliberative judgement is required to determine the relevance and relative significance of a range of methodological norms. A role is sketched for cognitive virtues which may be exercised in the course of the deliberative judgement.

Keywords: scientific realism, objectivity, theory-choice, values, method

1 Introduction

In this paper, I propose a realist account of the epistemic objectivity of science. Baldly stated, epistemic objectivity arises from the adoption of norms which promote truth about the objective world. Epistemic objectivity is explained in reliabilist terms as compliance with truth-conducive epistemic norms. To the extent that the scientist must deliberate on the application of competing epistemic norms, the account draws on the resources of virtue epistemology. The aim of the paper is not to defend a realist account of objectivity against anti-realist accounts of objectivity. The aim of the paper is to develop an account of epistemic objectivity that is suited to a realist conception of scientific inquiry.

It is not my intention to argue for scientific realism here. Still, it is important to set the stage by indicating the nature of the realist conception of science that lies behind my approach to objectivity. I take scientific realism in the first instance as a

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view about the aim of science. The aim of science is to discover the truth about the world, and progress in science consists in progress toward that aim. The world that science investigates is an objective reality that exists independently of human thought. Like reality itself, truth is also objective. Truth is a correspondence relation between claims about the world and the way the world is. Most importantly, science is not restricted to empirical claims of an observational nature. Science is strongly theoretical. Scientific theories make substantive assertions about the nature of unobservable theoretical entities. Observed phenomena are often explained in terms of the behavior of theoretical entities whose existence is postulated for such explanatory purposes. Well-established theories are to be accepted as true or approximately true explanations of the world that apply to both observable and unobservable aspects of reality.¹

The outline of the paper is as follows. Section (2) notes the ambiguity of the notion of objectivity and indicates how the notion of epistemic objectivity broadly relates to two other main notions of objectivity. Section (3) introduces the topic by way of T.S. Kuhn's discussion of subjectivity and objectivity in the context of multiple scientific values. Section (4) argues that Kuhn's discussion provides at most a minimal sense of objectivity on which the values play a neutral role, though their relation to truth is left unaccounted for. Section (5) introduces a robust sense of epistemic objectivity on which a belief is epistemically justified in an objective sense if it is based on a truth-conducive methodological norm. Section (6) notes a shortcoming with both forms of epistemic objectivity due to the potential conflict between competing norms, and the resulting need for subjective judgement with respect to the application of methodological norms. Section (7) explores the way in which judgement between competing norms may involve the exercise of cognitive virtues which import objective elements into the subjective sphere. Section (8) summarizes the discussion and raises questions for future work.

2 Objectivity

What is objectivity, and how is it exemplified by the sciences? The notion of objectivity is subject to a certain ambiguity. I distinguish three primary notions of objectivity applicable to the sciences: (i) an ontological sense of objectivity relating to the mind-independence of the natural world; (ii) a semantic form of objectivity relating to the nature of truth; (iii) an epistemic notion of objectivity relating to methodological norms and the epistemic justification of beliefs and theories

¹ See my (Sankey 2004), for details of this account of scientific realism.

licensed by those norms. Though distinct, I suggest that the three forms of objectivity have a certain interdependence.²

The first notion of objectivity is the idea that the world exists in its own right. The way the world is does not depend on us. Nor does it depend on the way we think it is. Reality is independent of human thought and experience. Its existence, nature and structure are independent of human thought, language, conceptual activity and perceptual experience. The world in itself, independent of all human contribution, is objective reality. As for its role in science, objective reality provides the subject-matter. It constitutes the object of study for scientific investigation. When scientists conduct research, their aim is to determine the nature of the objective reality that they investigate. The aim of science is to discover the nature of objective reality itself.³

The second notion of objectivity relates to truth. Truth is objective in the sense that it does not depend on what we believe. It depends on the way the world is. A true belief gets the world right. The truth need not be how we believe or wish the world to be. It has nothing to do with what we believe and everything to do with how the world is. The way the world is does not depend on what we believe or even what we are justified in believing. Not only may belief be false, but justified belief may be false. Moreover, a proposition does not need to be believed for it to be true (or false). A proposition that nobody believes, and for which nobody has any evidence, may nevertheless be true.

The dependence of truth on reality brings the objectivity of truth into relation with ontological objectivity. As the realist understands this dependence, truth is a correspondence relation which 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.

