The Problem of Whewell's Idealism

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'the metaphysical is a necessary part of the inductive moment' (Whewell 1847: I ix)

1. Introduction

William Whewell is a towering and yet ambiguous figure in Victorian natural philosophy. Professor of Moral Philosophy at Cambridge, Master of Trinity College, founding member of the British Association for the Advancement of Science, fellow of the Royal Society, and president of the Geological Society, he was a powerhouse in Britain's bourgeoning scientific institutions. His two main works, *History of the Inductive Sciences* (1837) and *Philosophy of the Inductive Sciences* (1840), feature alongside John Herschel's *Preliminary Discourse on the Study of Natural Philosophy* (1830) and John Stuart Mill's *A System of Logic* (1843) as the first major attempts to lay bare the logic of induction. In response to the enormous progress in early Victorian science—including John Dolton's law of proportions, Thomas Young's demonstration of the wave character of light, and Michael Faraday's work on electromagnetism—Herschel, Whewell, and Mill attempted to vindicate the autonomy of science by demonstrating its internal standards of justification (Butts 1985: 197; Yeo 1992: 4). Yet Whewell's account of induction was sharply at odds with the empiricism that dominated Britain's scientific institutions. Herschel and Mill defended an enumerative theory of induction according to which inductive inferences work from the facts of experience to generalized, descriptive statements. In contrast, Whewell claimed that scientific discoveries are best explained by a form of idealism according to which there is both an external and an internal constraint on knowledge. Scientific discovery does not begin with bare facts, Whewell argued, but with a cognitive act that combines factual and theoretical elements. A Whewellian induction begins with the observation of a fact or set of facts, unifies those facts under a law, and then demonstrates how those facts derive from the law within a system of laws.

Scholars agree that Whewell's theory of induction was strikingly discordant with the prevailing empiricism of his day. Yet the nature of his idealism is contested. Early critics interpreted Whewell's idealism against the standard of Kant's critical philosophy. In his review of *Philosophy of the Inductive Sciences*, G. H. Lewes (1846) argued that Whewell attempts to reintroduce the detritus of metaphysics to British experimental philosophy by way of Kant's *a priori* account of the categories. Lewes' critique has political undertones. The close of the Hanoverian dynasty, followed by the imposition of the Continental Blockade in 1806, was marked by a strong public aversion to German ideas in Britain (Sloan 2003: 41; Cooper 2021: 474). A spate of new journals launched a

sustained attack on the German universities, where 'the paths of the true science are forsaken for the labyrinths of the new philosophy' (anon. 1799: viii). Mill (1873: 190) drew a sharp contrast the British tradition of empiricism and the 'German, or a priori view of human knowledge' defended by Whewell. Yet the few British philosophers familiar with Kant's philosophy argued that Whewell in fact departed from Kant by conflating the categories of experience with contingent laws discovered in experience, thereby returning to a Platonic form of intuition. Henry Mansel (1851: 291) claimed that the Platonic moment in Whewell's theory of induction betrays 'a stumble at the threshold of the Critical Philosophy' (c.f. Whewell 1860: 335).

In the twentieth century, scholars continued to assess Whewell's achievement in relation to Kant (Blanché 1935; Marcucci 1963). When interest in his philosophy of science resurfaced in the late twentieth century against the background of David Lewis' best-system account of laws, the primary question was Whewell's Kantianism. Gerd Buchdahl (1991: 353) argued that Whewell offers 'a mistaken reading of Kant', Robert Butts (1994: 278) contended that Whewell 'owes his theory of science to Kant', and Menachem Fisch (1991: 105) denied that there is evidence of a Kantian influence in Whewell's work at all. Noting the discordant state of Whewell scholarship, Butts (1967: 177) identified 'the problem of Whewell's idealism': was Whewell philosophically confused, and failed to see that Kant's transcendental idealism is incompatible with Platonic metaphysics, or did he successfully harmonize two seemingly historically incompatible philosophical alternatives?[1]

While Butts' framing of the problem draws our attention to important elements of Whewell's project, the pervasive tendency to examine Whewell's philosophy of science against the standard of Kant isolates Whewell from a broader interest in German ideas within several British institutions that were sufficiently insulated from public critique (see Yeo 1992: 3–4). Without this contextual background, Whewell's idealism appears as a striking anomaly in Britain that can only be explained by a 'conversion' to Kant's philosophy (see Fisch 1991:105). Yet this portrayal overlooks the creative redeployment of German ideas unfolding in several of Britain's leading scientific institutions. In Trinity College, for instance, several of Whewell's contemporaries, including Julius Hare and Connop Thirlwall, staged an 'Idealist reaction against Benthamite radicalism' (Preyer 1985: 45). As undergraduates, Whewell and Thirlwall were tutored in German by Hare, who was a native German speaker (Preyer 1985: 43). Several members of the group attended Samuel Taylor Coleridge's lectures on German philosophy in London and frequently corresponded with the Irishman William Rowan Hamilton (Fisch 1991: 89). Whewell attended the annual lectures at the Royal College of Surgeons, where Joseph Henry Green and Richard Owen drew from Kant and Schelling to develop a scientific program of comparative anatomy (Sloan 2003: 57–8). Giving attention to this broader context places

[1] Elsewhere Butts (1965: 161) states that 'The Kantian motives of his [Whewell's] philosophy of science have not been clearly worked out.' Despite more than half a century of work, his statement still holds.

