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PERSONAL KNOWLEDGE

Towards a Post-Critical Philosophy

MICHAEL POLANYI

ENLARGED EDITION

with a New Foreword by

MARY JO NYE

PHILOSOPHY / SCIENCE

The publication of *Personal Knowledge* in 1958 shook the science world as Michael Polanyi took aim at the long-standing ideals of rigid empiricism and rule-bound logic. Today, *Personal Knowledge* remains one of the most significant philosophy of science books of the twentieth century, bringing the crucial concepts of "tacit knowledge" and "personal knowledge" to the forefront of inquiry. In this remarkable treatise, Polanyi attests that our personal experiences and ways of sharing knowledge have had a profound effect on scientific discovery. He argues against the idea of the wholly dispassionate researcher, pointing out that even in the strictest of sciences, *knowing* is still an art, and that personal commitment and passion are logically necessary parts of research. In this expanded edition, Mary Jo Nye sets the philosopher-scientist's work into contemporary context, offering fresh insights and providing a helpful guide to critical terms. In our technological age where fact is split from value and science from humanity, Polanyi's work continues to advocate for the innate curiosity and scientific leaps of faith that drive our most dazzling ingenuity.

"Polanyi's monumental work, *Personal Knowledge: Towards a Post-Critical Philosophy*, takes the shape of an orderly rejection of the false ideal of wholly explicit and wholly impersonal, so-called objective knowledge. The human mind, for him, is not an impersonal machine engaged in the manufacture of truth. In fact, *Personal Knowledge* represents a compelling critique of the positivist claim for total objectivity in scientific knowledge. . . . Polanyi, the scientist philosopher, calls forth an enormous array of examples to show that the scientist himself is engaged in acts of personal acceptance and judgment in the very doing of science."—***Philosophy Today***

"Rich in insights, groundbreaking in its interpretations, *Personal Knowledge* deserves to be better known."— ***Science and Education***

MICHAEL POLANYI (1891–1976) was a Hungarian-British chemist and philosopher, a Fellow of the Royal Society, and a Fellow of Merton College, Oxford. He is the author of many books, including *Science, Faith, and Society* and *The Tacit Dimension*, both also published by the University of Chicago Press.

MARY JO NYE is the Thomas Hart and Mary Jones Horning Professor of the Humanities Emerita and professor of history emerita at Oregon State University. She is the author of several books, including, most recently, *Michael Polanyi and His Generation*, also published by the University of Chicago Press.

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To

SIR THOMAS AND LADY TAYLOR

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FOREWORD

Mary Jo Nye

MICHAEL Polanyi's *Personal Knowledge: Towards a Post-Critical Philosophy* was first published in 1958. It is a classic work. Like other classics, it is a book that is rooted in a specific historical period and in the preoccupations of its author, but with themes that reverberate beyond its original context and writer. It is not a classic of philosophy, however, as judged by most professional philosophers, against whom *Personal Knowledge* was meant to serve as provocation and prophylactic. The range of its readers was perhaps unanticipated by Polanyi. They spread across a broad spectrum in sociology and political science, psychology, economics, theology, and education. Among his themes that are frequently cited in recent literature are tacit knowledge, levels of knowing, intuition, skills, and performance—none of which usually figures in formal philosophy. Judging by citations in journal literature, *Personal Knowledge* is read equally as a resource for discussions of complexity theory, emergent systems, faith, and values.

Polanyi's original philosophical targets in *Personal Knowledge* were a series of "isms" that constituted the core of mid-twentieth-century philosophy of science. It is no wonder the book had a mostly hostile reception in 1958. His philosophical targets included positivism, pragmatism, conventionalism, reductionism, mechanism, materialism, and determinism. In opposition to the mainstream in philosophy of science, Polanyi argued that objective empiricism and rule-bound logic do not successfully explain the essence of science. There is no codified scientific method that successfully captures the nature of science as it is actually practiced in everyday scientific life, because of what he called the tacit component of scientific learning and achievement.

Nor, Polanyi argued, can philosophies of verification or falsification satisfactorily justify the truthfulness of scientific knowledge, because they fail to explain the logical gap between evidence and theory, a gap discussed by earlier philosophers such as David Hume.[1] Ultimately, for Polanyi, the

[1] For a contemporary account in the 1960s of Hume and the problems of induction and inference, see *The Encyclopedia of Philosophy*, vol. 4, s.v. "Induction," by Max Black (New York: Macmillan and the Free Press, 1967): 169–81.

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achievement of scientific knowledge relies on overcoming the gap between evidence and theory by a commitment of belief on the part of the individual scientist and of the community of experts in the field. Scientific knowledge tells us that a comet is a body in orbit around the sun and that a comet is not the gods' portent of events to come. But the scientific theory is not logically ironclad. It depends upon a leap of intuition and conviction from evidence to explanation.

In making his argument, however, Polanyi knew full well that "belief" is a treacherous word when applied to scientific knowledge. There are all kinds of beliefs that scientists and other people regard as unscientific, false, or immoral. So how can we distinguish valid scientific belief from other forms of belief? And why is this important? In *Personal Knowledge* Polanyi aimed to establish a new epistemology, free of subjectivism or relativism, in which scientific knowledge is understood to be personal and free, rather than mechanical and deterministic. This knowledge is not solitary, however, because it is crucially based in a social community of "mutual trust and confidence" and rationally and morally capable of serving modern society "*as its guide*" (375, with italics in original text).

The first-time reader, as well as some previous readers, may find it helpful to have some guidance in taking up *Personal Knowledge.* The organization of the book is not straightforward. It is not "one long argument," as Charles Darwin said of his great work *The Origin of Species.*[1] Polanyi was a consummate essayist, and *Personal Knowledge* builds upon essays that he had been writing and publishing for some twenty years, while also incorporating entirely new materials and ideas.[2] There is overlap among sections and chapters of the book. Some sections stand well alone. Further, because *Personal Knowledge* is so closely rooted in Polanyi's own experiences and preoccupations, rather than in formal philosophy, some passages read more like political or moral philosophy than philosophy of knowledge. It is a very personal book that exemplifies Polanyi's theme of the personal nature of knowledge.