² That the notion of objectivity is multiply ambiguous is well-known. See, for example, Douglas (2004) for a useful discussion. I do not wish to take issue here with more fine-grained analyses of the ambiguity. I wish instead to emphasize three primary forms of objectivity, and to draw attention to a robust form of epistemic objectivity that is closely associated with epistemic warrant or justification.

³ The ontological form of objectivity relates primarily to inquiry in the natural sciences in which the objects of study lie outside the mind. It is an interesting question whether it can be applied to the social sciences which investigate humans and their mental activity. It can be unproblematically applied to artifacts (e.g. tables) which exist in a mind-independent manner despite being made by humans. But what about minds themselves? Surely, they do not exist independently of the mental. This raises intriguing metaphysical questions which lie beyond the scope of the present paper. But note that it makes coherent sense to say that one may have a mind without believing that one has a mind, or, indeed, having the concept of a mind at all. An individual's having a mind is independent of the mental in that sense. This seems precisely what one should say about some non-human animals as well as pre-linguistic human children.

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.⁴

The third notion of objectivity is an epistemic one. The epistemic notion of objectivity has a close connection with the idea of a scientific method. Science is characterized by the employment of a special method which distinguishes it from non-science and pseudo-science. For present purposes, this special method may be understood either in traditional terms as a single method or in more contemporary terms as a set of norms and procedures broadly constitutive of the methodology of science.⁵ 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 considered in scientific inquiry are epistemically relevant factors (e.g. empirical evidence) which contribute to the search for scientific knowledge. As such, use of the scientific method promotes the epistemic objectivity of science by excluding subjective factors in favour of epistemically relevant factors. As a result of its objective nature, scientific inquiry is characterized by widespread consensus among scientists. Disagreement, where it occurs, 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.

I have distinguished three forms of objectivity: ontological objectivity, the objectivity of truth and epistemic objectivity. I have 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 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

⁴ The world being objectively that way is what makes the proposition true. The correspondence view is a non-epistemic theory of truth which takes truth to be independent of epistemic notions such as justification. Epistemic theories of truth which treat truth as an epistemic property risk undermining the objectivity of truth, since truth in an epistemic sense may depend on variable systems of belief rather than on a fixed reality outside of belief.

⁵ The general point about the relationship between epistemic objectivity and the methodology of science may be put either in terms of a single scientific method or in terms of a plurality of methods (norms, procedures, etc.). In the next section, and throughout the remainder of the paper, I approach the issue in more contemporary fashion in terms of a range of methodological norms rather than a single scientific method.

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 to the objective truth about the objective world.

3 T.S. Kuhn on Scientific Values and Objectivity

In this section, I turn specifically to the question of the epistemic objectivity of science. To introduce the topic, I provide a brief overview of T.S. Kuhn's well-known treatment of subjective and objective factors in relation to the norms of scientific methodology.

Kuhn's famous book, *The Structure of Scientific Revolutions*, was met by a negative critical reaction due to the relativistic and irrationalist implications of the account of scientific theory-change the book proposed. In a number of publications dating from the early 1970s, Kuhn sought to dispel the impression of relativism and irrationalism which surrounded his account of theory-change.⁶ In particular, in his paper 'Objectivity, Value Judgment and Theory Choice', Kuhn claims that there is a stable core of scientific values found throughout much of the history of science.⁷ These values provide an objective basis for scientific theory-choice, though subjective factors enter into the individual scientist's understanding and application of the values.

As described in *Structure*, the choice that scientists make in revolutionary transition between paradigms is unable to be made on the basis of a shared set of methodological standards. Paradigms are incommensurable, due in part to a lack of shared standards, as well as being directed to disjoint sets of problems.⁸ Kuhn presents a modified view of the matter in 'Objectivity, Value Judgment and Theory Choice'.⁹ Rather than deny the existence of shared methodological standards,

⁶ In addition to (Kuhn 1977), which forms the focus of the discussion in this section, Kuhn makes related points in (Kuhn 2012, pp. 184–6, 198–9) and (Kuhn 1970, pp. 259–66).

⁷ Kuhn's presentation of the scientific values is intended in descriptive spirit as an enumeration of the values which are and have in fact been employed in scientific practice in the history of science, as well as in contemporary science.

⁸ There is, of course, more to incommensurability than this. For details, see my (Sankey 1993).