Whewell within a local, collective effort to develop an idealist alternative to dominance of empiricism in Britain's leading scientific institutions.

In this chapter I take a step back from Whewell's direct relation to Kant to examine his idealism within the broader exchange of ideas between Germany and England, giving particular focus to the institutional context of Trinity College in the first half of the nineteenth century. Very little work has been done to explore the reception of German philosophy by British readers, and the impact of this encounter on the endemic methodologies of Locke, Hartley, and the empiricist tradition. To address the problem of Whewell's idealism, I examine the role that German philosophy played in his development from student of minerology to philosopher of science. Drawing especially from his unpublished letters and notebooks, I argue that Whewell's encounter with Kant's critical method provided a framework to shift his inquiry from the objects of science to the practice of science itself. While Whewell's idealism is not transcendental in Kant's sense of the term, his philosophy of science nevertheless extends a key Kantian distinction between objects and laws, such that the task of philosophy is to discern the forms of judgment—what Whewell terms 'mental tendencies' or 'ideas'—that determine the inferential structure of scientific inquiry. The result is a distinct form of idealism that, while continuous with Kant, must be understood on its own terms.

2. From object to method

Whewell's early work in minerology foreshadows a shift that can be found in his notebooks 'from the object to the method' of science, as he puts it in a notebook from 1830 (*WP* R.18.17[6], 33).[2] After being elected as fellow of Trinity College in 1817, Whewell became an assistant mathematics tutor, wrote a textbook on mechanics, and undertook research in crystallography. When John Henslow vacated the chair of Minerology at Cambridge in 1825, Whewell put himself forward for the position. Lacking empirical experience, he made plans to visit the mining academy in Freiburg where he intended to work under the German minerologist Friedrich Mohs. On 11 July 1825, Whewell informed Hugh James Rose, who studied with Whewell at Trinity, of his intentions to spend three months in Freiburg before continuing to Vienna, Berlin, and Dresden (*WP* MS. R/2.99[24]). Writing from Dresden on 15 August, he confessed to Rose that 'I am afraid that I may not bring back my faith as untainted as you have done: for I find my mineralogical supernaturalismus giving way in some respects' (*WP* MS. R/2.99[25]). Whewell uses the term 'mineralogical supernaturalismus' to refer to a system classification based on empirical description, which operates on the assumption that the earth's structure has a supernatural cause. In contrast, Mohs' mathematical system treated geology as a science, classifying minerals according to internal characteristics such as density and composition. With unconcealed excitement, he states that it 'may perhaps be profitable to bring about a union

[2] The *Whewell Papers* (*WP*) are in the Wren Library, Trinity College, Cambridge. R.18.17 refers to the box of Whewell's notebooks, the number in superscript refers to the specific notebook, the final number after the comma is the page reference.

between the two creeds [empiricism and idealism], which I hope will not be such a horrible thing in science as you hold it to be in faith.'

On 17 October, Whewell wrote to Richard Jones, informing him that 'I have got hundreds of mineralogical maggots in my head which I found in Germany and which may crawl into daylight hereafter' (*WP* Add.Mss.c.51[23]). He issued Jones with the injunction not to inform any of their friends or colleagues that 'I am bewildered with German philosophy, as you once raised an outcry with the accusation of a priori metaphysics – If you do so you may easily give people an impression which you will not be able to remove when I have convinced you, as I certainly shall at the first opportunity, that everything which I believe is most true, philosophical, and inductive.' Whewell's notebooks suggest that he was reading Kant during his tour through Germany and was especially interested in Kant's account of the *a priori* conditions of experience.[3] He asks Jones not to think that he is focused exclusively on minerology. The study of minerals 'is one of the very best occasions to rectify and apply our general principles of reasoning; and my science shall, without ceasing to be good and true mineralogy, be also a most profitable example of that higher philosophy of yours which legislates for sciences.'

