INTRODUCTION

William Whewell, Victorian Polymath

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William Whewell was born on May 24, 1794, as the son of a Lancaster master carpenter.[1] He came up to Trinity College, Cambridge, in 1812 as a subsizar, the lowest rank of student, whose duties were to wait the tables and clean the rooms of his wealthier peers. Some fifty-four years later, on March 6, 1866, he died as master of Trinity, one of the leading figures in the scientific community of the early Victorian era, and a towering defender of the moral, social, and political status quo in the midst of Britain's "Age of Reform."

During the uninterrupted period he spent at Trinity College—the college, as he often reflected, of Isaac Newton and Francis Bacon—Whewell's rise was spectacular and his accomplishments many and impressive.[2] His family's chosen representative in an elite milieu, a young Whewell wrote that "*we* have reason to be proud" when telling his father of his first place in every subject in 1814.[3] Two years later he graduated second wrangler in 1816, beaten by a student of Gonville and Caius College, who was also first Smith's Prizeman, with Whewell taking second place. He was elected fellow of his college in October 1817, thus securing "a comfortable establishment for life,"[4] and afterward served as assistant tutor (1818–1823), tutor (1823–1839), and master (1841–1866) of his college. At the University of Cambridge, he was appointed professor of mineralogy (1828–1832), Knightbridge Professor of Moral Philosophy (1838–1855), and vice-chancellor (1842–1843, 1855–1856) and was a key figure in establishing the Natural and Moral Sciences Triposes. In these various roles Whewell was a dominating, inescapable presence in Cambridge's period of transition from a mathematical seminary to a leading center of scientific education and research. He was also a member of the Council of the Royal Society (1831, 1858), vice presi-

dent (1835) and president (1841) of the British Association for the Advancement of Science (BAAS)—in which founding he was involved—president (1837–1839) of the Geological Society, and in 1834 he helped establish the Statistical Society of London, later renamed the Royal Statistical Society.[5] From his self-created position of inside-outsider, Whewell set out to shape Victorian science—from its disciplinary boundaries and its methodology to its organizational structure and the ethos of its practitioners—in his own towering image.

Both inside and outside the walls of the university, Whewell used his growing power and influence to "keep up, constantly alive" that "formative spirit which makes *reform* unnecessary." What guided his activities as a conservative Anglican at Cambridge was twofold. First, an unshakeable belief in "our National Constitution and our National Religion" and the role of Oxbridge in protecting this holy marriage.[6] Second, he held a deep-seated dislike of anything—whether Lockean sensationalism, Ricardian political economy, French analytical mathematics, Paleyean natural theology, or the *Westminster Review* utilitarianism—that could be seen as a potential ground for those seeking "to destroy the church and democratize the nation."[7] Whewell was not a simple reactionary who favored the old over the new. His favorite image was that of a hand transmitting a torch to another hand, with the motto "Holding torches they will pass them on one to another." He was in favor of change, whether in society, culture, morality, education, or science, but only if this change was of a particular kind. The new had to "include and rest upon that which has been true up to the present time." For such truths were not just necessary and permanent—in the sense that, once disclosed, nothing could disprove them. They were also partial fulfillments of that greater "Truth" that God "has given us the means of seeing," such that "we *must* . . . accept them." Whewell looked at the status quo, not as a "dead, stationary, immovable thing," but as the gradual "unfolding" of God's providence on earth. This is why it had to be defended: to make sure that "all that is really good and great" was neither destroyed nor prevented from happening.[8]

One of, if not the most prolific authors of his time, Whewell took novel and authoritative issue with almost every major topic on the early nineteenth-century agenda. Many of these topics were put on there by Whewell himself, both through book-length publications like his Bridgewater Treatise, *Astronomy and General Physics Considered with Reference to Natural Theology* (1834), *The History of the Inductive Sciences* (1837), and *The Philosophy of the Inductive Sciences* (1840), as well as through "suggestions, comments, experiments, measurements, linguistic improvements, and . . . critiques of the work of others" in reviews, papers, reports, addresses, and sermons.[9] His monumental oeuvre—totaling some ten thousand pages at a very modest es-

timate—included textbooks on physics and mathematics; original scientific research on mineralogy and the tides; periodical reviews of books by Charles Lyell, Richard Jones, Mary Somerville, and John F. W. Herschel; numerous sermons and public addresses; translations of Greek philosophy and German and Latin poetry; and publications on political economy, church architecture, natural theology, history and philosophy of science, language, university education, ethics, and law. Over the course of the nineteenth century, many of Whewell's books went through numerous editions and were translated into several languages, including French, German, Russian, and Chinese.

In his fifty-year-long career Whewell assumed many roles and identities. He was a mathematician, a textbook author, a mineralogist, a physicist, a reviewer, a natural theologian, a meta-scientist or looker-on of science, a historian and philosopher of science, a scientific organizer, a college head, a prominent university figure, an educationalist, a preacher, a poet of sorts, a translator, an editor, and a moral philosopher. He was also a social climber; a husband; a two-time widower; a colleague; a candid and sensitive friend; a polemicist; a member of some twenty-five scientific societies in Britain, Germany, Austria, France, and Belgium; a conservative; a frequent traveler; and an avid note taker and letter writer (some seven thousand letters from or to some thousand correspondents).[10] Some of these identities were transient; others were more stable. Sometimes they overlapped; at other times they existed side by side or stood in some tension. Above all, as most commentators agree, Whewell was a *polymath*. This label, however, must not be taken to be self-explanatory, as it took on different layers of meaning. For it to capture something important, let alone essential, about Whewell's life and work it should arguably stimulate more questions than it answers.