⁹ Scholars may disagree with respect to whether this is a modification or a clarification of Kuhn's original view. In favour of saying that it is a clarification, it may be noted that Kuhn does refer at one point in *Structure* to "commitments without which no man is a scientist" (Kuhn 2012, p. 42). The commitments Kuhn had in mind might well have been the scientific values which he later enumerates. In favour of saying that it is a modification, it may be noted that Kuhn did not explicitly explain what the commitments are in a way that makes clear that they do include the values.

Kuhn holds that there is a set of methodological criteria which scientists employ in the appraisal of scientific theories and in the resulting choice of theory that they make. The criteria function as values which guide and inform theory-choice, rather than as rules which dictate the choice. Kuhn does not undertake to provide an exhaustive list of the values. But he does list accuracy, consistency, scope, simplicity and fruitfulness as being among the most prominent values actually embraced by scientists.¹⁰ The distinction between rules and values is important for some purposes. But it is not of crucial significance here. So, in what follows I gloss over it. Except where specifically discussing what Kuhn says about values, I will tend to employ the more general term ‘norm’ to refer to the criteria or standards which Kuhn describes as values, as well as to any criteria or standards that might be regarded as rules.

As opposed to the view that seemed to be presented in *Structure*, on Kuhn’s modified view scientists choose between theories or paradigms on the basis of shared methodological norms. Indeed, Kuhn describes the values as “*the shared basis for theory choice*” (Kuhn 1977, p. 322). What remains of the apparent relativism of the original view is the idea that the set of values which informs scientists’ choice of theory fails to uniquely determine that choice. Scientists who employ the same set of values in the appraisal and choice of theory need not reach the same decision. Kuhn explains that there are two main reasons for the lack of a unique outcome. First, the values themselves are imprecise, so that scientists may differ in their interpretation and application of an individual value. Secondly, it is possible for the values to conflict with each other; “accuracy may, for example, dictate the choice of one theory, scope the choice of its competitor” (Kuhn 1977, p. 322). As a result of the imprecision of individual values and the potential conflict between them, scientists who appeal to the shared set of values may nevertheless come to different decisions based on the shared values. As Kuhn expressed the point elsewhere, “there is no neutral algorithm for theory-choice, no systematic decision procedure which, properly applied, must lead each individual in the group to the same decision” (Kuhn 2012, p. 198).

Because the shared scientific values fail to uniquely determine choice of theory, Kuhn holds that both subjective and objective factors contribute to individual choice of theory. On the one hand, the shared values constitute objective factors which scientists take into account in choice of theory. On the other hand, individual scientists vary with respect to the interpretation and weight which they attach to the shared values. As a result of such individual variation in application

¹⁰ The five values cited in the text are the ones chiefly emphasized by Kuhn. But, as Hoyningen-Huene notes, other values are mentioned throughout Kuhn’s writings, e.g. unity of science, explanatory power (see Hoyningen-Huene 1993, p. 149).

and weighting of shared values, subjective elements enter into an individual scientist's choice of theory. Kuhn is at pains to insist, however, that such subjective factors do not make theory-choice an inscrutable matter of personal taste. To say that an individual scientist's choice of theory involves subjective elements is not to say that no discussion of the matter is possible: 'If my critics introduce the term "subjective" in a sense that opposes it to judgmental—thus suggesting that I make theory choice undiscussable, a matter of taste—they have seriously mistaken my position' (Kuhn 1977, p. 337). For Kuhn, the subjective elements of theory-choice left undetermined by the values are not exempt from challenge. So far from being a brute matter of personal taste, the subjective elements are themselves open to discussion. Indeed, to be taken seriously as a scientist, a scientist must be able and willing "to exhibit the bases for their judgments" (Kuhn 1977, p. 337).

In the next two sections (4 and 5), I explore the extent to which epistemic norms such as Kuhn's values provide an objective basis for epistemic justification and theory-choice. I return to the role purportedly played by subjective factors in the section that follows (6).

4 Minimal Objectivity

In this section, I consider the sense in which the scientific values identified by Kuhn provide an objective basis for theory-choice. The values reflect features of theories which are outside the minds of individual scientists. As such, they are able to play a neutral role in theory-appraisal. But Kuhn provides no epistemological grounding for the values. Hence, I suggest, the values are objective in a minimal sense of objectivity.