In the remainder of this introduction, I look briefly at the author's career as a distinguished scientist and identify the preoccupations that compelled him to write a book on scientific life.[3] After that, I turn to some details of the organization of the book, its central concepts, and keywords. In conclusion, by way of helping to highlight passages in the book, I look at ideas that

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moored *Personal Knowledge* to the 1950s, as well as those that make it a book of contemporary interest.

Personal Context and Preoccupations of Michael Polanyi's Philosophy

Born in Budapest in 1891, Polanyi's family upbringing was secular, literary, and scientific, as was characteristic of many intellectuals from an assimilated bourgeois Jewish background in central Europe. He finished two degrees at the University of Budapest: a medical degree in 1913 and a PhD in physical chemistry in 1917. Formative events of his youth were the First World War, in which he served as a medical officer, and political developments in Hungary from 1913 to 1919 in which he sometimes parted company with his more left-wing brothers Karl and Adolf and his eldest sister Laura. He served in the Ministry of Health in 1919 in a short-lived Hungarian republican government, resigning his post when a communist regime came into power. This regime was overthrown, in turn, four months later by conservative nationalist military and political alliances. After this period of political upheaval, Polanyi left Hungary to pursue a career in Germany, where he became director of the chemical kinetics research group in Fritz Haber's Institute for Physical Chemistry and Electrochemistry at the Kaiser Wilhelm Society in Berlin. While in Berlin, Polanyi established himself as a world expert in his field, heading a research group that pursued investigations on gas adsorption, catalysis, x-ray crystallography, solid-state chemistry, and reaction rates and mechanisms in the chemistry of simple gases. He is regarded as one of the founders of modern chemical kinetics based in thermodynamics and quantum theory.[1]

By the late 1920s Polanyi was paying close attention to crises in European economic and political conditions. At this time his brother Karl was a senior editorialist on economic and international affairs for the *Austrian Economist,* a periodical modeled on Great Britain's *Economist.*[2] In 1928 Michael Polanyi attended an economics seminar led by the Russian émigré Jacob Marschak and, two years later, Polanyi organized his own informal economics seminar

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whose members included Gustav Stolper, the editor of the prominent *German Economist* journal. After Adolf Hitler's appointment as German Chancellor in late January 1933 and implementation of anti-Semitic laws in April 1933, Polanyi moved to Manchester where he headed the university's physical chemistry laboratory. He was unable to duplicate the intellectual excitement of the science of his Berlin years, however, and, by the late 1930s and the war years, Polanyi was increasingly distracted from his chemical research. In 1948 he exchanged his position in chemistry for a chair in social studies that was specifically created for him at the university.

Polanyi's arrival in Manchester coincided with the coming to political power in Britain of a coalition government that proposed measures for centralized planning in order to combat problems of the Depression. Some scientists were calling for greater attention by scientists to the needs of British technology and social planning. Polanyi began to fear the development in Great Britain of the kind of strongly centralized, command economy that had come to dominate Nazi Germany and the Soviet Union.[1] After visits to the Soviet Union, where he talked with scientists about the implications of Five-Year Plans for scientific research and the Soviet economy, Polanyi put together films on the free market. In 1945 he published a book on employment and free trade in which he offered a positive brief for the efficacy of private enterprise as a system of spontaneous and mutually adjusting individual actions. Agreeing in part with the economic theories of John Maynard Keynes, Polanyi allowed for some government intervention, such as control of the money supply, to address recession and unemployment, but he rejected other aspects of Keynes's economic policies such as government-funded programs of public works.[2]

The late 1930s and early 1940s was a period when Polanyi and his family were trying to help many friends and relatives escape from incarceration and execution in Germany, Austria, Hungary, and the Soviet Union. On a 1935 visit to the Soviet Union, Polanyi saw his niece Eva Striker, whose Viennese husband had accepted a research position in physics at the Kharkov Institute of Physics and Technology. Shortly after Polanyi's visit, Eva was arrested on charges that she was part of a group aiming to kill Joseph Stalin. She spent a harrowing eighteen-month period in prison before she was freed and expelled from Russia. Arthur Koestler, who was a family friend, later said that Eva's

[1] In particular, Polanyi disagreed with the aims of the movements known as Social Relations of Science and Scientists for Social Responsibility, both associated with the physicist John Desmond Bernal's views that became known as Bernalism. See J. D. Bernal, *The Social Function of Science* (London: G. Routledge, 1939) and Michael Polanyi's essay review of the book, "The Rights and Duties of Science," first published in 1939 and reprinted in *The Contempt of Freedom* (note 3), 1–26.

[2] As one of the most influential economists of the twentieth century, John Maynard Keynes argued for some government intervention in free markets in order to avoid or mitigate recessions and depressions. For Polanyi's views on economics and Keynes, see Michael Polanyi, *Full Employment and Free Trade* (Cambridge: Cambridge University Press, 1945); also, Charles Thorpe, "Community and Market in Michael Polanyi's Philosophy of Science," *Modern Intellectual History* 6 (2009): 59–89.

story was the inspiration for *Darkness at Noon,* his novel of Soviet terror and Stalinist purges.[1]

Polanyi's loathing for centralized and repressive regimes, as he witnessed them in Hitler's Germany and Stalin's Russia, strongly influenced his economic and political writing, but he located his turn to philosophy of science in the specific case of Nikolai Vavilov, a Russian geneticist who became the target of Stalinist attacks in the mid-1930s on the ideological grounds that his plant research ignored Marxian principles. Western scientists learned in 1940 that Vavilov had been arrested, and they later discovered that he received a death sentence for espionage and died of malnutrition in 1943.