After returning to Cambridge, Whewell began experimental work with George Airy in Dolcoath mine in Cornwall to study the mean density of the earth (Snyder 2006: 149). Whewell took up the chair of Minerology in 1828, and advanced a nomenclature, taxonomy, and mathematical foundation for crystallography in his lectures and publications. Yet having little interest in developing the empirical part of his system, he gave up the chair in 1832. His unpublished notebooks from 1830 and 1833 track a period of intense methodological reflection in which he worked out the epistemology that underpinned his mature work on the history and philosophy of the inductive sciences (Butts 1965). The distinctive feature of the notebooks is a focused study on the history of scientific progress and an attempt to discern the general form of induction as it features in a range of scientific domains. Beginning in June 1830, Whewell sketched the outline for a book called 'On the Progress of Science and the Steps of which it consists' (*WP* R.18.17[5], 25), where he identifies two steps of inductive reasoning:

> The first step ↓then↓ in physical knowledge is the observation of phenomenon [*sic*], meaning the facts which come under the notice of any of our senses, ↓the selection of a particular class of facts as proper to those contained within↓, and the measurement of space, time, order, degree [and] to define them in a basic and clear manner.

[3] A notebook from 1825 includes reading notes from Kant's *Critique of Pure Reason*, in which Whewell recounts Kant's attempt to show how human knowledge can possess a universality and necessity that extends beyond experience (*WP* R.18.9, 19).

> The next step is the discovery of some law or rule ↓principle↓ connecting these ↓observations↓ together, so to give them a dependence on some common rule. This step connects the ↓scattered↓ phenomena which had before been observed, into a single view and given is the observation a healthier view of unity. (*WP* R.18.17[5], 27)

To illustrate the two steps, Whewell calls on Kepler's discovery of the elliptical form of planetary motion. On Whewell's reconstruction, Kepler began with an extensive series of observations of various points of Mars' orbit. He then applied the known conception of an ellipse to the known members of the class, such that the orbit of Mars takes the form of an ellipse with the sun at one focus. Finally, he generalised this conception to all the points of the orbit, including those that were not observed. The point of Whewell's illustration is that to unite a set of facts requires a mental act that adds something to the facts. In contrast to Hume's enumerative conception of induction, by which the inquirer infers from a statement of fact (all observed *x*s have *P*) to a prescriptive conclusion (the next *x* will have *P*), Whewellian induction consists of an inference from observations to a hypothesis of the form 'property *X* is shared by known members of kind A'. For Kepler, the inference goes from the observations of Mars' position to the hypothesis that the observed points share the property of lying on an elliptical curve with the sun as one focus.

Whewell explains that the two steps were possible only because Kepler anticipated an order to his observations that could be described mathematically. Scientific observation is not the bare experience of particulars but a form in inquiry whereby the observer seeks a class of facts that can be drawn under a rule. Kepler anticipated that each point in Mars' orbit features as the part of some greater whole, a contingent unity Whewell describes as a 'design' or 'selection'. As we see in the progress of celestial mechanics, the contingent order of design anticipates a rule that will convert a subjective unity into an objective or (physically) necessary unity. Newton's discovery of the inverse square law of gravitation is a further induction that searches beyond a property shared by a set of facts but also for its cause:

> the discovery of a cause for such a class of facts given to them more than that merely subjective unity of connexion; it shows, in general, that the law of the phenomena flows by a kind of necessity from the manner in which the phenomena are produced. (*WP* R.18.17[5], 49)

Newton's inverse square law explains the necessity of Kepler's law of phenomena. By identifying the cause of elliptical motion, Newton's discovery 'transfers the imperfection of order and beauty from the facts to the principles which connect the facts with their discovered origin: it transfers also the imperfection of selection and design from the ends to the means' (*WP* R.18.17[5], 49). Exactly how this transfer takes place is underdeveloped in the notebooks. To detect a law for a class of phenomena, the

discoverer first appreciates the beauty (the contingent unity) of the facts. This prepares the manifold for the discoverer's search for a law that would transform the appearance of design into a system in which the observations are shown to be the product of a law.

By locating the source of necessity in the activity of the mind, Whewell opens the problem of justification raised by Hume. By what right does the natural scientist anticipate and then impose a mental or subjective constraint onto the phenomena? Whewell does not yet have an explicit answer, though his argument constantly returns to the history of science. The great discoveries of science, he claims, cannot be explained by a passive view of the mind as a mechanical instrument that is causally affected by the external world. The discovery of scientific truths thus provides evidence that the 'conditions of our perception, in consequence of which we apprehend objects as existing in space and time, are capable … of giving truth to extensive and important sciences, that is, systematically arranged bodies ↓trains↓ of speculative truth' (*WP* R.18.17[6], 13). The progress of science vindicates a conception of the mind as an active force, 'perpetually exercising a formative and productive power' (*WP* R.18.17[7], 24).