For Kuhn, theory-choice is conducted on the basis of the shared values which constitute criteria of theory appraisal. In choosing between alternative theories, a scientist considers the extent to which the theories satisfy the values. Because alternative theories may all satisfy the values in various ways, and to varying degrees, the scientist must make a decision as to which values are to be accorded greater significance for the decision at hand. This is where Kuhn takes there to be individual variation between scientists, due to the fact that the values are unable to fully determine theory-choice. But we may set that point aside until we return to it in section (6). The point of present relevance is that, in choice of theory, the scientist appeals to a set of values which provides the basis for the choice. For example, a scientist may choose a theory because they take the theory to be simpler and more accurate than alternative theories. In such a case, the values of simplicity and accuracy provide the basis for the scientist's choice.

There is a sense in which the values to which a scientist appeals in choice of theory constitute an objective basis for theory-choice. The values to which the scientist appeals are independent of the scientist. They are outside the mind of the individual scientist. The values reflect features of theories which the theories possess independent of the scientist. For example, if a theory satisfies the value of accuracy, this means that the theory possesses the property of being accurate. Because of the independence of the value from the scientist, the value provides a basis for the scientist's choice of theory which is outside the mind of the scientist. The scientist's choice of theory is not therefore an unconstrained subjective mental state. It has an objective basis because it is based on something outside the mind of the scientist.¹¹

But while there is a sense in which the values provide an objective basis for theory-choice, it is at best a minimal sense of objectivity. To see this, it is important to recognize that Kuhn provides no epistemological grounding for the values. He takes there to be a difference between scientific values and values such as social utility (Kuhn 1977, p. 331). But he provides no explanation of how or why adherence to the values in the context of scientific inquiry leads to truth or knowledge. At one point, Kuhn appears to suggest that to provide such an account would require a solution to the problem of induction, something which he is unable to provide (Kuhn 1977, pp. 332–3).¹² The result is that, while the independence of the values enables them to play an objective role, no substantive account has been given by Kuhn of the epistemic role of the values. Nothing has been done to show that they have anything to do with truth or knowledge. Given Kuhn's resistance to talk of truth in relation to science (e.g. Kuhn 2012, p. 205), it is perhaps no surprise that he fails to connect the values with truth. Still, one might suppose that he could have said something about the relation between values and epistemic justification, since the latter is an important component of knowledge.¹³

Given the absence of an epistemological ground for the values, the sense of objectivity which the values provide is a minimal sense at best. The values are

11 A question might be raised about the sense in which the values provide an objective basis for theory-choice. Because the values are shared among scientists, this may suggest that they have an intersubjective status rather than being objective. But it is important to note that the values are keyed to features of actual theories, e.g., the accuracy of the theory. Because the properties of the theory lie outside the mind of the scientist they are objective rather than merely intersubjective.

12 Failure to provide a substantive epistemological rationale for the scientific values is part of a broader pattern. Kuhn never did develop a worked out metamethodological theory of the warrant of epistemic norms, at first flirting with a sociological account (Kuhn 2012, p. 94), later sketching a naturalistic account (Kuhn 1970, p. 237), and finally endorsing a conceptual grounding similar in spirit to a Strawsonian justification of induction (Kuhn 2000b). For detailed discussion, see Nola and Sankey (2014, pp. 285–97).

13 On the other hand, how to conceive of knowledge without talking of truth is problematic. It is worth noting in passing that Kuhn was less reticent about truth later in his career (e.g. Kuhn 2000a, p. 99).

objective in the sense of lying outside the mind of the individual scientist. But because the values have not been shown to have an epistemic role by leading to truth or knowledge, Kuhn's account of objectivity in terms of shared scientific values fails to provide a robust sense of epistemic objectivity. For the values to provide a robust form of epistemic objectivity they must have a substantive connection with truth or knowledge. The objectivity at issue could hardly be *epistemic* objectivity without a connection to truth or knowledge.

5 Robust Objectivity

In the previous section, I have argued that Kuhn's scientific values give rise to a minimal sense of objectivity. Without an epistemological grounding, they fail to provide the basis for a substantive notion of epistemic objectivity. The question now is whether a more robust account of objectivity may be found.

My aim in this section is to define a more substantive conception of epistemic objectivity than the minimal sense considered in the previous section. What I wish to propose is that methodological norms such as Kuhn's values are themselves able to possess objective epistemic warrant. If a scientist accepts a theory because the theory satisfies warranted methodological norms, the scientist's acceptance of the theory is itself thereby warranted. The scientist's acceptance of the theory has objective epistemic justification because the theory satisfies the methodological norms.