Whewell himself grappled with his scholarly identity almost his entire working life, which suggests that his polymathy was sui generis and changed over time. This already started in 1815, when as a nineteen-year-old undergraduate he suspected that "not much good would be likely to come of me if I were to remain in such an all-reading, all-learning mood for ever."[11] As the diary of his readings, which he kept from 1817 to 1830, shows, Whewell remained in this mood for most of the 1820s, devouring everything from Kant's *Kritik der reinen Vernunft* (first read in 1825) and De Ségur's *Histoire de Napoleon* to Boccaccio's *Life of Dante* and William Henry's *An Epitome of Chemistry*.[12] He, in fact, never stopped being his all-reading, all-learning self. What changed was that he eventually made the rigorous systematization of what he read and learned one of his main occupations. Tellingly, from 1838 on Whewell started referring to himself as a "system-maker."[13]

There are different ways to bring out the trajectory of Whewell's polymathy—his great "odyssey from mathematics to moral philosophy."[14] The

most insightful is to develop a down-to-earth look at his oeuvre as a whole (see "Appendix A: List of Whewell's Published Works") and to divide his career (see "Appendix B: Chronology of Whewell's Life") into three periods: 1810s–1820s, 1830s, 1840s–1860s. This makes it possible to recognize both major transitions and long-term continuities in his intellectual and professional development. It also shows that what Whewell is mostly remembered for, and what has often been taken to be key to his polymathy—metascience and especially philosophy of science—represented a fraction, albeit a very important one, of his oeuvre and just one period in his long career. While Whewell remained active as a scientist throughout the 1830s–1840s, he effectively ceased to be a philosopher of science by 1840, and he himself found his *History* and *Philosophy* less important than his *Elements of Morality*. Perhaps most crucially, Whewell's metascience was itself part of, and stood in the service of, his "meta-religion"—the lifelong zeal to (re)conceptualize everything in the world as either weakening or strengthening, as either a danger to or support of, Christian faith.

Whewell's Journey

During the first period, which started with his appointment as an assistant mathematics tutor at Trinity in 1818, Whewell emerged as a prolific author of textbooks.[15] Among several other works, he published *An Elementary Treatise on Mechanics* (1819), which went through seven editions by 1847, and *A Treatise on Dynamics* (1823), which reached a third edition in 1834. Whewell met John F. W. Herschel, Charles Babbage, George Peacock, and other members of the Analytic Society, founded in 1811 to advocate Continental notation and algebraic analysis at Cambridge. He was at first impressed by their plans, and in the *Mechanics* and *Dynamics* treated his subjects from an analytic perspective. However, subsequent editions emphasized the value of traditional geometrical, intuitive methods characteristic of Euclid and Newton, as they represented what he called "permanent" rather than "progressive" knowledge. Whewell would use this view—oriented around the belief that mathematics was a means and not an end in itself—to condition the reform of the Cambridge mathematical curriculum, which he did in various ways: through textbooks, tutorial lectures, pedagogical tracts—such as *Thoughts on the Study of Mathematics as Part of a Liberal Education* (1835, reprinted in *On the Principles of English University Education* in 1837)—and involvement in numerous syndicates.

Whewell was also involved in various scientific activities, which supported his election to the Royal Society (1820) and admission to the Geological Society (1827). Many of these started as onetime events, aimed at self-education: a geological expedition with Adam Sedgwick in 1821; three months of instruction in mineralogy and crystallography in Berlin, Freiburg,

and Vienna under Friedrich Mohs in 1825; experiments in a Cornwall mine in 1826 and 1828, with George Biddell Airy and Richard Sheepshanks, to discover the mean density of the earth; occasional architectural tours in Normandy (1823), Cumberland (1824), Germany (1829), Devonshire and Cornwall (1830), and Picardy and Normandy (1832); and the development of an anemometer to measure the velocity of the wind, first devised in 1837. Other pursuits were more sustained, each resulting from the application of mathematics to get to a subject's theoretical core. Between 1821 and 1827, the year in which he was elected professor of mineralogy, Whewell published several papers and an eighty-page books on crystallography and mineralogy. He provided a nomenclature, a taxonomy, and a simple mathematical foundation, thereby paving the way for mineralogy's development for the rest of the century. Having no ambition to pursue its details further, Whewell resigned the chair in 1832, never to return to the subject again, though he would forever remain associated with it through the mineral named after him (whewellite). Another field to which he applied mathematics was political economy, about which he learned in conversations with his close friend Richard Jones.[16] Whewell produced various publications, in which he attacked Ricardian (deductive) economics by reformulating its principles into mathematical equations, deducing consequences, finding them erroneous, and then concluding that political economy needed to be founded on induction from facts, a task he left for Jones to complete. These outputs appeared over a thirty-year period, in 1830, 1831, 1856, and 1862. Whewell also took an interest in church architecture, to which he brought a structural-analytic approach reinforced by careful geometrical descriptions.[17] In 1830 he published *Architectural Notes on German Churches, with Remarks on the Origin of Gothic Architecture*, enlarged and republished in 1835 and 1842—his last publication on the subject appearing as late as 1863 in the form of a lecture to the Royal Institute of British Architects. Whewell's goal was to point out and interpret the form and evolution of Gothic architecture and to propose a theory of why the Gothic's pointed arches came into existence. This had some bearing on his work on the history and philosophy of science, for instance, because it introduced the notion of a "Fundamental Idea"—in this case "verticality."

Having finished off mechanics, mineralogy, architecture, and political economy, at least temporarily, Whewell decided that it was time for something else. His most significant scientific research was his study of the tides, or tidology, which he sought to place on a new footing.[18] He took it upon himself to amass a body of data, leaving the theorizing largely to others. It earned him the Royal Society's Queen's Medal in 1837. Whewell published fourteen memoirs on the subject in the *Philosophical Transactions of the Royal Society* between 1833 and 1850 (about three hundred pages in total), wrote

several occasional papers, outlined practical instructions for making tidal observations in articles in the Admiralty's *Manual of Scientific Inquiry* and the *Journal of the Asiatic Society of Bengal*, and presented reports to the Royal Society, the BAAS, and the Cambridge Philosophical Society. For his "Great Tide Experiment" of 1835—a pioneering historical example of citizen science—Whewell directed thousands of people to take tidal readings simultaneously at 650 stations in nine countries, extending to the farthest edges of the Empire. One of his ambitions was to establish a global map of cotidal lines passing through all the points where high water occurs at the same time, and to discover the law of these cotidal lines. Much to his own disappointment, this experiment failed, though Whewell did manage to work out cotidal lines for restricted areas and to establish laws for the diurnal inequality. His work was not entirely in vain. But the fact that he relied entirely on the equilibrium theory, rather than Pierre-Simon Laplace's dynamical theory, placed him at odds with the "bolder and stronger mathematicians"[19]—George Biddell Airy, George Gabriel Stokes, and William Thomson (Lord Kelvin)—who continued British tidal studies.

