Contemporary Encounters with Ancient Metaphysics

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This book tries [...] to re-equip men with the faculties which centuries of critical thought have taught them to distrust.¹

Modern scientism fetters thought as cruelly as ever the churches had done. It offers no scope for our most vital beliefs and it forces us to disguise them in farcically inadequate terms. Ideologies framed in these terms have enlisted man’s highest aspirations in the service of soul-destroying tyrannies.²

Modern fanaticism is rooted in an extreme scepticism which can only be strengthened, not shaken, by further doses of universal doubt.³

It is the height of intellectual perversion to renounce, in the name of scientific objectivity, our position as the highest form of life on earth, and our own advent by a process of evolution as the most important problem of evolution.⁴

Contemporary philosophy of science has been characterized as a debate between realists, idealists, and skeptics about whether science gives us knowledge, and if so what kind.⁵ Twentieth-century analytic philosophy featured a debate between logical empiricism, represented by Carnap, Hempel, Reichenbach, and others, and the historicist view of science associated with such philosophers as Hanson, Kuhn, and Feyerabend. The extreme version of this debate, perhaps not held by any of these, would pit a radical objectivism against an equally radical subjectivism. Within continental philosophy, meanwhile, the primacy of consciousness in the natural and social sciences has been emphasized, though it remains a question whether phenomenological
and existentialist approaches to science differ significantly from idealism.\textsuperscript{6} The phenomenological work of Husserl, toward the end of his life, turned increasingly to the implications of the modern view of science for humanity,\textsuperscript{7} and, like Michael Polanyi, saw a correlation between the rise of irrationalism and the straitened outlook imposed on the world by modern natural science. Wilfrid Sellars, from the analytic perspective, provided a comparable critique based on the tension between what he called the manifest image and the scientific image of man.\textsuperscript{8} The relationship between science, the theory of knowledge, and the ethical-political implications of both thus came increasingly to the foreground. Contemporary disagreements about the understanding of science and its role tends to bolster the case for skepticism or relativism since, as Plato’s Socrates says, intellectual wandering implies absence of knowledge.\textsuperscript{9}

The renascence of key Aristotelian lines of thought in the work of Michael Polanyi (1891–1976) offers a critical realism that also does justice to the insights seemingly opposed to it – idealism, phenomenology, and the historicist school – by emphasizing the essential contribution of human beings to knowledge both in and beyond the natural sciences. At the same time, Polanyi’s realism combats the skepticism and “dogmatic subjectivity”\textsuperscript{9} often associated with these approaches. It does so, however, in a markedly different way from, for example, logical empiricism, which might be seen to exemplify the objectivism Polanyi seeks to overthrow. Polanyi considers objectivism to be problematic for physics and chemistry, and as having an especially pernicious influence in biology, psychology, sociology, and related disciplines. For him the objectivist ideal “falsifies our whole outlook far beyond the domain of science,”\textsuperscript{11} perverting our understanding and evaluation of the humanities, ethics, and religion. Objectivism tends to relegate these endeavors to the domain of the merely subjective, hence groundless. Polanyi calls the critical realism he advocates “personal knowledge,” which he expects to respond to difficulties in the epistemology of science that he sees playing into contemporary ethical-political problems.

We have three aims: (1) to show how central Aristotelian concerns, such as purpose and structure in nature, and the role of intellect in the human pursuit of knowledge, recur in Polanyi’s work; (2) to suggest how Polanyi’s rehabilitation of these Aristotelian concerns offers a valuable contribution to contemporary philosophy of science; and (3) to indicate ways that Polanyi’s approach to the philosophy of science answers to the ethical-political difficulties that he, like others, sees arising from misconceptions about the nature of science.

Polanyi resembles Aristotle in interesting ways. Trained as a physician and then an active researcher in physical chemistry for many years, Polanyi published numerous scientific papers before turning in the 1940s to philosophical reflection. Thus, like Aristotle, whose philosophy was informed by his biological studies, Polanyi married experience of doing natural science with philosophical reflection. As a philosopher, furthermore, Polanyi like Aristotle
worked in many fields, including the natural sciences, psychology, economics, politics, mathematics, metaphysics, religion, fine art, and history. The similarities between the two go even deeper, since for Polanyi all explicit knowledge depends upon tacit knowledge, which entails that we know more than we can say. This shows that human wisdom is never fully formalizable and points to the human involvement in every dimension of theory and practice. Polanyi and Aristotle both emphasize the crucial role played by seeing and intellectual intuition (νοῦς) in science. It follows that science is not something anyone can generate simply by applying a set of rules; rather, it depends at every stage upon an integrating activity of mind, utilizing what has previously been understood. Contrary to the notion that methodical rules can govern scientific investigation impersonally, Polanyi contends that the scientist, or wise person, must learnedly apply what can only be rules of art or maxims, reflecting Aristotle’s account of acquired intellectual virtues.

There are, of course, differences between Polanyi’s and Aristotle’s positions, especially due to their different historical situations. Although both are realists and are optimistic about our ability to make contact with reality through science, Polanyi’s view of reality is markedly more cautious and open-ended. Aristotle could see himself as seeking comprehensive understanding in all the most important sciences and, more radically, as bringing philosophy to completion as wisdom. This attitude reflects Aristotle’s conviction that the accumulated experience of the cultures of the ancient world had attained as much progressive development as could be achieved. Polanyi, however, confronts a world highly aware of scientific revolutions and progress, illustrated by the examples of Copernicus, Kepler, Newton, Darwin, Planck, and Einstein. Polanyi’s commitment to a certain conception of what he calls, after Teilhard de Chardin, the “noosphere” admits that “we may be totally mistaken” about what “we believe to be true and right.” Yet he supports our search for truth: he argues that our ability to make statements with universal intent indicates an orientation not merely to what others will accept, or what might prove useful, but toward the way things really are.