3. The semantics of discovery

Whewell addresses the question of justification more explicitly in the notebooks dated to 1833, where his attention shifts from the steps to the semantics of induction. In a section entitled 'Of the Principles implicit in Language' (*WP* R.18.17[7], 10), Whewell seeks to unearth the mind's active role in constituting scientific facts and discovering general laws. The first task is to discern the mental acts that make possible the progress of the sciences, beginning with classification. 'Things cannot be dealt with independently of words', he states, and yet 'words, in order to be of the service which is … required from them, must mean something more than things; they must imply things under some classification, under some conception of a chain' (*WP* R.18.17[7], 25). Once more, Whewell claims that perception cannot be sufficiently explained in causal terms. The Humean problem of justification is resolved as soon as we acknowledge that perception, as a mental act, is inherently conceptual. In the act of perception, the mind 'comprehends' what is given, which is to say that it 'obtains a power over it so as to be able … to see ↓perceive↓ its limits and connexion with other things, as we might do with an object held in the hand' (*WP* R.18.17[7], 39). The distinction between object and thought is a logical abstraction; *in concreto*, perception is a seamless conjunction of the two elements, such that ideas have power over things by prescribing how those things relate to other things. The term 'idea', Whewell explains, designates 'general notions of relation, connexion, dependence, of which ↓such↓ conceptions are contained with one another' (*WP* R.18.17[7], 61).

Clearly Whewell's semantics have a Kantian inflection. Yet as Fisch (1991: 105) warns us, scholars who hastily infer that Whewell underwent a 'conversion' to Kant occlude Whewell's own motivations for identifying the antithesis between ideas and things he would later call 'fundamental'

(see Whewell 1844). Whewell felt that few British philosophers had taken the Humean challenge seriously, and agreed with Coleridge, Hare, Thirlwall that enumerative theories of induction were insufficient to ground genuine progress in the inductive sciences. Consider the alteration Whewell's developing semantics brings to his next analysis of the historical development of the sciences in a notebook titled 'The Philosophy of the Progressive Sciences'. To discern the ideas operative within scientific progress, Whewell seeks to identify the 'mental tendencies' that present empirically given phenomena with a schema of order brought by the mind. The minimal semantic unit of cognition is the combination of 'external impressions, and an act of the mind', such that ideas simply are the mental acts that connect empirically given phenomena (*WP* R.17.18[8], 20). To have knowledge we must 'both perceive and conceive; we must both observe and connect; we must put into action the senses and thoughts.' The following two passages are typical formulations of Whewellian semantics, which takes the grammatical form, 'it is obvious/clear that …':

> It is thus obvious that in the function of general and abstract laws something is conditioned by the mind from within as well as by the senses from without. (*WP* R.18.17[8], 33)

> It is clear that this process is the effect of certain ↓mental↓ tendencies … and not a result of our sensations alone. (*WP* R.18.17[8], 34)

Whewell takes Kant's account of causation as the basic example of the mind's tendency to anticipate the connections between the facts given in intuition. However, his account of ideas is not restricted to Kant's *a priori* categories of the understanding but includes the regulative use of reason's ideas, which prescribe the form of lawfulness for which the understanding must seek. Consider the following passage, which extends the grammatical form of Whewellian semantics:

> It is clear therefore that the faculty by which … we apprehend the meaning of general laws does not unite with such precision as to put in marks and definitions to which shall fix the selection of limits of each law. To state marks of something which is common to the particulars which it includes … must be some form of effort of the mind, and not by taking for granted that the mind has always taken this step. (*WP* R.18.17[8], 29)

Whewell's claim is that unless we had anticipated that objects are instances of substances that are located within a system according to the relations between their defining properties, we would be unable to classify facts under names or designate the degree of particularity bestowed by the name. The unity 'given by the mind to a certain datum of the impressions of the senses may be called a conceptual unity; their unity being once given, one may supply the names of sensible things' (*WP* R.18.17[8], 23). It is only by anticipating a unity in which the datum appears that we can seek further

designations, for example, whether the 'tree may be an oak or a willow, the flower may be an iris or a tulip; or it may be necessary to name an item, like plant, which includes both trees and flowers.' The unity anticipated by the mind does not block the progress of the sciences, for it remains to be seen whether this division is natural. The important point is that it forms a fundamental part of discovery.