Despite his scientific achievements and the recognition he received, Whewell did not consider himself "an eminent man of science." One reason might have been that his contributions to mineralogy and tidology, though important, failed to meet his own criteria for major scientific breakthroughs. More likely is that he compared himself to the prominent discoverers around him, which made him feel very modest about his own work. "In the study of the tides," Whewell observed in 1840, "I have voluntarily given up all the profounder parts of the subject, and confined myself to collecting laws of phenomena in such a manner as it could be done with little of my own labor."[20] Another reason was that he simply had too many other interests and felt, with a mix of enthusiasm and regret, that his strengths lay elsewhere. As he wrote to Herschel in an almost apologetic letter in 1818: "There is another point of view [on recent research on the properties of light] which occurs to us lookers on, who, not making a single experiment to further the progress of science, employ ourselves with twisting the results of other people into all possible speculations mathematical, physical, and metaphysical."[21] It would take Whewell over a decade to accept that he himself was such a looker-on—a delay at least partly due to the low opinion of metaphysics (that "*poor word*"[22]) common among his circle of friends. And it would take several more years to work himself into a condition, with regard to "worldly affairs," to "be a philosopher and nothing else."[23] However cerebral, being a polymath was also a financial matter.

At the core of Whewell's metascience, developed in the 1830s, stood two distinct, yet mutually supportive projects: his "theology" and his "induction,"

that is, natural theology and the history and philosophy of science.[24] The first project ran from *Astronomy and General Physics* (1833) and *Indications of the Creator* (1845) to *Of the Plurality of Worlds* (1855).[25] It was aimed to demonstrate, and to flesh out the consequences of, the harmony of modern science with Christianity. An immediate "best seller"[26] and his first book for an audience outside Cambridge, in the *Astronomy* Whewell argued that the latest scientific knowledge of various phenomena—from the solar system to heat, electricity, sound, and light—offered proof of intelligent design. Although the book contradicted some of his statements in the *Astronomy*, in the *Plurality of Worlds* Whewell would also draw on scientific evidence, especially geology, to make a theological point: in this case, to counter the popular claim that all planets must be inhabited because, were that not the case, God's creation of them would have been wasted. What stood out particularly from the *Astronomy* was book 3 ("Religious Views") where Whewell introduced a theme running through his entire metascientific oeuvre: the contrast between inductive and deductive "habits of the mind," between reasoning by *ascending* from facts and by *descending* from principles. Whewell argued that the former was not just of greater value to science but also had a stronger tendency to religiosity. This was illustrated by the bold claim that "original discoverers" like Johannes Kepler and Newton had been men of Christian faith, whereas "mere mathematicians" such as Laplace and Joseph-Louis Lagrange were more inclined to atheism.[27]

The second project ran from the *History* and *Philosophy*—as well as various original papers included in later editions—to the spin-off *Of Induction, with Especial Reference to Mr. J. Stuart Mill's* System of Logic (1849). It took the form of a renovation, in light of the history of modern science, of Bacon's inductive philosophy. The two projects were explicitly brought together in *Indications of the Creator*, quickly compiled in response to Robert Chambers's controversial *Vestiges of the Natural History of Creation* (1845). Whewell's subtitle was *Extracts, Bearing upon Theology, from the History and the Philosophy of the Inductive Sciences*. From this book, as well as from several of Whewell's numerous sermons,[28] it becomes abundantly clear that the motivation behind all his metascientific work was deeply religious. Whewell did not think that science could bring people to faith. At a time when its meaning was not yet settled, his ambition was to define science such that it was understood to fall in fully and entirely with Christianity. It was no mere verbal coincidence that Whewell spoke of induction as *"the true faith."*[29]

The first step of Whewell's induction project was taken around 1830–1831, when he started carving out a new space for himself in the emerging British scientific world. Whewell privately began writing notebooks (1830–1834), scribbling hundreds of pages of "scraps and snatches"—some actually of book length—on the inductive nature and methodology of science.[30] He

also offered public statements on the subject in an address to the BAAS (1833), in two reports to that body on the state of particular sciences (1833, 1836), in a lengthy appendix to the textbook *Mechanical Euclid* (1837), and in major reviews of Herschel's *Preliminary Discourse on the Study of Natural Philosophy* (1831), Lyell's *Principles of Geology* (1831, 1832), Jones's *Essay on the Distribution of Wealth, and on the Sources of Taxation* (1831), and Somerville's *On the Connexion of the Sciences* (1834). Whewell's decision to devote himself to "that higher philosophy . . . which legislates for the sciences"[31] did not come out of nowhere. He was acting on a wish he had held since his student days, the "ancient subject of [his] early liking"; the "Inductive Method of Philosophising."[32] This Baconian outlook helped shape his myriad activities from the 1820s to the 1830s, in which he slowly but gradually, and bit by bit, developed his own mature philosophical views. Already in 1825 Whewell had boasted that he would use the Lucasian Professorship in Mathematics—which had fallen vacant—to "make very grand lectures on the principles of induction," and had sworn to accept the position of professor of mineralogy only because the field was "one of the very best occasions to rectify and apply our general principles of [inductive] reasoning."[33] By that time, however, most ingredients of his mature position, such as the key notion of conceptions, were still lacking.