Vavilov's fate was largely engineered by Trofim Lysenko, as he gained political power for his methods of agricultural plant breeding. Lysenko argued that accustoming plants to new environmental conditions would quickly alter the plants and their descendants, so that winter-intolerant stocks could thrive in harsh Russian temperatures. This theory was said to be consistent with Marxist ideology. In the West, it was reported that Vavilov had failed to convince his trial judges that the Lysenkoist theory was bogus in contrast to the scientifically accepted Mendelian theory of inheritance as a matter of the transmission of stable material particles (genes). Polanyi suddenly realized, he later said, that Vavilov did not have a philosophy of science that satisfactorily explains what distinguishes true science from imposters and opponents. This is the demarcation problem. So Polanyi began posing questions about Western philosophy of science: "How was its general acceptance among us to be accounted for? Was this acceptance justified? On what grounds?"[2] His conclusions surprised many philosophers of science.

Organization, Central Concepts, and Keywords in *Personal Knowledge*

In Polanyi's two-page preface to *Personal Knowledge* he states that his endeavor "is primarily an enquiry into the nature and justification of scientific knowledge" and an attempt to refute the usual view that scientific knowledge is detached and impersonal in character (vii). The book is divided into four sections. Part 1, titled "The Art of Knowing," has four chapters: "Objectivity," "Probability," "Order," and "Skills." Polanyi begins by discussing some great scientific achievements such as the Copernican revolution and Einstein's theory of special relativity. He argues the insufficiency of formal philosophies of science—commonly and loosely identified with positivism—to completely account for the discovery or justification of a new theory or conceptual framework. Scientific knowledge is probable knowledge, Polanyi

[1] See "Eva Zeisel, Ceramic Artist and Designer, Dies at 105," *New York Times*, 30 December 2011, A17; and Arthur Koestler, *Darkness at Noon*, trans. Daphne Hardy (New York: Macmillan, 1941).

[2] Quoted from Polanyi, *Science, Faith, and Society*, 2nd ed. (Chicago: University of Chicago Press, 1964), 9.

argues, and it tolerates or incorporates the existence of anomalous information and random occurrences while settling on general laws and patterns of order. The scientist has learned how to do this through what Polanyi calls the "tacit component" of accomplishing scientific work.

Introducing this novel conception in chapter 4 of part 1, Polanyi describes the informal and tacit elements essential to science. These include transmission of skills from master to apprentice, the development of "connoisseurship," and the inculcation in a student of a disciplinary tradition and interpretive framework. These tacit components of knowing account for the process of problem solving or discovery: the art of understanding the whole by intuitively combining an internalized subsidiary awareness of particular things with a focus on a question to be solved about external objects. Common experiences that give us a sense of this tacit knowledge, which cannot be articulated by rote rules, are the achievements of riding a bicycle or playing the piano or discriminating a fine wine (49–50, 54).

Part 2, titled "The Tacit Component," consists of individual chapters on "Articulation," "Intellectual Passions," and "Conviviality." Polanyi especially labored over chapter 5, "Articulation," and he took almost a year to write it.[1] This chapter, along with the one on intellectual passions, was singled out for its brilliance in Thomas Kuhn's blockbuster book of 1962, *The Structure of Scientific Revolutions.* A focus of both these chapters (chapters 5 and 6) is language and the relationship between thought and speech. Polanyi writes that there exists unspecifiable and unarticulated knowledge among scientists that is not susceptible to language and usually is dismissed in philosophy of science. In this context, Polanyi explicitly rejects the young Ludwig Wittgenstein's dictum "Of what cannot be said thereof one must be silent" (87, 87n2). Drawing here as elsewhere upon his own scientific career and briefly on historical examples, Polanyi describes how conceptual meanings in different language frameworks result in mutual incomprehension between holders of the different frameworks. Discovery and justification of novel phenomena and ideas require breaking out of a language system and overcoming a logical gap. It is a heuristic process, he writes. It is an experience of "conversion" that subsequently produces disciples who "live in a different world" from what they and other scientists believed beforehand (151).

Polanyi begins to develop in chapter 6 the theme of conviviality that is the center of chapter 7. The term "Conviviality" is a little puzzling, until one understands that Polanyi is discussing the kinds of social arrangements that further the pursuit of scientific truth in contrast to those which undermine and destroy it. On the one side are free societies and on the other are totalitarian societies. The pursuit of science thrives in free societies in which disciplinary communities of scientists control a system of learning and apprenticeship, advancing and disseminating scientific knowledge by consensus of scientific

[1] According to Marjorie Grene, "Tacit Knowing: Grounds for a Revolution in Philosophy," *Journal of the British Phenomenology Society* 8, no. 3 (October 1977): 168.

opinion that is exercised within a set of scientific institutions and scientific standards that are mutually decided by scientists themselves (216–19).

In contrast to this ideal of scientific life is the distortion of true science by the political values and social ends of a totalitarian state. Earlier in *Personal Knowledge* Polanyi identifies the concept of strictly objective and material knowledge with what he calls the Laplacian "paradigm," citing the statement in Laplace's 1814 *Treatise on Probability* that a powerful enough intelligence could use the laws of physics to calculate movements of all bodies from knowledge of natural forces and original positions of matter. Using such a mechanical program as a template for human affairs, one that reduces all actions to basic laws of matter and force, Polanyi argues, resulted in Hitler's and Stalin's authoritarian regimes of social calculation. These left "no justification to public liberties" and demanded that natural and social scientists serve the ends of the state in order to define and control all human activities, thereby discrediting science itself (139–42, 232–34). Polanyi concludes part 3 by asserting the need to reinvigorate confidence in scientific values and universal knowledge within a liberal and free society.