Polanyi, admitting that “no man can know more than a tiny fragment of science,” also faces the fact that the sciences have become highly specialized in the modern era. He contends, too, with our modern world that has instruments allowing observations well beyond the unaided senses, major developments in mathematics and natural science, and a complex religious, political, and philosophical heritage foreign, of course, to Aristotle. Can Aristotelian thought retain its purchase on reality in the face of the changes wrought by modern science and, more broadly, the history of over two millennia? Polanyi himself, in light of these developments, characterizes reality as radically open: “In this changing world, our anticipatory powers have always to deal with a somewhat unprecedented situation, and they can do so in general only by undergoing some measure of adaptation.”

Because the initial impetus to philosophy came for Polanyi from his political experience, we begin with the political and ethical dimensions of his work.
When Polanyi visited the Soviet Union in 1935, he was profoundly disturbed by a discussion he had with Nikolai Bukharin, at the time a top Bolshevik theorist of Marxism, who insisted that natural science must be subordinated to social needs. On this view, science as a free enterprise for its own sake gives way to a purely instrumental conception of science. What is worse, science is to be brought under state control for economic objectives. Such subordination of science led to the infamous Lysenko case in Soviet biology. Behind Bukharin’s argument, Polanyi discerns the irony of a misguided conception of science destroying science itself. Opposition to this outlook (and its appeal at the time to scientists in England) led Polanyi away from active chemical research to philosophical justification of his own view of science emphasizing the essential connection between freedom and truth.

Polanyi traces the historical movement that led to Bukharin from the rise of objectivism in natural science in the early modern period. Objectivism holds that the practice of science can be completely formalized and only what is verified is known. This promotes a materialistic, mechanized worldview, which Polanyi associates, like Husserl, with Galileo, and whose supreme exemplar for Polanyi is the French scientist and philosopher Pierre Simon Laplace (1749–1827). Objectivism’s critical emphasis on certainty and impartial verification dares humans to trust in nothing that cannot be empirically verified. Rebelling against a moribund Scholasticism, the early modern philosophers encouraged doubt about any tradition and any reliance on authority. Yet, as Polanyi notes, the corresponding emphasis on knowing for oneself resulted paradoxically over time in the elimination of the personal dimension in the pursuit of truth. Since the critical outlook easily led to extreme empiricism and materialism, it was only a matter of time before Laplace was to envisage a perfectly deterministic and in principle predictable cosmos.

The new scientific outlook contributed to tremendous discoveries and technological advancements; indeed, Polanyi credits scientific rationalism as “a major influence toward intellectual, moral, and social progress.” But this critical, skeptical spirit also progressively dissolved traditional ties in all spheres. Scientific rationalism through its rejection of authority led to great misunderstanding of what is requisite for science, which in turn made fertile ground for nihilism or what Polanyi calls “moral inversion.” Moral inversion – immorality driven by concealed moral passion – stems from the toxic combination of: (1) the devaluation of ethics, religion, and tradition brought about by the advance of the Laplacean program, coupled with (2) residual Christian moral perfectionism. Polanyi understands the Laplacean program as reducing all reality to matter in motion, hence demolishing much of science, as well as the human good that had hitherto served as the standard for human thought and action. Since the human good and purposes in general are intangible, they have no standing within the domain of objectivist science.
Yet humans still passionately desire the good, but in the absence of any traditional framework to make sense of this desire, humanity increasingly invests its moral passions in the very objectivism that undermines their true foundation: “The morally inverted person has not merely performed a philosophic substitution of material purposes for moral aims; he is acting with the whole force of his homeless moral passions within a purely materialistic framework of purposes.”

Paradoxically, with the loss of reliance on Christianity and the kingdom of God, morally inverted humanity seeks to realize perfection on earth all the more furiously and unreservedly.

For Polanyi, objectivism and its spirit of universal doubt were embodied in the nihilism and immoralism of the Soviet and Nazi tyrannies. Focusing on the Soviet Union, Polanyi assesses why the Stalinist contempt for ordinary moral standards and disavowal of ideals of justice, equality, and liberty, that is, its moral inversion, could yet win it intellectual support. Such a contradictory doctrine, he suggests, “enables the modern mind, tortured by moral self-doubt, to indulge its moral passions in terms which also satisfy its passion for ruthless objectivity.”

Soviet Marxism secured loyalty and discredited opponents by holding that “bourgeois” ideals have immanent in them capitalist material interests, while the proletarian material interests have scientific and historical objectivity. In this way the regard for justice implicitly propelling Marxism is covered by a supposedly impersonal scientific analysis. Thus Marxism could deny any force to moral claims while simultaneously relying on moral passions. Appeal to scientific objectivity apparently exposes hypocrisy in others’ moral ideals, ignoring that hidden moral motivations drive this very unmasking.

Moral inversion has a double defense: “Any criticism of its scientific part is rebutted by the moral passions behind it, while any moral objections to it are coldly brushed aside by invoking the inexorable verdict of its scientific findings.” The combination of scientific objectivity and disguised moral passion heightens the fanaticism and cynicism characteristic of moral inversion. Even today the worship of “objectivity” in science promotes skepticism about ethical purposes, and the double-game continues to be played: questioning the objectivity of claims when they fail to serve our purposes, and presenting our own purposes as though they were strictly objective.