Whewell's decision to become a meta-scientist did come with a significant transformation of his polymathy. During the second period of his career it became "simultaneous" in a different—more "clustered," less "fiddle faddle"—way, and altogether more "centripetal."[34] Whewell no longer primarily sought to reform each and every science in which he himself was active on the basis of a roughly Baconian notion of induction. Instead, he now set out to reform Bacon's inductive philosophy itself, looking almost exclusively at the physical sciences as a "connected and systematic body of knowledge."[35] Sometimes these ambitions overlapped. About his work on the tides, Whewell remarked in 1833, "I wish I could explain to you how useful my philosophy is in shewing me how to set about a matter like this, and how good a subject this one . . . is to exemplify it."[36] The induction project itself, however, was closest to his heart. "My induction 'invites my steps' every half hour that I am left to my own thoughts. If I am ever to do any good, I must set about it soon (I shall be forty in half a year)."[37] What stood in the way were his duties (or "business") as head tutor at Trinity, which he found increasingly tiresome. Over the course of the 1830s Whewell frequently toyed with the idea of retiring from his post. By 1836 he admitted to Herschel that he had "very serious thoughts of [giving up] my share in the active business of the College, and of giving *the rest of my life* to the formation and exposition of a Philosophy . . . such as we ought to have." For this Whewell realized he needed more time and focus:

> I do not know how you [Herschel] manage to carry on so many speculations at once; but for my own part I begin to find that I have set myself a task, which is hardly consistent with my other employments here [at Cambridge]. . . . I have tried for several years, and I cannot combine these two employments to my own satisfaction; and I think it is more wise and right to transfer to other hands occupations, which I am conscious of being unfit for, and duties, which I discharge imperfectly, than to go on with an impossible struggle, and to endanger the attainment of a great object.[38]

Whewell did not reach his decision lightly, knowing it was a leap in the dark. Besides, his work at Trinity was not "ungrateful, either as a chance of doing good or of making money."[39]

Between 1830 and 1834 Whewell pursued his project without a clear writing plan, moving back and forth between philosophical theorizing and historical illustration or "exemplification." A breakthrough came in the summer of 1834:

> I am to consist [*sic*] of three Books. Book 1, *History* of Inductive Science . . . historiographized in a new and philosophical manner. Book 2, *Philosophy* of Inductive Science. . . . It will be dry and hard . . . as it must contain most of the metaphysical discussions . . . , but it must also contain all the analysis of the nature of Induction and the Rules of its exercise, including Bacon's suggestions. Book 3, *Prospects* of Inductive Science. The question of the possibility . . . of applying Inductive processes, as illustrated in . . . Book 2, to other than material sciences; as philology, art, politics, and morals.[40]

From their inception, the *History* and *Philosophy* were conceived as mutually supportive, yet independent parts of a single inquiry: to complete, that is, to "renovate and extend" the "Reform of the Methods and Philosophy of Science" initiated by Francis Bacon.[41] The two books even stood to each other as Bacon's *Advancement of Learning* and *Novum Organum* (1620). The *History* appeared in 1837 in three volumes, totaling 1,600 pages. On the basis of a study of primary sources, but borrowing heavily from other writers' histories of specific disciplines, it gave an overview from the ancients to the present of the physical sciences—including astronomy, mechanics, acoustics, optics, "thermotics," "atmology," chemistry, mineralogy, botany, zoology, physiology, anatomy, and geology. One of Whewell's innovations was to label and classify the different sciences.[42] Another was to introduce a three-stage pattern, a historiographical novelty informed by Whewell's own philosophy:[43] a crucial period of discovery—"inductive epoch"—was marked by a convergence of distinct facts and clear ideas in the mind of a great scientist; it was preceded by a "prelude" in which these facts and ideas

were gradually clarified, and succeeded by a "sequel" in which the discovery was accepted and consolidated by the scientific community.

The *History*'s survey made it possible for Whewell to do what Bacon had been unable to do: to ground inductive philosophy on historical knowledge of the actual development of modern science. Whewell explicitly thought of his own theory of induction as adding to Bacon's nothing more and nothing less than "such new views as the advances of later times cannot fail to produce or suggest."[44] The *Philosophy* was published in 1840 in two volumes, totaling some 1,200 pages. At its heart stood the insight—on which Whewell had stumbled in 1833–1834—that all knowledge requires both facts and ideas or, that is, has both an ideal, subjective and an empirical, objective dimension. He called this the "Fundamental Antithesis" of knowledge, with which he carved out his own middle way between Immanuel Kant and the German idealists and John Locke and the sensationalists. What emerged was twofold. First, an antithetical epistemology, which said that observation is "idea-laden": the phenomena studied by scientists are first made possible by certain "Fundamental Ideas" supplied by the mind itself. For example, the Fundamental Idea of "Cause," together with the concept of "force" implied in it, is what allows physicists to obtain knowledge of mechanical phenomena. Second, a quasi-idealist philosophy of science in the form of a new theory of induction: "Discoverers' Induction." Whewell rejected the standard view of induction as the mere generalization from particulars. Instead, he argued, in induction "there is a New Element added to the combination [of particulars] by the very act of thought by which they were combined."[45] Whewell called this act of thought "colligation," that he defined as the mental operation of bringing together a number of facts by "superinducing" on them a concept that unites them and thus renders them capable of being expressed by a general law. More than Bacon, Whewell emphasized the creative role of the mind in science, and more than Kant, he insisted that the ideas that made the construction of scientific knowledge possible unfolded gradually over time.