Whewell's ongoing concern with the Humean problem of justification is particularly evident in a section entitled 'On the Idea of Causation', where he seeks to 'exhibit the philosophical grounds of the mechanical sciences' (*WP* R.18.17[9], 2). The goal is to make explicit the idea (mental act) from which all inferences in mechanics take their form. He begins by examining Locke's empiricism, which casts ideas as collections of sense data that stand in a causal relation to the objective world. A Lockean idea, Whewell explains, is a 'transformed sensation' produced by the mind's power of association, which converts an amalgam of sense impressions into another form. The idea of causation, however, does not arise directly from sense impressions. It arises through associating the alteration of the 'simple *Ideas*' with the alterations we experience in ourselves—either 'the impression of the outward Objects on the Senses' or 'the Determination of its own Choice'—such that we think of the alterations in the object as the effects of a determining cause (Locke 2008: 2.21.1). This analogy allows us to 'consider[] in one thing the possibility of having any of its simple Ideas changed, and in another the possibility of making that change.' By inferring that every alteration is made possible by an occasioning cause, the mind can infer 'from what it has so constantly observed to have been, that the like Changes will for the future be made, in the same things, by like Agents, and by like ways'. For Whewell, Locke rightly states that impressions, without an act of the mind, have no form. Yet Locke's account does not give us warrant to expect that future event-types will happen in the same way.

Whewell then examines the Scottish solution to the Lockean problem in the work of Thomas Reid, Dugald Stewart, James Beattie, and Thomas Brown. The Scottish solution, he explains, is to transcend Locke's epistemological reflections by accepting that the principle of causation, while acquired empirically, accompanies every experience of event-type happenings. Brown for instance argued that the 'memory of what conjunctions of events and the belief of similar future conjunctions, are facts, independent so far as we can discover' (*WP* R.18.17[9], 10). For Brown, the idea of causation is the major premise in every inductive inference, such that one can pursue scientific truth regardless of one's epistemic commitments. While Whewell agrees that the idea of causation accompanies every experience of change, he claims that the Scots fail to justify the universal application of causation.

Whewell then notes that while the Scots were debating the origins of the idea of causation, 'a great metaphysical genius ↓in Germany↓ was evolving this solution of the same problem' (*WP* R.18.17[9], 8). Kant demonstrated that 'causality is a condition of our experience; a connexion in events presupposed to our understanding them as events; the future mental connexion by causation'. Whewell's point is that 'The Scotch system only accepts the <u>universality</u> of the relation, the German attempts further to claim, its <u>necessity</u>' (*WP* R.18.17[9], 11). The German system entails that 'we have

not merely a tie connecting the impressions we perceptively receive, but a conception of the active faculties which makes the impressions impossible without the connexion'. The salient difference is that in the German system, the 'conjunction is not causal and separable but [lawful and intrinsic]'.

While Whewell sides with 'the great metaphysical genius', we have already noted several key differences between Whewell's and Kant's understanding of ideas. Kant argued that causation is a category of the understanding, which is a universal and necessary condition for experience. That event-type happenings feature within a system of causes, however, is underdetermined by the understanding and requires the regulative use of reason's ideas, which prescribe the forms of inference that underwrite the inductive sciences. Whewellian ideas, in contrast, include not only the idea of causation but also the idea of likeness and systematicity, such that observation is not equivalent to experience in the strict Kantian sense but includes the regulative use of ideas Kant introduces in the Doctrine of Method, which guide the understanding in the context of discovery. What Whewell takes from Kant is the reflective standpoint of the critical philosopher who discerns the forms of inference presupposed by the semantics of experience. Yet for Whewell, the object of analysis is not the transcendental logic manifest in experience but rather the inductive logic manifest in the best examples of scientific progress.

4. History and philosophy of science

In 1830, Herschel published a major treatise on scientific method entitled *Preliminary Discourse on the Study of Natural Philosophy*. Since their weekly Sunday morning gatherings as undergraduate students in Cambridge, Whewell and Herschel had aspired to rejuvenate Bacon's account of induction in response to the enormous progress of the sciences in the late-eighteenth and early nineteenth centuries. Herschel was less interested in the epistemological side of the problem than Whewell and endorsed a broadly empiricist theory of inductive logic. Induction, he argued, is a form of generalization 'commencing with the most circumstantially stated particulars, and carried up to universal laws' (Herschel 1830: 104). In contrast to Whewell's semantic treatment of the mental acts involved in discovery, Herschel viewed induction as an inference from a proposition about experience to a predictive conclusion. Without a mathematical proof, which can be achieved in only a few specialised contexts, inductive reasoning can enjoy no more than a provisional security.

In a lengthy review of Herschel's *Preliminary Discourse* published in February 1731, Whewell praised Herschel's achievement and yet raised a concern for his sharp distinction between mathematical and practical certainty. For the first time in print, he attempts to combine the empirical and *a priori* dimensions of induction, presenting induction as a middle path between the mere observation of facts and the deductive inferences of reason. 'Induction', Whewell (1831: 379) argues, 'agrees with mere Observation in accumulating facts, and with Pure Reason in stating general propositions'. However, induction 'does *more* than Observation, inasmuch as she not only collects facts, but catches some connexion or relation among them; and *less* than pure Reason . . . because she

only declares that there *are* connecting properties, without asserting that they *must* exist of necessity and in all cases.' Here Whewell hints at a kind of necessity that stands between enumeration and deduction, where *a priori* ideas prescribe the form but not the content of relations between phenomena. Induction 'seizes some thread on which a portion of the heap are strung', he states, 'and binds such threads together.'