The Laplacean conception of science thus has enormous ethical and political consequences. Rejecting this view, Polanyi conceives natural science much as Aristotle viewed theoretical science, as pursued freely and for its own sake. Yet Polanyi surprisingly remarks that “[the Greeks] never raised decisively the issues of intellectual freedom.” Plato’s cave allegory in Republic vii, however, clearly concerns the intellectual liberation resulting from philosophy, and Aristotle contends that the theoretical life is the most self-sufficient. In fact, Aristotle and Polanyi both see that self-sufficient life and theoretical research can only be pursued within a political community. And since politics decides for the πόλις (or state) what sciences are pursued and how far, in this sense political philosophy is the architectonic art:
[The human ultimate end] would seem to belong to the most authoritative art and that which is most truly the master art. And politics appears to be of this nature; for it is this that ordains which of the sciences should be studied in a state, and which each class of citizens should learn and up to what point they should learn them; and we see even the most highly esteemed of capacities to fall under this, e.g. strategy, economics, rhetoric; now, since politics uses the rest of the sciences, and since, again, it legislates as to what we are to do and what we are to abstain from, the end of this science must include those of the others, so that this end must be the good for man. (Aristotle \textit{EN} i 2.1094a27–b7)\textsuperscript{18}

Politics is the highest field for arranging the community, but Aristotle insists that engagement in theoretical science is and should be the goal of political science.\textsuperscript{29} Polanyi concurs that getting the relationship between politics and the sciences right, and seeing truth as the goal of the sciences, is of paramount importance. Since “institutions of higher learning and higher education can be upheld only by public subsidies,” the character of public opinion is crucial for the preservation of science as a free enterprise and academic freedom generally.\textsuperscript{30} Polanyi speaks of the importance of “indirect appreciation” as crucial to nurturing cultural life including science, because science, philosophy, and other free activities will fare badly with a public that only esteems instrumental value.\textsuperscript{31} A major motivation for Polanyi’s philosophical reflection is to foster among citizens and scientists a genuine appreciation of the deeper meaning of science, and thus to prepare them for accepting that the standards and values according to which they live are not self-evident. Yet our fallible beliefs can be secured to the extent that we can establish them under the hazardous conditions of personal knowledge.

\textbf{PERSONAL KNOWLEDGE AND REALISM IN SCIENCE}

Polanyi gives a helpful argument for knowledge as personal and against supposing truth a property of declarative sentences:

Any attempt to eliminate this personal coefficient [in statements of fact], by laying down precise rules for making or testing assertions of fact, is condemned to futility from the start. For we can derive rules of observation and verification only from examples of factual statements that we have accepted as true \textit{before} we knew these rules; and in the \textit{end} the application of our rules will necessarily fall back once more on factual observations, the acceptance of which is an act of personal judgment, unguided by any explicit rules. And besides, the application of such rules must rely \textit{all the time} on the guidance of our own personal judgment. This argument formally confirms the participation of the speaker in any sincere statement of fact.\textsuperscript{32}
Statements can only be confirmed on the basis of already held beliefs. So “we must accredit our own judgment as the paramount arbiter of all our intellectual performances.” Polanyi suggests:

Objectivism has totally falsified our conception of truth, by exalting what we can know and prove, while covering up with ambiguous utterances all that we know and cannot prove, even though the latter knowledge underlies, and must ultimately set its seal to, all that we can prove. In trying to restrict our minds to the few things that are demonstrable, and therefore explicitly dubitable, it has overlooked the a-critical choices which determine the whole being of our minds and has rendered us incapable of acknowledging these vital choices.

But this raises the question of how an understanding of science as personal nevertheless remains a conception of science, as distinct from superstitions or subjective whims.

Aristotle shares with Polanyi a realism that emphasizes the human dimension of knowledge. Essential to this realism is the conviction that human powers are adequate to make contact with a multifaceted reality. This requires a suitable connection with tradition and openness to the diversity of what may be known. The modern project of securing justice and improving human life through enhancing human power involved excessive rejection of tradition, which seemed to open the way to endless progress, but took too narrow an approach to knowledge. Humanity thus turned away from a speculative science seeking ultimate causes and principles to the sort of science that could predict how things would happen so that they might be productively utilized. Polanyi displays appreciation of the spirit of ancient philosophizing in coordination with contemporary science.

For Aristotle, in pursuit of science, we move from what is initially intelligible to us to what is more intelligible by nature. This corresponds to Polanyi’s basic idea about how objects of focal awareness can become subsidiaries that, in turn, allow us to reorient our focus and gain deeper knowledge. For Aristotle, as for Polanyi, the role of individual human beings in doing science is indispensable for an adequate account of what science is. Aristotle says that science or knowledge aspires to knowledge of causes:

We think we understand a thing simply (and not in the sophistic fashion accidentally) whenever we think we are aware both that the cause on account of which the object is is its cause, and that it is not possible for this to be otherwise. It is clear, then, that to understand is something of this sort; for both those who do not understand and those who do understand – the former think they are themselves in such a state, and those who do understand actually are.

Knowledge requires the knowing person’s awareness of having the peculiar cause or causes. But how do we come to understand causes for Aristotle? It
is not ultimately a matter of deduction or syllogism since, as he repeatedly says, demonstrations depend on knowledge of causes, not vice versa. Aristotle rejects that all knowledge is based on demonstration, for this leads to an infinite regress making knowledge impossible, for each premise or proposition of a demonstration would itself be in need of demonstration. It is rather the case that “all teaching and all intellectual learning come about from already existing knowledge.” Intellectual processes in conjunction with sense perception lead to the discovery of causes that can then serve as middle terms of demonstrations; hence we move from what is initially intelligible to us to what is intelligible in virtue of itself though grasped by us. Demonstration assumes that we understand the cause and the terms in which the syllogism is set out. Polanyi likewise emphasizes that supporting any new knowledge is a whole background of beliefs and a tacit understanding of the terms in which the knowledge is expressed. His emphasis on personal and tacit knowledge underscores “the contributions made to scientific thought by acts of personal judgment which cannot be replaced by the operation of explicit reasoning.”