Whewell believed that this Kant-inspired Baconianism—as opposed, for instance, to Herschel's empiricist alternative—made him Bacon's legitimate heir. Others were less convinced. Unlike the *History*, the *Philosophy* was met with almost universal rejection, including from Herschel, who reviewed the book in 1841. This did not come as a surprise to Whewell, who was aware of the widespread antipathy to metaphysics among his English countrymen. Neither did the negative reactions to his philosophy position despair him completely. Whewell himself wrote that the reform of inductive philosophy, "when its Epoch shall arrive, will not be the work of any single writer, but the result of the intellectual tendencies of the age."[46] He expressed a similar sen-

timent about his metascience—a mix of humility and self-confidence—in 1840 when he received an invitation to serve as president of the BAAS:

> My only pretensions to such a position are what I may have done as a cultivator of science, and my constant attendance upon the business of the Association. With regard to the former point, . . . I know perfectly well that there is nothing of such a stamp, in what I have attempted, as entitles me to be considered an eminent man of science. . . . My *History* and *Philosophy* of Science are disqualifications, not qualifications, for my being put at the head of the scientific world; for I cannot expect, I know it is impossible, that men of science should assent to my views *at present*: and those who have laboured hard in special fields will naturally feel indignant at having a person put at their head, recommended only by what they think vague and false general views.[47]

Whewell found himself in a peculiar situation: to become a meta-scientist, he had had to abandon his work as a man of science, but now that his project was finished, his position in the scientific world (that of "*lay* speculator") counteracted its potential influence. Already in 1836, around the time of his career switch, he was aware of this situation: "I shall do this with some regrets; . . . because I think I perceive that any improvement in our academical studies (and of course a reform of philosophy ought to improve *them*) may be introduced with greater advantage by a person actively engaged in them than by an insulated spectator."[48] The *History* and *Philosophy* were Whewell's crowning achievements as commentator on, and aspiring judge of, science, establishing his reputation for posterity. Lyell, Herschel, Adam Sedgwick, and James Clerk Maxwell, among other leading men of science, praised their value for understanding how science developed and how it might proceed. The books also capped the central part of Whewell's induction project, without sending the shock waves through the scientific community their author had hoped for. The *History* was "too crabbed for the general reader," too limited for the specialist, and not scholarly enough for the historian; the *Philosophy*, in turn, was too "dry and hard" for almost everyone.[49] Perhaps for this reason, the books (which saw a first print run of 1,500) reached their third and final editions only some twenty years after they first appeared. Neither of them was ever significantly revised.[50] This is most telling in the case of the *History*. Whewell did incorporate new discoveries into subsequent editions, which the young Charles Darwin found very useful. But already in the second edition of 1847, Whewell introduced no new branches of science and accepted that the book was no longer (as its title still promised) a history up to the present. It stood in marked contrast to the original ambition of creating "a platform on which we might stand and look into the future."[51] A decade later, this was simply no longer feasible, and not

just because of the rapid developments in the physical sciences. The fact was that Whewell himself had moved on to other pursuits.

The next step of Whewell's induction project was taken around 1840. Whewell had been appointed Knightbridge Professor at Cambridge in 1838 and resigned as tutor of Trinity College the next year, thereby completing his career switch from man of science to philosopher. At the beginning of 1841 he briefly considered leaving Cambridge to take up a country parish. A few months later things looked decidedly different: he was married to Cordelia Marshall and installed as master of Trinity, a Crown appointment recommended by Robert Peel, the Tory prime minister. An extraordinary feat of social elevation—accompanied by a new, formal, and stiff demeanor—it enabled Whewell to put into practice the conservative Anglican vision that underpinned his metascientific project. For instance, in 1844 Whewell revised the college statutes to limit the system of private tuition—a utilitarian, commercial practice that he believed weakened the moral and theological dimension of a liberal education. In 1848 he introduced the Moral and Natural Sciences Triposes, which widened the traditional Cambridge curriculum for the first time in its history. The aim was not to break the dominance of mathematics and classics, which Whewell continued to defend in educational writings and textbooks. Instead, it was done from a wish for university reform to be internally directed rather than externally imposed, in the form of a Royal Commission (appointed, much to Whewell's chagrin, in 1850).[52]

Upon his election to the Knightbridge Chair, Whewell, ready to take off his "mathematical boxing gloves, and go on with arms of wider range,"[53] changed its title from "Moral Theology or Casuistry" to "Moral Philosophy." It marked the start of his pursuit of the final part of his system, the subject of "Book 3" from his original 1834 plan: the application of induction to "other than material sciences." For the next two decades or so, interrupted only by his work as vice-chancellor (1842–1843, 1855–1856), Whewell made moral philosophy the main subject of his reading, lectures, and sermons. He published several books on the topic—*On the Foundations of Morals* (1837), the four-hundred-page *Elements of Morality, including Polity* (1845), *Lectures on Systematic Morality* (1846), and *Lectures on the History of Moral Philosophy in England* (1852)—and also edited other ethical and legal writings, explaining their significance in prefaces, including James Mackintosh's *Dissertations on the Progress of Ethical Philosophy* (1836), Joseph Butler's *Three Sermons on Human Nature* (1848), and Hugo Grotius's *De Jure Belli et Pacis* (1853).

From 1840 Whewell, at least in his own mind, ceased to be a historian and philosopher of science. He shifted his "centripetal" polymathy to the moral sciences, where it became more "limited" and focused on the humanities (or "moral sciences"). As he wrote in a letter to Herschel on April 22,

1841, in the *Philosophy* he had put down his philosophical views on science "once and for all."[54] This does not mean that the *History* and *Philosophy* did not have a moral. Quite the contrary, the books were written precisely to "get a scientific *moral* out of" them. The John Stuart Mill–Whewell debate from the 1840s to the 1850s makes this feature of Whewell's metascience abundantly clear.[55] Both men thought of their different views on induction as a struggle literally between good and evil. Mill believed Whewell's idealistic philosophy, "*physical as well as moral*, . . . to serve as a support and justification to any opinions which happen to be established."[56] This is why, for Mill, to defeat Whewell was "no mere matter of abstract speculation," but rather to defeat conservatism and, as such, "full of practical consequences."[57] Whewell, for his part, believed that the empiricism of Mill's *System of Logic* was "entangled in the prejudices of a bad school"[58]—the utilitarian ethics of Jeremy Bentham and William Paley, whose writings Whewell successfully managed to remove from the curriculum at Cambridge. This link traced back to the 1820s, when Whewell had lumped together Ricardians and utilitarians as the "irreligious school," hoping that an inductive methodology would create an "ethical" political economy based on a view of humans as divine creatures rather than selfish beasts.[59] This argument was continued in the *Philosophy*, which Whewell presented as a continuation of the fight, initiated in the field of ethics by Sedgwick in 1833, against the "ultra-Lockian school" that falsely advocated the "exclusive authority of the senses."[60] The book's key message was that humans can obtain absolutely certain knowledge of the God-created world and that this knowledge is made possible by God-given ideas, existing independently from experience. This view was important as a philosophical insight on the nature of science, and Whewell had strategically chosen to illustrate it by drawing examples from the physical sciences that were generally accepted as certain and true. "But," Whewell scribbled in a notebook in 1833:

> It is a subject of a far higher and deeper interest when we include in our survey all branches of human knowledge, those which concern his moral and religious condition as well as those which refer us to the material world. And it is not only allowable but necessary, to consider all the branches of human knowledge as having before them the same prospect of . . . perfection, till we have discovered how and why the rules and processes under which the physical sciences flourish and advance are incapable of being applied, with some modifications, to other parts of our knowledge.[61]

Whewell had long wondered whether what held for knowledge of the physical world also applied to knowledge of the moral world. By 1840 he was ready to take up the challenge and create a new system of non-utilitarian ethics.[62] Whewell set out on two missions, one historical and the other phil-

osophical, each building on his metascientific outlook. First, he traced the history of moral philosophy in England, seen as a centuries-long struggle between the secular and the religious, between the "low morality" of pleasure and consequences and the "high morality" of "necessary, universal, and eternal" principles derived from mankind's innate moral conscience.[63] Whewell ridiculed proponents of the former, especially Bentham, and took what he considered valid from advocates of the latter, such as Butler. Second, for his own system of "independent morality," Whewell put forward five "Ideas" ("Benevolence," "Justice," "Truth," "Purity," and "Order")—corresponding to the five elements of human nature: love, mental desires, speech, bodily appetites, and reason—as the ground of virtues, to be realized in social rules, duties, laws, and institutions. Whewell's reasoning was rather similar, as he himself recognized, to Plato's argument in the *Republic* for finding the cardinal virtues by examining the different elements of the soul. For Mill, whose criticism of Whewell's moral philosophy was harsh, the system amounted to an arrangement of dominant opinions put into an obscure framework.

Whewell's central aim was to show that morality must be understood in terms that also apply to science. He initially compared morality to geometry and, somewhat later, to mechanics, drawing an analogy between moral and scientific "Ideas" and "Axioms" and suggesting that both are necessary and unfold over time. It is possible to obtain moral and scientific knowledge, since God created the physical and moral world and gifted humans with the powers and Ideas that make them knowable. At the same time, because of the limited powers of the human mind, the self-evident truths (or axioms) that follow from these Ideas may neither be immediately self-evident nor seen to be necessarily true by everyone at all times. This is why the "intuition" through which humans come to realize such truths, and come to recognize that they are implied in the Ideas, develops "progressively."[64] The process starts by using an implicit apprehension of an Idea to organize certain observed facts; and these organized facts, in turn, help to arrive at a more explicit awareness of the Idea. Whewell admitted there were significant differences between scientific and moral knowledge—in morality, for instance, a crucial role is played by conscience, understood as reason applied to moral subjects. But he always maintained that progress in the latter occurs in the same way as in the former. It is clear that Whewell's thinking on what this progress consists of changed over time. By the 1850s it was less Kantian and more Platonist and Romantic, placing the emphasis much more heavily on intuiting, or "guessing," Ideas in the mind of God.

Whewell's moral philosophy—the grand finale of his religious-moral-philosophical project—offered an alternative to utilitarianism but was received largely negatively, and would soon be forgotten, buried by Mill and Henry Sidgwick under a heavy tombstone. Even his biographer, Isaac Tod-

hunter, writing in the late 1870s, believed that it was best laid to rest. From Whewell's own, Cambridge-centered perspective, things looked decidedly different. By the 1850s he had introduced his *History*, *Philosophy*, and *Elements of Morality* as well as his editions of Mackintosh and Butler into various Trinity examinations and into the Moral Sciences Tripos (first offered in 1851). Because he felt he had accomplished his "great object," Whewell resigned the Knightbridge Chair in 1855 at age sixty-one.

During his second professorship, which he combined with his work as master and his vice-chancellorships, Whewell took up various other subjects, none of which was scientific or directly related to his metascience. He now gave free reign to a more leisurely polymathy, allowing it to become more "centrifugal,"[65] and shifted his focus to the general English reader. In addition to moral philosophy, natural theology, sermons, college management, and university politics, language became one of Whewell's main occupations. There are several senses in which language had stood high on his agenda ever since the 1820s: as a mineralogist, he had been concerned with nomenclature and classification and as a philosopher with scientific terms ("instruments of thought"), many of which he coined himself, such as *ion*, *anode*, and *Pliocene*.[66] It suggests that the languages of nature and culture—indeed, nature and culture themselves—were for Whewell deeply integrated: they were divine co-creations, both designed according to God's plan. At a later point in his career, it was language itself that became an object of interest and study. Over the course of the 1840s–1860s, Whewell, who was well versed in French, German, Latin, and Greek, published various poems and was for some time a member of the Cambridge Etymological Society and the London Philological Society. Some of his linguistic undertakings were important but sporadic, such as in etymology.[67] Others were more sustained and took years of dedicated labor. All of them were aimed, in one way or another, to promote the standing of the English language.

One of Whewell's projects was to introduce hexameters, popular in Germany, into England.[68] Against the tide, and unsuccessfully, Whewell hoped to "naturalize" the hexameter: to show that English hexameters were different from Latin or Greek hexameters, and that English was a suitable language for poetry in this meter. He published adaptations into hexameters of English-language works (e.g., Thomas Carlyle's *Chartism* [1840]) as well as numerous translations of German-language prose into English hexameters. His most important work was *English Hexameter Translations from Schiller, Goethe, Homer, Callinus, and Meleager* (1847). It contained, among other texts, his own translation of Johann Wolfgang von Goethe's *Hermann and Dorothea* (1798) and translations by others, including Herschel, who at one point also translated the entire *Iliad* into hexameters. Whewell's work on

hexameters points to the influence of German Romanticism on his mature outlook—he came to greatly admire Friedrich Schiller's *Der Spaziergang*—in addition to the usual Kantianism. What he liked about hexameters was the way in which they allowed for the expression of "the simplicity and truth of reality."[69] Unlike his Romanticist peers, such as Julius Hare, Whewell brought his typical approach to the subject: he went for its foundation, in this case the grammatical technicalities of spondees and trochees, on which he wrote several articles and reviews.