In his review of Herschel's *Preliminary Discourse*, Whewell refers to a physical kind of necessity that stands between the contingency of experience and the logical necessity of mathematics. The implications of his idealist account of induction are evident in his major works, *History* and *Philosophy of the Inductive Sciences*, where Whewell (1837: I 87) presents a history of inductive science to show that the 'necessity and universality of truths are derived from the Fundamental Ideas which they involve.' The laws of motion, for instance, gain their axiomatic character by virtue of being '*interpretations* of the Axioms of Causation' (Whewell 1837: I 265). The point is that the 'universality of the laws of motion was not gathered from experience, however much the laws themselves might be so.' The laws of motion 'borrow their *form* from the Idea of Causation, though their *matter* may be given by experience: and hence they possess a universality which experience cannot give' (Whewell 1837: I 267). Rejecting Kant's threefold distinction between the forms of intuition, the categories of the understanding, and reason's ideas, Whewell identifies a single frame of experience in which the appearance of objects given within the relations prescribed by the fundamental ideas, which include time, space, causation, substance, and likeness.[4] The term 'idea', Whewell (1847: 26) explains, designates 'those inevitable general relations which are imposed upon our perceptions by acts of the mind, and which are different from anything which our senses directly offer to us.' Ideas are not bundles of sense data, as they were for Locke. Rather, they are qualitatively distinct from the senses to the extent that they refer only 'to the relations and conditions which are imposed on our sensations through the activity of the mind', thereby forming one part of the act of knowledge (Whewell 1847: 27). Yet the separation of ideal relations from the content of perception is merely an abstraction produced by reflection. The units of experience are '*informed* sensations', for 'no knowledge can exist without the practical union of the two, nor any philosophy without their speculative separation' (Whewell 1847: 32–3).

The form-matter compounds of Whewellian perception signals a sharp departure from Plato's idealism, according to which ideas are transcendent objects. Whewell's position is much closer to Kant's, according to which ideas are the 'Laws of Thought'. Yet in contrast to Kant, who held that ideas are available to us by reflecting on the transcendental structure of cognition, Whewell's broader conception of experience entails that ideas come to consciousness in the historical progress of the sciences:

[4] For an account of Whewell's notion of experience, see Butts (1965: 165-7).

> But it may suffice to observe that we use the word *Ideas*, in the manner already explained, to express that element, supplied by the mind itself, which must be combined with Sensation in order to produce knowledge. For us, Ideas are not Objects of Thought, but rather Laws of Thought. (Whewell 1847: I 29)

As a branch of science progresses, the Fundamental Idea that prescribes the inferential relations within that branch becomes more explicit. Whewell's historical analysis of mechanics, for instance, reveals that true mechanical propositions are arranged under three Fundamental Ideas: force, matter, and cause. The chemical sciences are arranged under the Ideas of polarity, chemical affinity, and substance. The biological sciences are arranged under the Idea of life.

To explain how ideas arise historically and come to unify a distinct domain of scientific inquiry, Whewell defines induction as a conjectural process whereby the scientist proposes a law that extends beyond the available evidence, which serves to 'colligate' that evidence (Whewell 1847: II 49). A colligation is an 'act of thought' that consists of bringing together a number of empirical facts by 'superinducing' on them a unity such that they can be explained by a law (Whewell 1847: 44). The greatest evidence for the correctness of an induction is given when a hypothesis can be applied to a different set of facts to that which initially gave rise to the hypothesis. Thus, inductions are proved by an extraevidential form of confirmation Whewell (1858: 70-71) terms 'consilience', a 'test of truth' that takes place 'when an Induction, obtained from one class of facts, coincides with an induction, obtained from another class'. For instance, Newton's inverse square law is an inductive hypothesis that explains the motion of bodies near the surface of the earth, the motions of planetary bodies, the behaviour of the tides, etc. – collections of phenomena that were not previously thought to be of the same kind. 'That rules springing from remote and unconnected quarters should thus leap to the same point, can only arise from *that* being the point where truth resides' (Whewell 1858: 71; c.f. Herschel 1830: Sect. 180). Whewell thus affirms the core assumption of Baconian science that we have no epistemic access to true causes, which are unobservable. Yet the more one's theories tend towards unity, simplicity, and generality, the more one can be sure that one has discovered the true cause.