In part 3, titled "The Justification of Personal Knowledge," Polanyi sets out to demonstrate in greater detail the operation of personal knowledge as an act of commitment within the process of scientific knowing. Scientists and philosophers of science, including Laplace for example, often express confidence in facts or theories in terms of their degree of probability. Yet, argues Polanyi in chapter 8 on "The Logic of Affirmation," what is happening in an affirmative statement based in probability is a statement that is made in a "fiduciary mode." The scientist asserts "I believe" this to be the case, not that this *is* the case, with confidence that the theory very likely is true, although it may be false (255–56). It is impossible, Polanyi argues, to make a statement of *absolute* certainty, and, in chapter 9, titled "The Critique of Doubt," he advises that we must abandon a critical philosophy that prohibits statements of belief and favors statements of doubt, because doubt is no better guide to truth than is belief.

In "The Critique of Doubt," Polanyi writes of both the difficulty of doubting and the tendency to doubt. We can be subject to doubt in many different kinds of situations: a court of law, a house of worship, or an African Azande witchcraft ceremony. In contrast, we may not experience doubt at all because of the difficulty of breaking out of a coherent system of beliefs to which we are accustomed. Yet if we operate within a set of beliefs or dogmas, how, then, can a scientist step out of an established disciplinary framework into a different way of thinking? How do we justify a step in science that relies on logic that is inferential and probable and therefore dubious even if reasonable? For Polanyi, the answer lies in the leap of commitment, as he argues in chapter 10 (titled "Commitment"). The act of commitment is personal, but it is not simply subjective, he argues (300). Commitment is acknowledgment of the "person of the scientist as the agent responsible for conducting and accrediting scientific discoveries" that have objective validity (311). This po-

sition is not solipsistic, he argues, because it is based on belief in an external reality, and it assumes "the existence of other persons who can likewise approach the same reality" (316).

Part 4, titled "Knowing and Being," might appear a change in focus from theories of scientific knowledge to theories of evolutionary biology, but Polanyi's larger project is to locate scientific knowing within a broader heritage of knowing that has evolved over the course of cosmic history. Chapter 11, "The Logic of Achievement," uses examples ranging from embryological development to animal learning, in order to argue that consciousness and intelligence cannot be reduced to the kinds of material processes explained by chemistry and physics. This theme is further developed in chapter 12, "Knowing Life," where Polanyi's discussion of morphological notions, such as Hans Driesch's regulative principle and Hans Spemann's principle of embryonic organizers, is followed by analysis of Gestalt psychologist Wolfgang Köhler's studies of learning and creativity in apes. For Polanyi, these kinds of studies demonstrate the evolution of the human capacity for understanding the real world (374).

In the final chapter 13, "The Rise of Man," Polanyi introduces the notion of "emergence" in order to link themes of the entire book. Distancing himself from Neo-Darwinian theory, Polanyi insists that there is in biological evolution an ordering action that operates within the random fluctuations and environmental conditions of life (384). He argues that these operations are unspecifiable in terms of preceding levels of life and that consciousness and intelligence are results of emergence from lower to higher levels. No new creative agent is required in the process. It is a phenomenon, Polanyi suggests, which Teilhard de Chardin called "noogenesis," or genesis of the sphere of mind, in his book *Le phénomène humain.* We have an intuition of this process, Polanyi suggests, because of our own experience of the emergent heuristics of sudden insight or scientific discovery (395). Having earlier in *Personal Knowledge* likened the process of scientific discovery to religious conversion, Polanyi returns in the very last sentence of his book to the theme of belief and faith, harking back to his earlier references to St. Augustine's struggles to acquire religious faith (266–67, for example). Polanyi concludes: the human belief that truth is the result of contact with reality is "how a Christian is placed when worshipping God" (405).

In reading *Personal Knowledge* there are keywords that the reader may find helpful. Some of these keywords were prominent in most philosophy of science in the mid-twentieth century. Others are words that were unusual in philosophy of science, but culturally important.[1] Thus, on the philosophical

[1] Raymond Williams began putting together a list of cultural keywords while writing his book *Culture and Society 1780–1950* (London: Chatto and Windus, 1958). He first published this list and his analysis as *Keywords: A Vocabulary of Culture and Society* (New York: Oxford University Press, 1976). His keywords included communism, community, consensus, creative, elite, empirical, evolution, expert, humanity, idealism, ideology, individual, institution, isms, liberal, mechanical, positivist, progressive, rational, realism, science, standards, subjective, theory, tradition, unconscious, and Western.

side, we have: discovery, empiricism, evolution, framework, heuristic, indeterminism, justification, language, logic, mechanism, objectivity, positivism, reality, subjectivity, theory, and truth. On the political side: authority, communism, community, freedom, free society, liberalism, materialism, Marxism, tradition, totalitarianism. "Authority," "community," "consensus," and "tradition"—words that Polanyi identifies as essential to the stability of scientific knowledge—were terms common in mid-twentieth-century sociology or political science, but not in philosophy of science. Although a few philosophers of science, notably Karl Popper, explicitly framed their philosophical work in the context of political concerns such as freedom and totalitarianism, most did not, unlike Popper and Polanyi.

"Belief," which is a keyword in Polanyi's philosophy of science, carried the common connotation in the 1950s of ideology, religion, or opinion. "Belief" triggered skepticism or outrage in formal philosophy unless explained rationally, for example by degree of probability. "Conversion" was an even more objectionable word to philosophers of science, since it was tinged with psychological or religious meaning. Here Polanyi obviously is doing something radical. "Tacit knowledge" and "personal knowledge" are perhaps the two most important keywords that Polanyi coins, and he ties their meanings to other keywords that he marshals in order to explain how science works: articulate and inarticulate knowledge, commitment, connoisseurship, conviviality, fiduciary mode, framework, indwelling, logical gap, passion, skill, subsidiary and focal knowledge, unspecifiability, wholes, and particulars. Other keywords to pay attention to are the morally and politically infused terms "moral inversion" and "public liberty" which clearly place Polanyi's philosophy in ethical and political contexts.[1] The keyword "emergence," which appears only in the last chapter of the book, is a word that Polanyi borrows from earlier usages in order to link together his antireductionist accounts of scientific knowledge and human life.