To explain the objective basis of justified theory acceptance, I draw upon the resources of reliabilist epistemology. The reliabilist theory of the warrant of methodological norms that I adopt is a modified version of Laudan's normative naturalism (Laudan 1987) which I have developed in earlier papers (especially Sankey 2000, 2002). Unlike Laudan, I place the normative naturalist meta-methodology in a scientific realist context by arguing that truth is an aim of science that may be rationally pursued. Once normative naturalism is placed within a realist context it is transformed into a kind of method reliabilism because the methodological norms of science are conceived as a reliable means of arriving at the truth. For simplicity, I present the approach in terms of truth though scientific realism tends to emphasize approximate truth rather than truth.¹⁴

¹⁴ The position is characterized as a form of method reliabilism to distinguish it from process reliabilism. The processes considered by process reliabilism are typically cognitive processes with which humans are naturally endowed (e.g. perception, reasoning, memory). By contrast, methods of the kind at issue here are typically developed by scientists in the course of scientific practice and are acquired by training and education. For the distinction between process and method reliabilism (see Goldman 1986, pp. 93–5).

The reliabilist theory of epistemic justification enables an explicit connection to be made between justification and truth. For a methodological norm to convey epistemic warrant, use of the norm must lead reliably to truth. Methodological norms are conceived in instrumental fashion as tools of inquiry.¹⁵ They are means for the realization of the epistemic aim of truth. The relation between epistemic means and ends is not an analytic or conceptual relation that may be known in an *a priori* manner. It is a contingent synthetic relation that is subject to *a posteriori* investigation. Conceiving methodological norms in this way enables the question of whether a norm is warranted to be understood as the empirical question of whether use of the norm leads to the epistemic aims it is meant to promote. Methodological norms are to be evaluated empirically to determine whether their use leads to truth.

It is not possible to directly observe that use of methodological norms leads to truth at the level of theoretical claims about unobservable entities. The truth of the non-observational content of theories is unable to be determined by direct observation. This is the basis for Laudan's anti-realist version of normative naturalism (Laudan 1987, p. 30, fn 19; cf. Laudan 1984, p. 53). As against Laudan, I employ an inference to the best explanation at the metamethodological level to the effect that the best explanation of the role played by methodological norms in the production of successful scientific theories is that they constitute truth-conducive tools of inquiry. This approach employs a meta-methodological analogue of the classic 'no miracles' argument for scientific realism. To put it concisely, it would be a miracle for a theory to satisfy a range of methodological norms to a high degree and yet be completely mistaken (for detailed development of my approach, see Sankey (2000, pp. 224–5, 2002, pp. 75–8, 2004, pp. 69–72).

The reliabilist approach to the warrant of methodological norms that I have just outlined enables us to conceive of epistemic objectivity in a more substantive sense than the minimal sense considered in the previous section. It is a more substantive sense of epistemic objectivity because it is grounded in factual relations between method and truth. If a methodological norm is in fact genuinely truth-conducive, there is a sense in which belief licensed by the norm is objectively warranted. For it is an objective matter of fact that use of the norm actually does lead to truth. The objective connection between the norm and truth gives rise to an objective sense of epistemic warrant. A belief is epistemically justified in an objective sense if it is based on a norm that in fact conduces to truth.

¹⁵ The instrumentalist conception of method is an idea with a strong pragmatist lineage. The primary inspirations for my approach are the methodological pragmatism of Rescher (1977) and the hypothetical imperative analysis of the rules of method due to Laudan (1987).

In sum, the reliabilist analysis of the warrant of methodological norms provides the basis for a robust sense of epistemic objectivity. The objectivity provided by reliably truth-conducive methodological norms is not just objectivity in the minimal sense that the norms are independent of the mental states of individual scientists. It is stronger than that. The epistemic justification provided by the methodological norms derives from the fact that there is a reliable connection between use of the norms and the truth. Because there is a real fact of the matter about the truth-conducive character of the norms, there is a robust sense in which the epistemic justification provided by the norms is objective. It is objective in a robust sense precisely in virtue of the objective fact that the methodological norms really do promote truth. The norms are not just independent of an individual scientist's thought processes. They are grounded in objective facts about the relationship between method and truth.¹⁶

6 Subjective Elements

In section (3), we saw that Kuhn took scientific theory-choice to involve subjective elements not determined by the shared scientific values. Given the imprecision of the values and the potential for conflict between them, there is scope for individual variation in the interpretation and weighting of the values. In this section, I return to that issue.