Whewell argues that necessary truth is marked by two features. The first is that no necessary truth can be derived from experience. This is to say that evidence for a necessary truth can never be empirical, for, as Hume showed us, no process of enumeration can arrive at the necessity contained in scientific truth. The second is that a truth is necessary when its negation is not simply false but also impossible: 'necessary truths are those of which we cannot distinctly conceive the contrary' (Whewell 1847: II 648). This does not mean that necessity is simply logical necessity. Whewell identifies a kind of physical necessity that can be traced back to Fundamental Ideas, which are discovered by a noetic faculty Whewell terms 'intuition':

> the way in which those Ideas became the foundation of Science is, that when they are clearly and distinctly entertained in the mind, they give rise to inevitable convictions or intuitions, which may be expressed as *Axioms*; and these Axioms are the foundations of Sciences respective of each Idea (Whewell 1860: 336–7)

Whewell's intuitionalism is the most controversial aspect of his theory of induction, but perhaps also the most widely misunderstood. He does not mean to say that the fundamental ideas are innate or possessed by every inquirer. Intuition explains how Fundamental Ideas such as causation and the corresponding Axioms such as 'every effect is produced by its cause' become foundational to scientific inquiry.

5. Ideas: from *a posteriori* to *a priori*

To get a better grip on the role of intuition in Whewell's idealism, it will be helpful to examine Mill's critique of Whewell in *A System of Logic: Ratiocinative and Inductive* (1843). In his bold and expansive text, Mill presents a theory of induction that builds on the work of both Herschel and Whewell. Yet in opposition to Whewell's semantic analysis of inductive inference, according to which sense and ideas are both involved in the act of perception, he sided firmly with Herschel's empiricist view of induction as 'simple enumeration' or 'generalization from experience' (Mill 1843: I 370). Induction, Mill (1843: I 352) explains, is 'the process by which we conclude that what is true of certain individuals of a class is true of the whole class, or that what is true at certain times will be true in similar circumstances at all times'. Induction is thus a matter of both discovery *and* proof of natural laws, amounting to a practical certainty that goes beyond any reasonable grounds to doubt. Even 'the most universal class of truths, the law of causation for instance, … are duly and satisfactorily proved by that method alone [i.e., simple enumeration], nor are they susceptible of any other proof' (Mill 1843: II 111). Mill emphatically rejects Whewell's claim the mark of necessity is that the counterinstances of a proposition are inconceivable. Inconceivability is simply a sign that we have not yet experienced a negation. Idealism is not only misguided but also dangerous for science, Mill claims, for it entails that 'every inveterate belief … is enabled to dispense with the obligation of justifying itself by reason, and is erected into its own self-sufficient voucher and justification' (Mill 1873: 191).

To Mill's disappointment, Whewell was slow to respond to his critique of idealism.[5] It was not until 1849 that Whewell published a short book *Of Induction: With Especial Reference to Mr. J. Stuart Mill's System of Logic*, in which he criticises Mill for reducing induction to merely practical form of knowledge. In *The Philosophy of Discovery* (1860), Part III of the third edition of *Philosophy of the Inductive Sciences*, Whewell appended a slightly more pointed criticism of Mill in section titled

[5] For an account of the Mill-Whewell debate, see Snyder (1997).

‘Absurdities in Mr Mill’s philosophy’. One of the listed absurdities is Mill’s claim ‘that the axiom, that every event must have a cause, is established by means of an “induction by simple enumeration”’ (Whewell 1860: 288). Whewell does not immediately explain why this claim is absurd, but instead appends two further sections that can be seen as a response of sorts: ‘Modern German Philosophy’ and ‘Influence of German Systems of Philosophy in Britain’, in which he situates Mill within his account of the German alternative to British empiricism. In the latter section, Whewell (1860: 332) begins by noting that Kant ‘was not … at first favourably received among British philosophers, and those who accepted it were judged somewhat capriciously and captiously.’ Dugald Stewart’s reading of Kant is deemed typical of the British reception to the extent that it aligns Kant with the metaphysical excesses of Plato (Whewell 1860: 333). Yet Whewell argues that Stewart failed to situate Kant’s idealism as a response to Hume’s problem of induction.

To demonstrate the inexorable role of metaphysics in induction, Whewell revisits Lewes’ characterisation of his position as a failed version of Kantianism. Whewell (1860: 333) admits that he ‘adopted some of Kant’s views, or at least some of his arguments’. Specifically, he agrees with Kant ‘in placing in the mind certain sources of necessary truth’. Yet departing from Kant, Whewell explains that his sources of truth include not only ‘Space and Time’ but also ‘Cause, Likeness, Substance, and several more.’ To the extent that he rejects the Lockean conception of ideas as units of sense data, Whewell shares with both Kant and Plato the notion of ideas as transcendental archetypes that extend beyond anything given in sensation. Yet for Whewell, those archetypes cannot be thought independently of sensation; they are not objects but rather the conditions that make objects possible. Ideas form an irreducible moment in the process of discovery by prescribing the form in which event-type experiences take place. This position, Whewell (1860: 336) explains, stands in stark contrast to ‘Mr. Mill, the most recent and able expounder of the opposite doctrine.’ Mill ‘derives all truths from Observation, and denies that there is such a separate source of truth as Ideas’.