Polanyi explicates the way knowledge depends on previous knowledge in terms of the relation between tacit and explicit understanding. When we focus on some aspect of reality attempting to know it, we are subsidiarily aware of a wide assortment of factors, ranging from our bodies, to the tools we use, to the theories we employ in order to see reality. In seeking to grasp aspects of reality as wholes, furthermore, we attend subsidiarily to their parts. When we speak we employ words to which only subsidiary attention is paid so that what they mean can receive focused attention. Thus in using speech we have only tacit understanding of our individual phrases and words. Moreover, the motions of our body in producing our speech constitute a yet deeper level of subsidiaries. Polanyi illustrates this tacit dimension ubiquitously in human experience, from using our body in walking or riding bikes, to using our senses in recognizing faces or allowing for perspective, in our thinking in focusing on a logical or mathematical proof while tacitly accepting all the assumptions being made, and so on.

Aristotle’s appreciation of how we move our bodies without being aware of all that goes on internally, his awareness that knowledge presupposes knowledge, and his view of speech as employing symbols prefigures Polanyi’s treatment of the tacit dimension of personal knowledge. Polanyi and Aristotle would agree “that only a speaker or listener can mean something by a word, and a word in itself can mean nothing.” Names, as Aristotle asserts, are conventional, and only speakers’ use of them gives them meaning. This recognition of the “tacit dimension,” that is, how our focal understanding is based on what we subsidiarily understand, fits with the Aristotelian approach and makes the strongest counter to the objectivist demand for full clarity, which Polanyi shows unachievable, because all knowledge depends upon further and often tacit knowledge.

Polanyi denies that there is any particular method of scientific research, or set of rules, that will automatically give good results in investigating (here he resembles Feyerabend). He observes:
Upon examining the grounds on which science is pursued, I found that it is determined at every stage by undefinable powers of thought. No rules can account for the way a good idea is produced for starting an enquiry; and there are no rules either for the verification or the refutation of a proposed solution of a problem.\(^4^5\)

As knowledge depends upon knowledge, and research cannot depend upon strict rules, tradition must have great importance, not only for the transmission of science from one generation to the next, but also as cultivating the scientific sensibility by which knowledge develops. Scientific research, for Polanyi, depends upon the training of scientists in the tradition of science, for only thus do they gain the skilled judgement for assessing current theories and theories under investigation. The role of this training is made evident by the importance of the main centers of science:

Rarely, if ever, was the final acclimatization of science outside Europe achieved, until the government of a country succeeded in inducing a few scientists from some traditional centre to settle down in their territory and to develop there a new home for scientific life, moulded on their own traditional standards.\(^4^6\)

Polanyi’s emphasis on tradition and training corresponds to Aristotle’s account of the way that we learn arts and become habituated to moral virtue and develop intellectual virtue. Virtues are appropriate dispositions of the soul. For Aristotle, the well-educated person, that is the person suitably trained, is the one who knows how to appreciate and receive accounts in the different sciences.\(^4^7\)

Scientific work is the seeing and assessing of some order in nature; those with skill who have received the requisite training and who have the appropriate talent can discern such order and test the reality of this order and its implications. How compelling this perceived order is depends on its improbability of being the case due merely to chance, for “[a chance occurrence] cannot be strictly contradicted by experience.”\(^4^8\) There is always the possibility that the most unlikely apparent order pertains, or that what we take to be a real relation is not one, as humans believed constellations to be real for millennia. New hypotheses may only have apparent or chance confirmation or disconfirmation. As Polanyi emphasizes:

There is an even wider area of personal judgment in every verification of a scientific theory. Contrary to current opinion, it is not the case that a proven discrepancy between theoretical predictions and observed data suffices in itself to invalidate a theory. Such discrepancies may often be classed as anomalies.\(^4^9\)

Sounding a lot like Kuhn, Polanyi insists that innovations in theory require such a change in outlook that they cannot be viewed as straightforward additions to previous theories:

Scientific controversies never lie altogether within science. For when a new system of thought concerning a whole class of alleged facts is at issue, the question will be whether it should be accepted or rejected in principle, and those who reject it on such comprehensive grounds will inevitably regard it as altogether incompetent and unsound [. . .] Proponents of a new system can convince their audience only by first winning their intellectual sympathy for a doctrine they have not yet grasped [. . .] Such an acceptance is a heuristic process, a self-modifying act, and to this extent a conversion.50

This should be compared to what Aristotle says of gaining new knowledge:

The acquisition of [knowledge] must in a sense end in something which is the opposite of our original inquiries. For all men begin, as we said, by wondering that the matter is so (as in the case of automatic marionettes or the solstices or the incommensurability of the diagonal of a square with the side; for it seems wonderful to all men who have not yet perceived the explanation that there is a thing which cannot be measured even by the smallest unit). But we must end in the contrary and, according to the proverb, the better state, as is the case in these instances when men learn the cause; for there is nothing which would surprise a geometer so much as if the diagonal turned out to be commensurable.51

Learning and defending a new hypothesis require embracing a new framework. Clear but unobvious human desires support this effort.

The innate human love of truth – which recalls Aristotle’s insistence that by nature humans desire to know52 – Polanyi traces back to its prefiguration and origin in our non-human animal ancestors. Polanyi distinguishes three primary sorts of learning that correspond to three principal fields of knowledge. (1) Animals can learn to solve problems, such as finding the way through a maze or figuring out how to use a tool to gain access to food. This is a kind of invention that becomes most fully developed in human technology. (2) Animals can also learn from observing signs, the observational and contemplative approach of which has its complete development in humans’ pursuit of natural science. And (3) animals can interpret a situation, as when they understand a maze well enough to use an alternative path upon finding the previously used path is blocked; Polanyi supposes that this full understanding in humans can be seen in mathematical knowledge, in which we have general clarity about the domain.53 This division rather resembles Aristotle’s division of science into
practical and theoretical science, with the theoretical sciences including natural science and mathematics.\textsuperscript{54} Like Aristotle, Polanyi sees the development of the arts for utility, that is technology, preceding theoretical sciences.\textsuperscript{55} Also Aristotle’s view of mathematical entities arrived at by abstraction analogously explains why we can have full understanding of such domains.\textsuperscript{56} What enables humans to take these sorts of ability beyond that of the animals is our having language:

The intellectual superiority of man is due predominately to [...] the representation of experience in terms of manageable symbols which he can reorganize, either formally or mentally, for the purpose of yielding new information [...] To speak is to contrive signs, to observe their fitness, and to interpret their alternative relations; though the animal possesses each of these three faculties, he cannot combine them.\textsuperscript{57}

Human use of speech is thus “rooted in the kind of comprehension by which animals make sense of their situation.”\textsuperscript{58}

Polanyi’s reflections on how animals learn, how actual scientific research goes, and his own experience led him to an appreciation of the role of the tacit dimension and the commitment to reality in learning. What a human or an animal seeks to learn, understand, or be able to do poses a problem for the animal or human. This entails the identifying of the problem, the seeking of a resolution to it, and the gaining of this resolution.\textsuperscript{59} Polanyi depicts how discovery takes place and has its own standards. Other animals, even worms, can be awakened to the existence of a problem that they need to solve; animals can display unease as they work out a way to deal with the problem; they show excitement as they find a way to resolve the problem; and their self-satisfaction appears as they confidently continue to employ the solution that they have found. Analogously, a person undergoing suitable apprenticeship in science will take on the intellectual passion for contributing to science. Hopefully the emerging scientist envisions a problem needing investigation worthy of his or her intellectual ambition. A worthy problem should be one neither too taxing nor too easy for the investigator and one with intrinsic interest and importance for science, technology, or mathematics.

This problem should engross the person’s energies. At nearly all hours, even when the scientist is relaxing or doing other things, the problem occupies some recesses of the mind. It is the intellectual passion of the scientist that demands this occupation with the problem. In relation to the problem and the methods being employed to deal with it, the researcher has some inkling about ways to handle the problem and the outlines of its resolution. Here is where a considerable amount of counterevidence or failure to obtain anticipated confirmation will be rejected or overlooked by the researcher. Polanyi states that the scientist’s
success will depend ultimately on his capacity for sensing the presence of yet unrevealed logical relations between the conditions of the problem, the theorems known to him, and the unknown solution he is looking for. Unless his casting about is guided by a reliable sense of growing proximity to the solution, he will make no progress towards it. Conjectures made at random, even though following the best rules of heuristics, would be hopelessly inept and totally fruitless.  

The researcher’s sense of order grasps a reality the proximity to which can be felt by the researcher even before it is well clarified. And the reality of what is sought will only be progressively confirmed by the unanticipated implications of the problem’s eventual resolution, if it is resolved. And these unanticipated implications develop in the course of later work by many researchers besides the one or several originally resolving the problem. This shows the reality and significance of what has been sought. Polanyi is convinced that sincere researchers have the personal commitment to pursue a truth that will satisfy universal standards. In human involvement with and resolution of problems in science, technology, and mathematics, the resolution should have universal interest and value, whereas a beast merely seeks a solution peculiarly for itself. 

In Polanyi’s elucidation of the process of locating problems and their resolution, his realism shines through. If even non-human animals have a heightened sensitivity and growing awareness of their proximity to the resolution of a problem, this clearly also applies to human researchers, and this sense is that of proximity to some reality. If the problem is a technical problem, the solution will show its reality in its successful application. If the problem is one of science, the solution will have the appearance of truth and beauty. Of course the scientist working out the solution will be convinced of its truth and value, and if it wins over others and shows its fertility in having even unanticipated implications, it seems to warrant its acceptance and display its universal relevance.

Comparable to this scenario of research found in Polanyi are the many passages in Aristotle that point to the passions of the researcher driving the pursuit of truth. Moreover, in Nicomachean Ethics VI Aristotle speaks of the way the investigator and expert is in the truth of the very matters in question. This dwelling in the truth of things well captures the sense of realism for which Polanyi aspires in his account of how the researcher delves into problems, feels the proximity to some reality, and submits to universal standards.

In tracing the continuum of learning from animals to its highest fulfillment in humans, Polanyi conjoins modern evolutionary thinking with an Aristotelian notion of hierarchy in nature and teleology. Aristotle famously thinks that nature works for the sake of something, yet his teleology remains quite sober. Polanyi contrasts “the science of inanimate things, in which no purpose is apparent, and that of living beings which can be understood only in teleological terms.” Were there no living things, purposiveness would have no real meaning at all. As Polanyi puts it, “inanimate nature is self-contained, achieving nothing,
relying on nothing and, hence, unerring.”

It is only with living beings that it really makes any difference that nature, the internal principle of motion and rest of natural beings according to Aristotle, works for the sake of something. Plants and animals, the natural beings that manifest purpose, seek to fulfill their natures and have the potential to miss becoming what they were to be: “with [living beings] hazard enters the hitherto unerring universe.”

Polanyi challenges the neo-Darwinian belief that higher-level life forms arise by accidental mutations that get favored by their survival ability. Like Aristotle, who looks to emphasize form over matter, Polanyi focuses on the morphological possibility already present to explain the emergence of higher life forms. Polanyi states:

It is as meaningless to represent life in terms of physics and chemistry as it would be to interpret a grandfather clock or a Shakespeare sonnet in terms of physics and chemistry; and it is likewise meaningless to represent mind in terms of a machine or a neural model. Lower levels do not lack a bearing on higher levels; they define the conditions of their success and account for their failures, but they cannot account for their success, for they cannot even define it [. . .] I shall regard living beings as instances of morphological types and of operational principles subordinated to a centre of individuality.