On the assumption that science is not governed by a single fixed method, a pluralistic approach to the methodology of science may be adopted. On such a conception, scientists adhere to a variety of methodological norms. These norms vary in specificity and abstractness. The norms range from low-level rules applying to the use of specific instruments in laboratory settings, to general principles of experimental design, to over-arching accounts of the relationship between theory and evidence, and criteria of theory-appraisal of the kind described by Kuhn. On such a pluralist conception of methodology, there may be variation of methodological norms between various branches of science, and, indeed, throughout the history of science.¹⁷

16 The account of robust epistemic objectivity that I have sketched in this section is broadly externalist in spirit. As such, it may attract the ire of those of an internalist persuasion. For present purposes, there is no need engage in a defence of reliabilism against internalist critique. The main purpose at hand is to provide an example of a robust account of objectivity by putting it on display.

17 The existence of a plurality of norms of method raises the specter of epistemic relativism. One of the strengths of the normative naturalist or method reliabilist approach is that there is no need to grant to the relativist that one norm is as good as any other norm. There is an objective difference between norms which promote truth and norms which do not, so the relativist view that all norms are of equivalent epistemic status may be rejected. For details of this response to epistemic relativism, see my (Sankey 1996) and (Sankey 2010).

On such a pluralist conception, the methodology of science is constituted by a range of methodological norms that scientists employ in the practice of science. While it may be possible to rank-order the norms for specific purposes in specific contexts, it seems unlikely that they can be set into a fixed or universally applicable ordering. Moreover, it seems unlikely that the norms can be codified in a way that yields a mechanical decision procedure which might lead all scientists to arrive at exactly the same choice of theory. In light of these points, Kuhn's claim that there is no algorithm for theory-choice seems entirely plausible.

On the assumption that there is no algorithm of theory-choice, it seems clear that a role must be played by deliberative judgement in the choice between theories. Even if the norms of scientific method are objective in both the minimal and the robust senses identified in the previous two sections, the individual scientist must still arrive at a judgement as to which norms to treat as relevant and most significant. The role of individual judgement raises the possibility that an element of subjectivity is involved in the decision-making process in much the way that Kuhn suggested.

In sum, if Kuhn is right, objective methodological considerations leave scope for subjective elements to enter scientific decision-making. Individual scientists must decide upon the relevance and relative significance of a range of methodological considerations. Despite the existence of objective methodological norms, an individual scientist must engage in a process of deliberation in arriving at a judgement of the relative weighting and merits of diverse methodological considerations. The question is what is to be said about the nature of such judgement.

7 A Role for Virtue

In the previous section, we saw that a necessary role is played by deliberative judgement in deciding how to weight and apply a range of methodological norms. As Kuhn suggested, the need for such judgement imports a subjective element into theory-choice that is not determined by the objective norms. It is important to bear in mind Kuhn's insistence that the role played by subjective elements does not render theory-choice a matter of inscrutable personal taste. The subjective elements of a scientist's decision are open to critical discussion. Indeed, it seems clear that, for Kuhn, rational considerations play a crucial role in the subjective elements of the decision that are left undetermined by the objective norms.

Kuhn did not develop an account of the nature of the judgement involved in scientists' deliberations concerning the significance and relative weight of the

scientific values.¹⁸ But it is possible to say something positive about the nature of such judgement by drawing on the resources of recent virtue epistemology. Though this possibility has yet to attract attention in relation to Kuhn's ideas about theory-choice, relevant discussion has occurred in relation to Pierre Duhem's idea of "good sense", beginning with a seminal article by David Stump (2007).¹⁹

The basic idea is that, in addition to the two forms of epistemic objectivity canvassed so far, there is a third notion of objectivity that may be distinguished. This form of objectivity is located within the process of deliberative judgement that Kuhn described as being subjective. More specifically, the idea is that there is a range of cognitive virtues that may be exercised by a scientist in the process of forming a judgement. The judgement involved in weighing up and applying the methodological norms in the context of theory-choice may itself be a virtuous process in the sense that the virtues are appropriately employed in the course of forming the judgement. Virtuous judgement can itself be objective because the cognitive virtues themselves embody and manifest a form of cognitive objectivity.