As we noted earlier, Whewell (1860: 338) argued that one of the tests of scientific axioms is that ‘the contrary of them is inconceivable.’ This does not simply stand for the axioms in mathematics and geometry but also for those in mechanics, chemistry, and biology. Mill rejected the idea on empirical grounds: some people who have not mastered a subject ‘do not see this inconceivableness’ (Whewell 1860: 338). Whewell (1860: 344) accepts Mill’s observation but denies that it poses a threat to his position. Scientific truths are ‘seen by intuition’, he explains, and ‘this intuition is progressive.’ Whewellian intuition is not akin to Kant’s ‘intellectual intuition’ but is closer to Goethe or Schiller, or even to Coleridge, who reenergises the *pre*-Kantian notion of intuition as a noetic faculty by which the mind ‘sees’ the ideal within the real. In contrast to Mill’s empiricism, according to which necessary truth is simply given, Whewell (1860: 347) claims that the history of the inductive sciences shows us that ‘Necessary truth is progressive.’ This is not to claim that ideas can be understood psychologically, as Mill had proposed, but rather that to account for the progress of the inductive sciences we require an idealist account by which ‘a posteriori truths become a priori’ (Whewell 1860:

257–8). The history of the inductive sciences identifies the moments of discovery whereby hypotheses proposed by discoverers colligate the facts, which spring up to the status of scientific truth, and the philosophy of the indicative sciences tells us what cognition must be like for those colligations to be possible.

6. Conclusion

Whewell's philosophy of science seeks to vindicate the inductive sciences as a privileged source of truth. The history of science, he claims, justifies the cognitive autonomy of induction by demonstrating how the various domains of inquiry have progressed from contingent collections of facts to systematic bodies of scientific truths unified under ideas. Swimming against the tide of the empiricism endemic to Britain, Whewell defended an idealist theory of induction according to which scientific axioms are grounded in fundamental ideas that guarantee the necessity of scientific truth. Buchdahl (1971: 350) is right to claim that Whewell 'emphasizes the Kantian doctrine that … the division between "data" and "inference" is artificial.' This is to say that Whewell, like Kant, stresses the *theory-ladenness* of the data of science. Discovers begin with narrow conceptions, work to clarify them through argumentation empirical testing, and refine and confirm the results of their inquiry through the extraevidential test of consilience.

Yet whatever Whewell drew from Kant was in service of his own philosophical project to develop a science of inductive logic capable of vindicating scientific progress. Here Butts (1967: 181) is right to qualify his Kantian reading of Whewell by noting that 'Whewell took from other philosophers only what he thought he needed.' Through his reading of the history of inductive logic—from Locke's empiricism, to the Scottish response, and to the great metaphysical genius of Germany—Whewell demonstrates how 'properly contextualized philosophies of the past could be deployed in contemporary debate' (Fisch and Schaffer 1991: vii). Where Whewell (1860: 358) decisively departs from Kant is in his answer to the question of justification: 'How can it be that the world without us is thus in some respects identical with the world within us?' When revising his *Philosophy of the Inductive Sciences* for its third edition in 1860, Whewell emphasised the theological underpinnings of his project in response to the growing influence of Mansel's Kantianism, which restricted the possibility of scientific and theological arguments for transcendent ideas (Yeo 1979: 513). He claims that 'the truths which exist or can be generated in man's mind agree with the laws of the universe, because He who has made and sustains man and the universe has caused them to agree' (Whewell 1860: 358). The theological grounding of Whewell's project has troubled commentators, for it seems to stand at odds with the historical grounding of scientific autonomy that marks the distinctive character of Victorian philosophy. The irony of Whewell's position is that it ultimately paved the way for the naturalistic theories of evolution and ethics developed by Charles Darwin and Henry Sidgwick, *despite* his best attempts to limit their influence in Cambridge and beyond. Nevertheless, more important than the question of justification for Whewell is the fact that there *are*

instances of scientific inquiry that had reached such a state of necessity and completion, making it a small step for the following generation of philosophers, including C. S. Peirce, to transpose his discoverer's account of induction into a pragmatic register. If we grasp Whewell's creative response to the problems of induction arising in early Victorian science, the supposed 'problem of Whewell's idealism' is resolved by identifying a distinct form of idealism endemic to Cambridge.

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