Personal Knowledge in its Past and the Present

As he mentions in chapter 13, Polanyi borrowed the notion of emergence from other authors, including his Manchester colleague Samuel Alexander (382). As a monographic volume, *Personal Knowledge* had its immediate origin in revisions of Polanyi's 1951–52 Gifford Lectures at the University of Aberdeen, and Alexander had discussed the idea of emergence in his own Gifford Lectures of 1916–18.[2] The mandate of the Gifford Lectures is discus-

[1] "Moral inversion" is used in a different historical context by Robert Jay Lifton and Greg Mitchel in their book *Hiroshima in America: Fifty Years of Denial* (New York: G. P. Putnam and Sons, 1995): "in other words, to avoid historical and moral responsibility, we acted immorally and claimed virtue. We sank deeper, that is, into moral inversion" (309). The U.S. Supreme Court Justice Stephen G. Breyer discusses the meanings of "public liberty" in *Active Liberty: Interpreting Our Democratic Constitution* (New York: Knopf, 2005).

[2] Samuel Alexander, *Space, Time, and Deity: The Gifford Lectures at Glasgow, 1916–1918*, 2 vols. (London: Macmillan, 1920).

sion of natural religion or natural theology as knowledge "without reference to or reliance upon any supposed special exceptional or so-called miraculous revelation."[1] Given this immediate context for Polanyi's book, it is hardly surprising that it has had a following among theologians and religious scholars. There is much in the book that draws thought-provoking and contentious analogies between scientific belief and religious faith. Two sections of the book, "Dwelling In and Breaking Out" and "Religious Doubt," often are cited by religious scholars.[2]

Members of the intelligent design community argue that biological complexity is evidence of God's intelligence rather than of natural selection, and some have claimed that Polanyi's views on evolution support their position. Most Polanyi scholars note, in contrast, that his discussion of emergence does not include the kind of agency required by the intelligent design thesis. Polanyi explicitly wrote that the evolutionary process is neither predetermined from the start nor the result of an external creative agency (395). Biologists and philosophers of biology have largely found Polanyi's discussion of evolutionary biology unsupported and unsound. Marjorie Grene, who later became a distinguished philosopher of biology, provided research and editorial assistance to Polanyi in the 1950s while he was writing the book. Her discontent with chapter 13 increased in later years as she became convinced that Polanyi had failed to understand Darwinian theory. While Grene praised much of the first three parts of *Personal Knowledge,* especially Polanyi's working out of the elements of tacit knowledge and what she saw as his undermining of Cartesian body-mind dualism, she found his anthropocentric cosmic and emergent evolutionism unconvincing.[3]

Polanyi's antimechanistic views, however, and his emphasis on hierarchy and development in biology were in keeping with some work in contemporary biology, for example, views discussed in Max Delbrück's biophysics group in Berlin and in the Theoretical Biology Club which met in Cambridge and Oxford in the 1930s.[4] The idea that biological properties and the structure of organisms arise from lower-level entities, but are novel and irreducible to the particulars from which the whole has emerged, became an increasingly significant theme in biology and in philosophy of biology by the late twentieth

[1] On the Gifford Lectures, see "History of the Gifford Lectures," accessed February 26, 2014, http://www.giffordlectures.org/online.asp.

[2] A worry among philosophers of science was Polanyi's elision of the distinction between science and religion or other kinds of thought systems or ideologies. A distinction that is not based on social organization is found in Polanyi's argument that science fundamentally rests in "verification" by empirical evidence, while other thought systems rest in a more emotional process of "validation" (202).

[3] Grene 1977, 168n11. On Grene's role in *Personal Knowledge*, see Phil Mullins, "Marjorie Grene and *Personal Knowledge*," *Tradition and Discovery* 37, no. 2 (2010–11): 20–44.

[4] On these anti-reductionist biological groups, see Phillip R. Sloan, "Biophysics in Berlin: The Delbrück Club," in *Creating a Physical Biology: The Three-Man Papers and Early Molecular Biology*, ed. Phillip R. Sloan and Brandon Fogel (Chicago: University of Chicago Press, 2011), 62–98; and Pnina Abir-Am, "The Biotheoretical Gathering, Transdisciplinary Authority and the Incipient Legitimation of Molecular Biology in the 1930s: New Perspective on the Historical Sociology of Science," *History of Science* 25 (March 1987): 1–70.

century. Arguments of emergence and complexity became important, too, in organizational management and systems theory, in which Polanyi's work found new applications by the 1990s.

Polanyi's political concerns in *Personal Knowledge* found resonance in a large audience of readers, as has continued to be true in later years. At the time of the first printing of the book in 1958, the Cold War was in full swing. Stalin had died in 1953 and a program of de-Stalinist reforms had begun under Nikita Khrushchev.[1] Some reforms took place in Soviet-controlled Poland in 1956, but the Hungarian uprising that year against its communist regime was forcefully suppressed by Soviet troops. The Berlin wall would be constructed in 1961 just at the time that Polanyi's book was still finding its readers, and it was only in 1965 that the Soviet prohibition against modern genetic research was lifted and Lysenko lost his official scientific position.

Personal Knowledge offered a message in political thought not dissimilar from Hannah Arendt's writings in the 1950s and 1960s. Polanyi quotes, from the British edition of *The Origins of Totalitarianism,* Arendt's memorable statement that Soviet ideology insists on abolishing its citizens' capacity to distinguish between truth and fiction while terrorizing them in submission to the state (242, 242n2). Much like Arendt, Polanyi insisted that there are universal truths, and he argued for the necessity of a balance between individual freedom and public liberty in a liberal democracy.