What are the virtues, and how do they perform this role? It would take us too far afield to survey all the cognitive virtues or versions of virtue epistemology to be found in the literature. I confine myself, therefore, to the virtue highlighted in Stump's discussion of Duhem. Stump places considerable emphasis on "the image of the scientist as impartial judge" (Stump 2007, p. 151). The need for a scientist to deliberate in an impartial manner requires that the scientist adopt a certain attitude of detachment. As Duhem himself writes:

[...] nothing contributes more to entangle good sense and to disturb its insight than passions and interests. Therefore, nothing will delay the decision which should determine a fortunate reform in a physical theory more than the vanity which makes a physicist too indulgent towards his own system and too severe toward the system of another. We are thus led to the conclusion so clearly expressed by Claude Bernard: The sound experimental criticism of a hypothesis is subordinated to certain moral conditions; in order to estimate correctly the agreement of a physical theory with the facts, it is not enough to be a good mathematician and skillful experimenter; one must also be an impartial and faithful judge. (Duhem 1954, p. 218)

As can be seen here, Duhem cautions against falling into the grip of "passions and interests", as well as the "vanity" of being "indulgent" towards one's own theory while being overly critical of theories held by others. Though it consists of a number of elements, the primary virtue at issue here is the virtue of impartiality. If a

¹⁸ For discussion of the relevant notion of judgement, see my (Sankey 1994), and, for a developed theory of judgement, see Brown (1988).

¹⁹ Stump's article has prompted discussion of the relationship between Duhemian good sense and empirical considerations in theory choice, as well as alternative versions of virtue epistemology. See, for example, Ivanova (2010, 2012) and Kidd (2011).

scientist exercises the virtue of impartiality, they form a judgement in a neutral and detached way that is free from bias and not unduly committed to their own favoured theory.

How is the virtue of impartiality to be brought to bear on the problem of judging the relative significance and applicability of multiple methodological norms? One key role played by impartiality is to ensure that appropriate methodological considerations are recognized and correctly applied. If a theory is in fact supported by relevant empirical evidence, the impartial judge will both recognize the existence of the evidence and accord due weight to that evidence whether or not the theory is their preferred theory. Equally, where competing theories differentially satisfy the same norms, the impartial judge will recognize the respects in which the theories satisfy the norms. Where it is possible to make a decision in light of this assessment, the impartial scientist will arrive at a judicious determination of which theory is to be favoured on balance, if one theory is indeed to be favoured on balance.

The virtue of impartiality provides a sense in which objectivity may obtain within the sphere that Kuhn describes as subjective. No doubt, further cognitive virtues (e.g. humility, intellectual honesty, even-handedness) remain to be explored which will enable this notion of objectivity to be amplified. Equally, it may be possible to provide a substantive account of the epistemological basis of such virtues which explains the extent to which they possess objective epistemic warrant. For now, though, it suffices to show that a role may be played by the cognitive virtues in ensuring the appropriate application of objective methodological norms.

8 Summary and Future Work

In this paper, I have sought to show how a realist might account for the epistemic objectivity of science. The stage is set by Kuhn's idea that theory-choice is based on shared scientific values and involves both objective and subjective elements. Because Kuhn provides no epistemological grounding for the values, they provide at best a minimal form of objectivity. However, it is possible to define a more robust sense of objectivity drawing on a normative naturalist conception of the warrant of methodological norms. Even so, there remains scope for subjective factors given potential conflict between norms. A role may be played by cognitive virtues such as impartiality which may import objective factors into the sphere of the subjective.

Two questions remain to be pursued. The first is the question of the relationship between methodological norms and cognitive virtues. One possibility is that the methodological norms are the primary bearers of epistemic objectivity. The role

of the cognitive virtues in this case is to play at most a supporting role in the application of the objective methodological norms. Another possibility is that the cognitive virtues themselves possess a form of epistemic objectivity in their own right. They do not just play a supporting role with respect to the methodological norms. The virtues themselves embody a form of epistemic objectivity.

The second question relates to the epistemological grounding of the cognitive virtues. A unified theory of epistemic objectivity would provide the same account for the objective warrant of the cognitive virtues as it does for the methodological norms. The question, then, is whether it is possible to treat the cognitive virtues in a way that is analogous to treating the norms of method as truth-conducive tools of inquiry whose reliability is open to empirical investigation.

These two questions indicate a direction of further inquiry into the nature of epistemic objectivity from a realist point of view. Much will turn on the prospects for a naturalistic account of the epistemological ground of the virtues along the lines of the approach that has been adopted for the norms of method. Given the track record of naturalism, there are grounds for optimism in this regard.

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