Another significant project was the translation and editing of the *Platonic Dialogues*, published in three volumes in 1860–1861. Here, the rationale was to "naturalize" ancient philosophy. Whewell, by combining translation and comment, sought to make the dialogues "intelligible and even interesting to the ordinary readers of English literature." But he also had a scholarly purpose in mind: "It seems not unreasonable to require," Whewell wrote, "that if Plato is to supply a philosophy for us, it must be a philosophy which can be expressed in our own language."[70] Plato was Whewell's "new love" from the 1850s, by which time his "old love,"[71] Bacon, had been taken care of. He presented five papers on aspects of Plato's philosophy to the Cambridge Philosophical Society. These appeared together in a booklet in 1855, and some were reproduced in *On the Philosophy of Discovery: Chapters Historical and Critical* (1860)—the third part of the third edition of the *Philosophy*. His interest in Plato did not come out of the blue. Whewell had started his career as an orthodox follower of Bacon, became a Kantian idealist of sorts in the 1830s, and from the 1840s on was more and more attracted to Platonism. It informed his *Elements of Morality* and *Plurality of Worlds*, which revived the Platonic theory of ideas. Following Richard Owen's application of Platonism to biology and paleontology, Whewell defended the view that all objects and laws of nature reflect "Archetypal Ideas" in the Divine Mind.[72] Since he never ceased to self-identify as a Baconian, it would be more accurate to say that Whewell made true Coleridge's remarkable claim that Bacon was "the British Plato."[73] The *Platonic Dialogues* also, and once again, bore witness to German influence on Whewell, who admitted to having derived all his views on Plato directly from the Plato scholar Joseph Socher. For instance, Whewell followed Socher in arguing—rather controversially—that the *Parmenides* was not a Platonic dialogue because Plato himself could not have written such a harsh attack on his own theory of ideas. Whewell's final publication, the unfinished article "Grote's Plato," appeared posthumously in April 1866. It showed a crucial feature of his mature philosophical thinking. No philosophy for the present time can be derived ready-made from the past. Neither can it be the creation of a single author. Instead, it will always be a product of the age itself. Whewell clearly saw it as his role to be the voice of his age, eventually echoing a present that was no longer there.

Whewell died after falling from a horse in 1866 at the age of seventy-one. Following the loss of his first wife in 1855, he had married Lady Affleck—the sister of his former pupil Robert Leslie Ellis—in 1858. She died on Saturday, April 1, 1865. Early the next morning, Whewell rose to the pulpit of Trinity College Chapel, allowing all to witness "the saddest of all sights, an old man's bereavement, and a strong man's tears."[74] After a few months of sorrow, he managed to write his articles on Auguste Comte and Plato. But his final thoughts and efforts were for Trinity. During the last years of his life, it had been his singular place of refuge. Whewell's bond to Trinity was both spiritual and tangible. In 1860 the first Master's Court, now Whewell's Court—a building opposite the Great Gate erected at Whewell's own expense—was completed. In his will Whewell also established and endowed a chair of international law that materialized his view, put forward in *Elements of Morality*, that international obligations between nation states marked the highest development of morality. On the last morning of his life, Whewell ordered his bedroom windows to be opened wide, allowing him to see the sun shine on the Great Court. "He smiled as he was reminded that he used to say that the sky never looked so blue as when it was framed by its walls and turrets."[75]

Whewell Scholarship: Past and Present

Any new volume on Whewell must position itself in relation to Menachem Fisch and Simon Schaffer's *William Whewell, a Composite Portrait*. Fisch and Schaffer opened their 1991 book with a reflection on how best to deal with the problem of Whewell's polymathy. Unlike previous studies, which they held to be typically limited in scope and compartmentalized in focus, their editorial strategy was to aim for a holistic treatment. "In a darkened Oxford pub we sketched out on a paper napkin a list of chapter headings such as 'Whewell the Teacher,' 'Whewell the Priest,' 'Whewell the Historian,' and so on. However, as this volume emerged, these carefully constructed compartments dissolved. . . . The dykes burst under a deluge of cross-reference and debate."[76] The present volume is organized exactly in such compartments. It brings together a group of scholars, each of whom contributes a chapter on one particular aspect of Whewell's polymathic oeuvre and career. This editorial decision was inspired by three considerations.

First, rather than seeking to oppose, let alone replace, the holistic accounts of Whewell in Fisch and Schaffer's volume—some of which have become classics—*William Whewell: Victorian Polymath* builds on, updates, and complements them. Whewell scholarship has developed significantly since 1991. It has undergone what might be described as simultaneous horizontal and vertical development: horizontal in that previously unexplored subjects in Whewell's publications have come to be studied, and vertical in that well-known topics and themes have been revisited through study and

debate. Moreover, Whewell scholarship has been shaped by broader developments within the best historical research from the past thirty years or so. For instance, the history of the humanities, including the history of the book, has been emerging in interaction with the older fields of the history of science and the history of philosophy, together transforming the study of Victorian intellectual culture through conceptually rich, highly contextualized studies of science. Or, to give another example, Whewell often figures in accounts of neo-Kantian philosophy of science, so prominent today, in which he is often recognized as a founding father of the history of philosophy of science. The chapters in the present volume take stock of and add to the current state of Whewell scholarship, offering new, pithy, and authoritative starting points for research on Whewell's life, work, and times.