Polanyi's ideas also resonated with readers of the economist Friedrich von Hayek. Much like Hayek, although differing from him in some important details, Polanyi was arguing in *Personal Knowledge* that the most propitious forms of organization in political, economic, and scientific life are analogous: individual and freely-acting initiatives must be allowed to prosper and to interact and mutually adjust themselves without calculation or premeditation in order to produce systems that result in order, novelty, and progress.[2] This kind of dynamic mirrors the processes of cosmic evolution, in Polanyi's view, and his argument continues to resonate in discussions of economic, political, and systems theory.

Polanyi's epistemology of science—notably his emphasis on tacit knowledge and on commitment of belief—was based in his experiences as a the-

[1] *Personal Knowledge: Towards a Post-Critical Philosophy* first was published in 1958 by the University of Chicago Press and by Routledge & Kegan Paul. A corrected edition appeared in 1962 with the University of Chicago Press, followed by Harper & Row Torchbook editions in 1962 and 1964. The University of Chicago Press reprinted a paperback edition in 1974. Polanyi returned to the essay format provided by a short lecture series in his widely read *The Tacit Dimension* (Chicago: University of Chicago Press, 1966), reprinted in 2009.

[2] The analogies are especially clear in his later "The Republic of Science: Its Political and Economic Theory," *Minerva* 1 (1962): 54–74. On public liberty, see the discussion in Phil Mullins, "Michael Polanyi's Early Liberal Vision: Society as a Network of Dynamic Orders Reliant on Public Liberty," *Perspectives on Political Science* 42, no. 3 (2013): 162–71. Although Polanyi does not mention in *Personal Knowledge* the similar views of Friedrich von Hayek, they knew each other from at least the 1930s, and they drew upon each other's work, as discussed in my *Michael Polanyi and His Generation*, 161n4, 177, 206–7. The programmatically conservative ISI Books has published a biography of Polanyi: Mark T. Mitchell, *Michael Polanyi: The Art of Knowing* (Wilmington, DE: ISI Books, 2006).

oretical and laboratory scientist, as well as in his political and economic concerns. There have been few twentieth-century philosophers of science with his career scientific credentials, although many philosophers of science have had a mathematical or scientific education. As an accomplished scientist, Polanyi had special status in philosophy, but his status was also that of the outsider. In Anglo-American philosophy of science of the 1950s, logical empiricism and formal analytic philosophy were in the mainstream, and philosophers focused within these traditions on problems such as methods of probabilistic verification and implications of the holistic Duhem-Quine thesis that any theory can be saved as a whole by background adjustments and auxiliary hypotheses. Philosophers asked what justifies belief in a theory, and Polanyi's answer was quite different from the usual ones.[1]

Another philosophical problem much in vogue in the 1950s was the demarcation question, at a time when there were highly visible discussions in the public media of science and pseudoscience. The pseudoscience question was debated not only for Lysenkoist biology, still in effect in the Soviet Union, but for parapsychology, eugenics, racial biology, and Freudianism. Immanuel Velikovsky's *Worlds in Collision,* which broke with all accepted scientific theories of the early history of the solar system, created a furor about pseudoscience after it was published in 1950.[2] Polanyi entered these debates with his own answers to the demarcation question and the underdetermination problem.

Regarding Lysenkoism and demarcation, we have seen the outline of Polanyi's answer. He argued that science is social in its very essence in the ways in which skills, standards, and tacit understandings are transmitted from person to person in an institutional system in which members act freely but work within mutual consensus. What counts as real science has to be learned within this system. As a consequence, Lysenko was in no respect a scientist, nor was Lysenkoism a science. This social approach to demarcation looked suspicious to philosophers, however, because it roots scientific knowledge in social and historical circumstances, as well as in empiricism and logic. This seemed a dangerous path and, in any case, an unphilosophical one.[3] Polanyi

[1] On the underdetermination problem identified with the names of Pierre Duhem and Willard V.O. Quine, see Peter Godfrey-Smith, *Theory and Reality: An Introduction to the Philosophy of Science* (Chicago: University of Chicago Press, 2003) and Karen Merikangas Darling, "The Complete Duhemian Underdetermination Argument: Scientific Language and Practice," *Studies in History and Philosophy of Science* 33, no. 3 (2002): 511–33.

[2] For a lively discussion of the science vs. pseudoscience debates in the 1950s and afterwards, see Michael D. Gordin, *The Pseudoscience Wars: Immanuel Velikovsky and the Birth of the Modern Fringe* (Chicago: University of Chicago Press, 2012).

[3] The sociology of scientific institutions as a discipline has its classic exemplar in Robert K. Merton's essays collected in *The Sociology of Science: Theoretical and Empirical Investigations*, ed. N. W. Storer (Chicago: University of Chicago Press, 1973). The bugbear of sociology of knowledge is exemplified in Karl Mannheim, *Ideologie and Utopia: An Introduction to the Sociology of Knowledge*, trans. Louis Wirth and Edward Shils (New York: Harcourt, Brace, and World, 1936). The sociology of knowledge of the Polish scientist Ludwik Fleck was widely discussed after its translation from the 1935 German edition into *Genesis and Development of a Scientific Fact*, trans. Fred Bradley and Thaddeus J. Trenn, ed. Thaddeus J. Trenn and Robert K. Merton (Chicago: University of Chicago Press, 1979).

himself did not intend to suggest the contingency of scientific truth, and he insisted upon the stability of interpretive frameworks in science and scientists' ability to establish contact with reality. His statements of his personal belief and commitment to this ontology failed to assuage many philosophers' misgivings, however.