Polanyi summarizes the whole development: “While the first rise of living individuals overcame the meaninglessness of the universe by establishing in it centres of subjective interests, the rise of human thought in its turn overcame these subjective interests by its universal intent.” As animals seek the self-satisfaction of solving problems and humans have universal aspirations and standards of greatness, this can be seen at work in the way the emergence of configurations by random processes then become the meaning and controlling factor of the lower parts constituting them; at each level there is “a centre seeking satisfaction in the light of its own standards.” This of course corresponds to Aristotle’s preference for top-down explanations and the priority of form and actuality over matter and potentiality, for which Aristotle argues in Metaphysics Θ.8–9.

Much like Aristotle who, in the De Anima and Parva Naturalia, has even the functions of plants somewhat centered, and articulates animals as highly centered – that is the senses unite to permit discrimination and self-awareness when awake and general incapacitation in sleep, and animal motion and nutrition derives from the center – Polanyi emphasizes centering in the higher living beings. “But a living individual is altogether different from any of the inanimate things, like tunes, words, poems, theories, cultures, to which we have ascribed meaning before this. Its meaning is different, perhaps richer, and above all, it has a centre.”

This centeredness pertains to the way all life forms, each at its own level, is committed to a purpose. Contrary to the advice of behaviorism, which counsels against observing animals with analogy to ourselves, Polanyi
urges that the only way to make sense of animal actions is in “identifying ourselves with the centre of action in the animal and criticizing its performance by standards set up for it by ourselves.” As Polanyi insists that we cannot escape evaluating by our own present standards, even if we can appreciate that in the past other standards may have been used, Aristotle assesses his predecessors always in terms of his own standards and the four kinds of causes that he has so carefully elicited. Thus science and life, for Polanyi and Aristotle, have truth and reality as their aim, and personal knowledge pursues these.

TRADITION, FREEDOM, AND THE UNITY OF SCIENCE

Polanyi marshals numerous arguments against “the ideal of scientific detachment,” as though science could provide a view from nowhere, from no particular standpoint or set of beliefs. In this, he can be seen to countenance the insights of idealism, phenomenology, and existentialism into the human dimension of all scientific inquiry. And like Aristotle, Polanyi seeks to secure the role of tradition in science while doing justice to the element of freedom necessary for scientific discovery. “Scientific tradition,” he remarks, “enforces its teachings in general, for the very purpose of cultivating their subversion in particular.” Aristotle typically begins any investigation with a review of the thought of his predecessors. Polanyi, we have seen, emphasizes training in a center of science. Whether research then reinforces and expands and clarifies existing theories or destroys them in whole or in part with a revolutionary new theory, Polanyi has any researcher beginning from existing knowledge. Polanyi thus rejects Cartesian “hyperbolic doubt,” for without a beginning in a tradition of beliefs there is no way forward. As he says, “discoveries are made by pursuing possibilities suggested by existing knowledge.”

Polanyi stresses the unity of science and at the same time recognizes important distinctions between the different sciences. He conceives unity broadly enough to claim that personal knowledge “bridges the gap between the natural sciences and the study of man,” thus “bringing science and the humanities together.” Yet this does not mean that the principles of one science can simply be taken over by another; rather, it indicates that the broad understanding of science as personal knowledge applies to all the different fields of science and to scholarship in the humanities. Aristotle likewise supposes that the same intellectual powers support the various sciences and arts, and the works in the Organon are intended for any of the diverse sorts of science, including such fields as rhetoric and poetics. Different sciences do indeed have different principles and purposes. Aristotle frequently rejects the view that there could be one science of everything, and he holds that different sciences must have different principles to account for their different subject matters.

Polanyi indicates that there are three main fields of knowledge where discoveries are made: technology, natural science, and mathematics. Technology is a means through which human beings can make contact with reality, and
the same can be said for natural science and scholarship generally. By interiorizing the theories of natural science or the achievements of technology, they become subsidiary parts of our understanding contact with reality. Such tacit knowledge and interiorization is “indwelling.”

Natural science may contribute to technological development and technological achievements may aid natural science, but technology and science are not the same thing, and Polanyi sees the attempt to identify them as having deleterious consequences. The sciences, both natural and human, differ from technology in putting us in greater proximity to the reality they seek to encounter, and this is because technology lacks the intellectual element in itself that characterizes the sciences. The difficulty Polanyi sees with technology is that it easily plays into the view that humanity’s only real needs are material ones. To suppose that natural science is for utility’s sake, for making gadgets that increase our material comfort, is to return to the prescientific outlook when:

Horoscopes, incantations, oracles, magic, witchcraft [. . .] were all firmly established through the centuries in the eyes of the public by their supposed practical successes. The scientific method was devised precisely for the purpose of elucidating the nature of things under more carefully controlled conditions and by more rigorous criteria than are present in the situations created by practical problems. These conditions and criteria can be discovered only by taking a purely scientific interest in the matter which again can exist only in minds educated in the appreciation of scientific value.

Polanyi sounds much like Aristotle in rejecting the pursuit of natural science for utility rather than for the sake of the knowledge itself. But gaining this appreciation can prove difficult where cultivation has been insufficient and practical interests prevail. Polanyi observes that “in all parts of the world where science is just beginning to be cultivated, it suffers from a lack of response to its true values. Consequently, the authorities grant insufficient time for research; politics play havoc with appointments; businessmen deflect interest from science by subsidizing only practical projects.” This of course seems overly optimistic, for similar problems can exist even in the centers of science. Polanyi rightly stresses that valuing science appropriately depends upon sound preparation. Proper education counters some of the dangers of scientism, skepticism, and objectivism, while bolstering rigorous science alive to the personal dimension.