Second, the volume takes issue with Fisch and Schaffer's opinionated approach to Whewell's polymathy. According to them, it is "misleading to use the term 'polymath' for Whewell, since he was precisely in search of a means of synthesizing a vast range of allegedly disparate material."[77] There are several problems with this claim. It suggests that *polymath* is a monolithic term, whereas in fact it can be said to have several meanings and come in different kinds. Indeed, the attempt to synthesize knowledge defines one particular, "centripetal" type of polymath. Fisch and Schaffer, in abandoning the term *polymath*, essentially replaced it by that of *omni-* or *meta-scientist*, at the heart of which they situated his "historico-philosophical" project. It is true that metascience is key to understanding Whewell, but it is not a definition of who he was and what he did. After all, history and philosophy of science were his main occupation during one period of his career (the 1830s) and represent only a fraction of his large oeuvre. It is too reductive to read metascience into his work from the 1820s and to extrapolate it to that from the 1840s to the 1860s. Whewell's metascience offers one possible solution to the riddle of pinpointing to what he owed his status as one of the leading men of science of the Victorian era. But others are needed as well that take into account, for instance, that Whewell addressed many different audiences: not just men of science but also Cambridge students and the general English reader. Taken together, rather than abandoning the idea that Whewell was a polymath, it is arguably more fruitful to recognize that his polymathy was complex, many-sided, changing, and not free from internal tensions. This, in brief, is what *William Whewell: Victorian Polymath* brings clearly into view through studies of Whewell's many and interlinked polymathic interests.

Last but not least, there is the issue of Whewell's place in the early Victorian landscape. During the revival of Whewell scholarship in the 1970s, Whewell was approached either rather narrowly as a philosopher of science or as a leading member of an expansive "Cambridge Network."

Since the publication of Fisch and Schaffer's *William Whewell* and Richard Yeo's *Defining Science*, the focus has been predominantly on Whewell as a meta-scientist. This shift in Whewell scholarship went hand in hand with a broader criticism of Susan Faye Cannon's Cambridge Network as somewhat of a fictitious entity—though it has lived on, in another form, in Laura Snyder's *Philosophical Breakfast Club*.[78] It neglected individual differences between key members in favor of an emphasis on collective agreement on a shared project to transform the whole of British science. Cannon, for instance, tended to regard Whewell's and Herschel's view of science as the view of science of all members of the Cambridge Network. Although it was recognized that there were several subgroups, she not just glossed over fundamental disagreements between Whewell and Herschel but also ignored their distance, in certain crucial respects, from each other and from someone like Charles Babbage. William Ashworth's recent *Trinity Circle* instead pits Whewell squarely against Babbage, while bringing into view other, lesser-known allies of Whewell's religious-scientific-moral project, such as Sedgwick, Connop Thirlwall, Julius Hare, and, by extension, Robert Leslie Ellis, John Grote, and Thomas Rawson Birks.[79] At the same time, it is clear that Whewell, Herschel, and Babbage remained on friendly terms, and there remained commonalities between them that set them apart from other scientific reformers, whether it was William Hamilton, David Brewster, or Henry Brougham.

All this presents at least two significant challenges for future scholarship. First, "Morrell's Challenge": to zoom in and explore British science in the early Victorian period in terms of the "singularity" or "individualism" of figures like Whewell, Herschel, and Babbage.[80] Rather surprisingly, very little work in this regard has been done for Herschel and Babbage.[81] Moreover, Fisch and Schaffer's claim notwithstanding, the same holds for Whewell, albeit to a lesser degree. By 1991 the number of compartments used to study Whewell's oeuvre and career was fairly limited. Looking at their *William Whewell*, at least eight out of a total of thirteen chapters dealt purely with the history and philosophy of science. The present volume seeks to redress this situation, opening up more windows to Whewell's polymathy, also beyond his metascience. Second is "Cannon's Challenge": to zoom out and reshuffle the individual pieces to recompose a new big picture of British science in the (first half of the) nineteenth century. Once the well-rounded accounts of all aspects of pivotal figures (organizations, societies, groups, etc.), rather than some aspects of only a few of them, are available, scholars of nineteenth-century Britain should be in a better position to draw large-scale comparisons, unearth broader developments, and flesh out new major themes, contexts, and geographies. For instance, important work is currently being done to study the efforts of the Society for the Diffusion of

Useful Knowledge, founded in 1826. It will be key to bring the results to bear on ongoing research on other visions of science—whether Babbage's rational-mechanical utopianism or Whewell's Anglican conservativism or that of the Royal Society or the BAAS—and to see how these connect to those coming after them in the late Victorian era.

It is important to emphasize that, however comprehensive, the present volume is not exhaustive. Among the topics not included are Whewell's contributions on English hexameters; his poetry; his work as editor of Mackintosh, Butler, Grotius, and Plato; and his diary-keeping. Furthermore, with the digitization and further cataloging underway of the Whewell Papers held at Trinity College Library, Cambridge, it is very well possible that new Whewell material will be found that has not been taken into account. The hope is that this volume will inspire future work that will make up for its shortcomings.

The issue of Whewell's polymathy is perhaps most strongly felt when structuring a book about it. There is no ideal solution to capturing it, and the roughly chronological rather than thematic structure adopted here surely has drawbacks. Indeed, the chronology is, and can, only be quasi-chronological. For only very few of Whewell's myriad activities come with clear-cut start and end dates. Some were pursued infrequently (such as his contributions on political economy) or with greatly varying intensity over time (such as work on his textbooks, which climaxed in the 1820s but continued through the 1840s, and the delivery of sermons). Others concern themes running, sometimes explicitly and at other times implicitly, through his entire oeuvre—such as his views on politics and on women.[82] The chosen order of chapters hopefully gives a lively sense of the nature and development of Whewell's polymathy and naturally bring out certain thematic clusters. This holds, for instance, for the chapters dealing with his thinking on the history and philosophy of science, which tellingly find their place at the heart of the book.

Throughout the book, letters to or from Whewell included in Todhunter's *William Whewell* or Douglas's *Life of Whewell* are quoted from those books, as these can be readily consulted. In all other cases, full reference is provided to archive, collection, and item number. An overview of Whewell's works can be found in the "List of Whewell's Published Works," which is published as an online supplement to this book.