Other challenges to mainstream philosophy of science helped establish the context in which *Personal Knowledge* was discussed and evaluated in the late 1950s and afterwards. The Viennese-born Karl Popper rejected the legitimacy of empirical verification as the right way to establish scientific hypothesis and theory. Instead, despite the Duhem-Quine thesis and other objections, Popper insisted on the criterion of falsifiability, or the necessity for a hypothesis to withstand tests that could decisively disprove it, as a basis for theory choice. Further, Popper argued that falsifiability is the best criterion for demarcating true science from pseudoscience.[1] In a different vein, but like Polanyi, Stephen Toulmin judged formal logic to be a misleading and inadequate representation of how humans acquire knowledge, and he proposed a gradualist Darwinian model for conceptual advance in the sciences.[2]

Thomas Kuhn, like Polanyi, judged Popper to be naive in his normative attitude that scientists should be eternally skeptical about their theories and that they should respond immediately to evidence of any anomaly that appears to falsify a theory. In contrast, Kuhn developed an explanation of scientific change as a process of stages that proceed through acceptance of a dominant stable framework or "paradigm," the practice of normal science, the accumulation of anomalies that generate a crisis, and the accomplishment of a revolution as scientists convert to the new framework and try to convert others in turn. Like Polanyi, Kuhn described science as a social community, and he highlighted the productive tension in science between tradition and innovation or between stability and change. Like Toulmin, he suggested that an evolutionary epistemology might solve some problems in philosophy of science, although Kuhn emphasized revolution rather than evolution in *Structure.*[3] These four men occasionally saw each other during the 1950s, and they expressed criticism of each others' views to varying degrees, with Popper especially vehement against Polanyi's and Kuhn's lines of argument.[4] Among the four, Polanyi was the only one who took a realist

[1] Karl Popper, *The Poverty of Historicism* (London: Routledge and Kegan Paul, 1957); *The Logic of Scientific Discovery* (London: Hutchinson, 1959); and *Conjecture and Refutations: The Growth of Scientific Knowledge* (New York: Basic Books, 1962).

[2] Stephen Toulmin, *The Uses of Argument* (Cambridge: Cambridge University Press, 1958) and *Human Understanding: The Collective Use and Evolution of Concepts* (Princeton: Princeton University Press, 1972).

[3] Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962). Also see his collection of essays, *The Essential Tension: Selected Studies in Scientific Tradition and Change* (Chicago: University of Chicago Press, 1977).

[4] In his preface to *The Logic of Scientific Discovery*, Popper sarcastically rejected "obscurantist faith in the expert's special skill and in his personal knowledge and authority; a faith that so well fits our 'post-rationalist' and 'post-critical' age" (p. xxvi in the 2002 Routledge Classics edition). For some insights into Polanyi and Popper, see Struan Jacobs and Phil Mullins, "Relations between Karl Popper and Michael Polanyi," *Studies in the*

position on the ontology of scientific explanation, comparing his conviction, as we have seen, to the worship of God.

Although it was far from his intention, Polanyi's ideas revolutionized the sociology of science and played an important role in the conceptual foundations of the new field of science studies. This area of teaching and research developed in the 1970s out of programs meant to reform science education and to integrate liberal values and human and social dimensions into studies of the history and methodology of scientific knowledge. David Edge, the cofounder of the journal *Science Studies* (later renamed *Social Studies of Science*) wrote that the new field drew initial inspiration from the work of Kuhn and from Bernal and Polanyi. Taking a leaf from Polanyi's (and Kuhn's) reflections on the stability of systems of belief, the new sociologists of scientific knowledge suggested that all systems of belief should be assumed equally legitimate until proven otherwise and that the aim of sociological analysis is to discover how scientists convince one another and their audiences of the superiority of a particular scientific explanation over other forms of explanation. The science studies methodology emphasizes the social and psychological conditions of the *construction* of scientific knowledge rather the empirical and logical structure of the *discovery* of scientific knowledge. Constructivists have made use of Polanyi's notions of tacit and personal knowledge, as well as his emphasis on passion, commitment, trust, and belief, but their work has often been critical of scientific elites and nearly always denied a realist foundation to scientific achievement. These are results with which Polanyi would have deeply disagreed, of course.[1]

The initial impact of *Personal Knowledge* was very much conditioned by the furor over Kuhn's book that brought added attention to Polanyi's exposition of tacit knowledge and its roots in the social structure of science.[2] Kuhn was not especially interested in the demarcation problem, nor did he worry at the time about the public status of scientific knowledge, as Polanyi did. Polanyi thought that he had successfully provided a philosophy that not only demarcated science from nonscience but also demonstrated how the scientific community provides a model for the political order by balancing individual liberty and collective authority, while not relinquishing the quest for transcendental truth.

Personal Knowledge is a book that clearly displays its historical moorings

History and Philosophy of Science 42, no. 3 (2011): 426–35. Among Polanyi scholars, there has been debate about intellectual debts that the younger Kuhn may have owed Polanyi, e.g. as summarized in Martin X. Moleski, SJ, "Polanyi vs. Kuhn: Worldviews Apart," *Tradition and Discovery* 33, no. 2 (2006–7): 7–24; and Struan Jacobs, "Michael Polanyi and Thomas Kuhn: Priority and Credit," *Tradition and Discovery* 33, no. 2 (2006–7): 25–36.

[1] On the origins and development of social constructivism within sociology of science and science studies, see David Edge, "Reinventing the Wheel," in *Handbook of Science and Technology Studies*, ed. Sheila Jasanoff et al. (London: Sage, 1995), 3–24 (on Polanyi, p. 7); and David Kaiser, "A Mannheim for All Seasons: Bloor, Merton, and the Roots of the Sociology of Knowledge," *Science in Context* 11 (1998): 51–87.