The aim of natural science is truth about its subject matter, which Polanyi and Aristotle unite in seeing as the ultimate goal even of political and economic life. Hence there can be no central control of science, any more than for the economy; rather we must depend upon “spontaneous order.” Science requires freedom so that individuals and groups of researchers can pursue the problems that present themselves to them. No one standing beyond the researchers can tell for sure in advance which problems are the really interesting ones.
Even grant programs that are too narrowly designed tend to pervert scientific research instead of supporting it as they are meant to do. Much as Aristotle defends private property and the operation of markets in his *Ethics* and *Politics*, but with advocacy of these as instrumental to the highest culture in theoretical science, Polanyi resists socialism and collective planning, both in science and economic life, as unworkable. Just as no central planner could have all the information reflected in all the areas of scientific research, and cannot foresee the implications of the solutions of problems, so the would-be economic planner cannot have all the information contained in the various prices worked out in the market. Attempts to impose central control of science cripple scientific research, just as similar attempts in the economic domain cripple economic life resulting in oversupply and shortages. Unlike many of his contemporaries in economic thought, however, who also defend markets, Polanyi, much as Aristotle, never loses sight of the hierarchy of pursuits, and hence they both view economic and political life as in service to higher culture.

Polanyi’s effort to present a viable “post-critical philosophy” finds him reinvigorating many fundamental Aristotelian approaches. We believe that this reveals the promise of Polanyi’s approach while also pointing to the way that various modern developments can be brought into the framework of Aristotelian naturalistic and realistic reflection upon everything that is.

NOTES

1. Michael Polanyi, *Personal Knowledge* [PK], p. 381
2. Ibid. p. 265.
3. Ibid. p. 298.
5. David Papineau, *The Philosophy of Science*, pp. 1–20 identifies skepticism, realism, and idealism as the three major generic positions that fight it out over the epistemology of science. Larry Laudan, *Science and Relativism*, presents an imagined dialogue between a positivist, a realist, a relativist, and a pragmatist. Laudan associates relativism with skepticism about the possibility of knowledge in science and further ties this trend to the “unmistakable relativist implications” of the writings of Kuhn and Quine (p. xi). Polanyi attacks objectivism, which he says seems realistic about matter in motion and skeptical about everything else. Objectivism’s hallmark is its rejection of the personal dimension in science, which has as its corollary depreciation of the role of tradition and authority in science and generally.
7. See Edmund Husserl, *The Crisis of European Sciences and Transcendental Phenomenology*. 
11. Ibid. p. vii.
12. Although this position strikes us as naive, even into the twentieth century philosophers and scientists have in some cases avowed a systematic ambition to complete the philosophical-scientific enterprise.
15. *PK* p. 110; see also pp. 124, 196, 208.
16. Polanyi refers to this encounter with Bukharin repeatedly: see Michael Polanyi, *Science, Faith, and Society* [*SFS*], p. 8; *PK* p. 238; *TD* pp. 3–4, 60.
17. For Polanyi’s discussion of the Lysenko affair, see Michael Polanyi, *The Logic of Liberty* [*LL*], pp. 72–80. *KB* pp. 24–39 treats the important shift in thought within the Soviet bloc following Stalin’s death.
18. For Laplace, the mind knowing all the forces at work in any one moment and the location of all bodies could compute all the past and future. Polanyi comments at *PK* p. 140:

> This ideal of universal knowledge is mistaken, since it substitutes for the subjects in which we are interested a set of data which tell us nothing that we want to know [. . .] That such virtually meaningless information was identified by Laplace with a knowledge of all things past and all things to come, and that the stark absurdity of this claim has not been obvious to succeeding generations since his day, can be accounted for only by a hidden assumption by which this information was tacitly supplemented. It was taken for granted that the Laplacean mind would not stop short at the list of $p$’s and $q$’s at the time $t$, but proceed by virtue of its unlimited powers of computation to evaluate from this list the events, and indeed all the events, that we might be interested to know.

19. *TD* p. 57.
20. Polanyi observes that the authoritarian dominance of traditional cultural life was broken in the modern period. In previous periods society accepted its own structure as permanently established [. . .] during the greater part of recorded history [. . .] a hierarchical social structure was for the most part regarded as essential to the very existence of the body politic. Only after the American and French revolutions did the conviction gradually spread over the world that society could be improved indefinitely by the exercise of political will of the people, and that the people should therefore be sovereign, both in theory and fact. This movement gave rise to modern dynamic societies, of which there are two kinds. When
a society is resolved on a sudden complete renewal of itself, its
dynamism is revolutionary; if it aims at a more gradual approach
to perfection, its dynamism is reformist. (PK p. 213)

See also Friedrich Nietzsche, *The Gay Science*, §346:

Have we not exposed ourselves to the suspicion of an opposition
– an opposition between the world in which we were at home
up to now with our reverences that perhaps made it possible
for us to *endure* life, and another world *that consists of us* – an
inexorable, fundamental, and deepest suspicion about ourselves
that is more and more gaining worse and worse control of us
Europeans and that could easily confront coming generations
with a terrifying Either/Or: ‘Either abolish your reverences or –
yourselves!’ The latter would be nihilism; but would not the
former also be – nihilism? – That is *our* question mark.

22. PK p. 228.
23. Ibid. p. 229.
24. Polanyi interestingly finds a precursor of this working of moral inversion
to discredit what opponents say while employing it itself in a hidden form
in Kantian “regulative ideals” about which he asserts:

Knowledge that we hold to be true and also vital to us, is made
light of, because we cannot account for its acceptance in terms
of a critical philosophy. We then feel entitled to continue using
that knowledge, even while flattering our sense of intellectual
superiority by disparaging it. And we actually go on, firmly
relying on this despised knowledge to guide and lend meaning
to our more exact enquiries, while pretending that these alone
come up to our standards of scientific stringency. (Ibid. p. 354;
see also p. 369)

In the context in which Polanyi offers this, he is arguing that teleology
is inevitable in life sciences, though scientists suppose that they must, as
scientists, reject final causes.