[2] On *Structure*, see Ian Hacking, "Introductory Essay," in *The Structure of Scientific Revolutions*, 4th ed., Thomas S. Kuhn (Chicago: University of Chicago Press, 2012), vii–xxxvii.

in political, philosophical, and moral issues that Polanyi confronted over the course of his long professional and personal career. Polanyi's audience has numbered readers far wider than philosophers of science, whom he meant to reach, or sociologists of science, who became an unintended audience.[1] The book has remained a classic that is read because of the multiple ways in which it addresses questions at the heart of how we learn, how we know, and how we live. *Personal Knowledge* reflects an identity of Polanyi as *provocateur* and polemicist. It challenges the reader to debate the tension between the rationalist ideal of value-free knowledge and the humanist ideal of ethically responsible knowledge. It is not an easy book to read. Keep the keywords in mind.

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[1] An early book on Polanyi's thought written from a theological perspective is Richard Gelwick, *The Way of Discovery: An Introduction to the Thought of Michael Polanyi* (Oxford: Oxford University Press, 1977). Scholars of educational theory include Jeffrey Kane, *Beyond Empiricism: Michael Polanyi Reconsidered* (New York: P. Lang, 1984) and, with philosophical analysis, Stefania Ruzsits Jha, *Reconsidering Michael Polanyi's Philosophy* (Pittsburgh: University of Pittsburgh Press, 2002). James MacLean's *Rethinking Law as Process: Creativity, Novelty, Change* (New York: Routlege, 2012) is an example of a recent book with a discussion of Polanyi and legal thinking.

PREFACE

THIS is primarily an enquiry into the nature and justification of scientific knowledge. But my reconsideration of scientific knowledge leads on to a wide range of questions outside science.

I start by rejecting the ideal of scientific detachment. In the exact sciences, this false ideal is perhaps harmless, for it is in fact disregarded there by scientists. But we shall see that it exercises a destructive influence in biology, psychology and sociology, and falsifies our whole outlook far beyond the domain of science. I want to establish an alternative ideal of knowledge, quite generally.

Hence the wide scope of this book and hence also the coining of the new term I have used for my title: Personal Knowledge. The two words may seem to contradict each other: for true knowledge is deemed impersonal, universally established, objective. But the seeming contradiction is resolved by modifying the conception of knowing.

I have used the findings of Gestalt psychology as my first clues to this conceptual reform. Scientists have run away from the philosophic implications of gestalt; I want to countenance them uncompromisingly. I regard knowing as an active comprehension of the things known, an action that requires skill. Skilful knowing and doing is performed by subordinating a set of particulars, as clues or tools, to the shaping of a skilful achievement, whether practical or theoretical. We may then be said to become 'subsidiarily aware' of these particulars within our 'focal awareness' of the coherent entity that we achieve. Clues and tools are things used as such and not observed in themselves. They are made to function as extensions of our bodily equipment and this involves a certain change of our own being. Acts of comprehension are to this extent irreversible, and also non-critical. For we cannot possess any fixed framework within which the re-shaping of our hitherto fixed framework could be critically tested.

Such is the *personal participation* of the knower in all acts of understanding. But this does not make our understanding *subjective*. Comprehension is neither an arbitrary act nor a passive experience, but a responsible act claiming universal validity. Such knowing is indeed *objective* in the sense of establishing contact with a hidden reality; a

contact that is defined as the condition for anticipating an indeterminate range of yet unknown (and perhaps yet inconceivable) true implications. It seems reasonable to describe this fusion of the personal and the objective as Personal Knowledge.

Personal knowledge is an intellectual commitment, and as such inherently hazardous. Only affirmations that could be false can be said to convey objective knowledge of this kind. All affirmations published in this book are my own personal commitments; they claim this, and no more than this, for themselves.

Throughout this book I have tried to make this situation apparent. I have shown that into every act of knowing there enters a passionate contribution of the person knowing what is being known, and that this coefficient is no mere imperfection but a vital component of his knowledge. And around this central fact I have tried to construct a system of correlative beliefs which I can sincerely hold, and to which I can see no acceptable alternatives. But ultimately, it is my own allegiance that upholds these convictions, and it is on such warrant alone that they can lay claim to the reader's attention.

Manchester M. P.
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'The Hypothesis of Cybernetics', *The British Journal for the Philosophy of Science*, **2**, (1951–2). (Chapter 8, pp. 261–3.)

'Stability of Beliefs', *The British Journal for the Philosophy of Science*, November, 1952. (Chapter 9, pp. 286–94.)

'Skills and Connoisseurship', *Atti del Congresso di Metodologia*, Torino, December 17–20th, 1952. (Chapter 4, pp. 49–57.)

'On the Introduction of Science into Moral Subjects', *The Cambridge Journal*, No. 4, January, 1954. (Survey of one aspect of the argument.)

'Words, Conceptions and Science', *The Twentieth Century*, September, 1955. (Chapter 5, passim.)

'From Copernicus to Einstein', *Encounter*, September, 1955. (Chapter 1, pp. 3–18.)

'Pure and Applied Science and their appropriate forms of Organization', *Dialectica*, **10**, No. 3, 1956. (Chapter 6, pp. 174–84.)

'Passion and Controversy in Science', *The Lancet*, June 16th, 1956. (Chapter 6, pp. 134–60.)

'The Magic of Marxism', *Encounter*, December, 1956. (Chapter 7, pp. 226–48.)

'Scientific Outlook: its Sickness and Cure', *Science*, **125**, March 15th, 1957. (A brief survey of the main argument.)

'Beauty, Elegance and Reality in Science', *Symposium on Observation and Interpretation*, Bristol, April 1st, 1957. (Survey of Chapters 5 and 6.)

'Problem Solving', *The British Journal for the Philosophy of Science*, August, 1957. (Chapter 5, pp. 120–31.)

'On Biassed Coins and Related Problems', *Zs. f. Phys. Chem.*, 1958. (Chapter 3, pp. 37–40; Chapter 13, pp. 390–402.)

PART ONE

THE ART OF KNOWING