26. Polanyi appreciates the richness of the background of moral inversion:
“A loathing of bourgeois society, a rebellious immoralism and despair, have
been prevailing themes of great fiction, poetry and philosophy on the con-
tinent of Europe since the middle of the nineteenth century” (ibid. p. 236).
This anti-philistinism led to great art, but prepared the ground for “unscru-
pulous revolutionary power” (ibid. p. 237).
27. M p. 6.
29. See ibid. VI 1141a20–22, 1145a6–11, X.7–8.
32. Ibid. p. 254.
33. Ibid. p. 265.
34. Ibid. p. 286.
35. When Descartes in *Discourse on Method*, part 6 speaks of humans becoming “master and possessor of nature” through numerous contrivances that will reduce or eliminate human labor and medical innovations that will secure health, he may envision modern science, conceived as mathematical physics, as returning humans by their own efforts to the Garden of Eden.
37. Renewed interest in skeptical texts, such as Sextus Empiricus (see Popkin, *The History of Scepticism from Erasmus to Spinoza*), combined with a Christian view that knowing the essence and purpose of things is reserved for God (see Descartes *Meditations*, AT 35) would contribute to this.
39. Ibid. 71a1–2.
40. See ibid. I.1 71a11–17.
41. *KB* p. 105.
42. Aristotle, *On the Movement of Animals*, ch. 11.
43. Aristotle, *De Interpretatione* [DI], 16a3–4.
44. *PK* p. 252; consider DI ch. 4.
45. *PK* p. ix.
46. *PK* p. 182.
47. Aristotle, *Parts of Animals* [PA], I.1, 639a1–12; *Meta*. B.3 995a12–14.
49. Ibid. p. 20. Karl Popper, *The Logic of Scientific Discovery*, pp. 75–7 suggests this simple logical analysis for the refutation of hypotheses. Assume hypothesis H, which if true should give the experimental result R, that is, \( H \supset R \). But experiment does not yield R, i.e. R is not the case, or \( \neg R \). Then by *modus tollens*, H is untrue, i.e. \( \neg H \). But Polanyi denies that any earnest scientist gives up so easily as this logic suggests.
50. *PK* pp. 150–1.
52. Ibid. A.1 980a21.
53. See *PK* ch. 5 and ch. 12 sec. 6.
54. See *Meta*. E.1.
56. Ibid. M.3.
57. PK p. 82.
58. Ibid. p. 250.
59. See PK ch. 5 sec. 6, 11, and ch. 6 sec. 11.
60. Ibid. p. 128.
61. Polanyi may have a fuller notion of what inspires scientific revolutions than Thomas Kuhn, *The Structure of Scientific Revolution,* since Polanyi does not limit it to handling anomalies: “Some discoveries are prompted by the conviction that something is fundamentally lacking in the existing framework of science, others by the opposite feeling that there is far more implied in it than has yet been realized” (*PK* p. 277).
63. See EN VI 1139a19–31, b14–17, 1140a9–10, b20–1, 1141a17–18.
64. See *Phys.* II.8. In “Is Aristotle’s Teleology Anthropocentric?” David Sedley speaks of teleology as anthropocentric. This is a mistaken reading of Aristotle since it misses how it is only in the political rather than the theoretical context that Aristotle suggests any human end of non-human beings. In the theoretical context Aristotle has ensouled beings as definitely purposive, but each natural kind, having its own nature, soberly pursues the natural purpose of its own kind. *Meta.* A.10 and *De Anima* II.4, besides the political works, entertains a more unified end of various natural beings.
65. *PK* pp. 175, 394.
66. *TD* p. 44.
67. *TD* p. 91.
68. *PK* pp. 382–3.
69. Ibid. p. 389.
70. Ibid. pp. 384, 396.
71. Ibid. p. 398.
72. Ibid. p. 344.
73. See ibid. p. 363.
74. Ibid. p. 364.
76. *KB* p. 67.
77. There has been dispute about the role of dialectic and the sifting of ἐνδοχα in Aristotle since G. E. L. Owen, “Tithenai ta phainomena,” urged its importance (see in favor Martha Nussbaum, “Saving Aristotle’s Appearances,” and opposed Rob Bolton, “Aristotle’s Method in Natural Science: *Physics* I,” and Myles Burnyeat, *A Map of Metaphysics Zeta,* p. 79). We think that those opposed only in fact narrow rather than reject the role of dialectic in Aristotle. The dialectic in scientific investigation resembles Socratic ἔλεγχος, from which Aristotle appropriates the approach. For passages in Polanyi that advocate this sort of dialectic, see for example *PK* pp. 267, 269, 294–5.
78. See also Hans-Georg Gadamer, *Truth and Method*, pp. 272–3: “There is one prejudice of the Enlightenment that defines its essence: the fundamental prejudice of the Enlightenment is the prejudice against prejudice itself, which denies tradition its power.”

79. *TD* p. 67.

80. *M* p. 44.

81. Ibid. p. 57.


83. *APo* I.7.

84. *PK* p. 124.

85. *TD* pp. 17–18.

86. *PK* p. 183.

87. Ibid. p. 182.

88. Mark Mitchell, *Michael Polanyi: The Art of Knowing*, p. 22 relates that Polanyi invented this phrase in his discussions of economics, and it was later taken over by Friedrich Hayek and others who advocate the market system. Hayek acknowledged Polanyi’s coining of the term.

89. “Post-Critical” is in the subtitle of Polanyi’s major book. In insisting on Polanyi’s Aristotelian kinship, we actually go against his own self-understanding. He rather supposes himself more like St. Augustine at the end of antiquity formulating a “post-critical philosophy” and leading the way toward a new world of faith and belief (see *PK* 266–7). But Polanyi, like Aristotle, was himself an active natural scientist concerned with the way to view the various sciences.

**BIBLIOGRAPHY**


