

# Polanyi's 'Ontological Equation': A Response to Recent Discussions of Polanyi's 'Realism'

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ABSTRACT Key Words: Polanyi, technological analogies, complexity, emergence.

*Although Polanyi regards technological knowledge as inferior to scientific knowledge, he uses the idea of machine-like operational principles as an analogy for both his epistemology and his ontology. Since his epistemology is based on personal knowledge, this suggests the need for a personal ontology. Polanyi tries to avoid such a conclusion by invoking impersonal evolutionary factors.*

The amazing range of Michael Polanyi's ideas was well reflected in the various contributions to the recent issue of *Tradition and Discovery* (26:3). The unifying theme of that issue was the problem of 'realism' as seen by a group of contributors, who could loosely be described as 'Polanyians', all of whom are experienced philosophers.

All of us have to start from our own traditions and experiences. According to Polanyi, this is not only inevitable but also a source of strength. He had the advantage of a most unusual breadth of education and experience that enabled him to cross the boundaries of academic disciplines. Of course that laid him open to the criticism of academics who dislike trespassers on what they consider as their own territory. Philosophers in particular resented his intrusion. Except for Polanyians, they still do so

Philosophers start from philosophy. As an engineer I start from engineering. During my career I have had one foot in industry and the other in academia. I have had no training in philosophy and my view of philosophy is almost a 'view from nowhere'. In daring to comment on the philosophical articles in *Tradition and Discovery*, I plead the example, although not the wisdom, of Polanyi. It is relevant that Polanyi has several references to engineering and technology in his book *Personal Knowledge*, although he had no first-hand engineering experience. However, as the son of a railway engineer, he probably had a good deal of tacit engineering knowledge and, as an experimental scientist, he must have valued engineering skill. Because of my engineering background, I was particularly grateful to Dr. Jha for her comments on Polanyi's use of engineering analogies. These seem to me to be at the heart of Polanyi's understanding of reality. However, before discussing Dr. Jha's paper, I should like to make some remarks that apply to the other contributions as well.

## A Newtonian Universe?

It is not surprising that philosophers generally seem to operate with the assumptions made by Newton in elucidating the problem of motion. These assumptions are so widely accepted that they appear as obvious to most of us unless our particular speciality forces us to question them. Newton described space in terms of a reference system of Cartesian coordinates. A universal set of such coordinates could be constructed using Euclid's axiom of parallel lines. Newton considered time to be independent of space, so that a universal clock

could measure it. The problem of motion consisted therefore of formulating the laws governing the trajectories of particles in an empty space-time. Gauss, however, pointed out that Newton's space-time was the special case of a flat manifold and that the Euclidean axiom had to be experimentally tested. Geometry was therefore experimental rather than axiomatic. Faraday and Maxwell showed experimentally that time was not independent of space and that space-time was far from empty. Instead of being a mere reference system, space-time was therefore a physical object. All this is, of course, well known. Nevertheless, the fact that the speed of electromagnetic waves is so enormous means that in ordinary circumstances it is usual to think in Newtonian terms. I hope I shall be forgiven if I say that my impression of the articles in the 'realism' issue of *Tradition and Discovery* is that the writers are Newtonians at heart.

Let me explain what I mean. First, their mental picture of making contact with reality appears to be spatial. Reality is seen as based on real objects 'out there'. True, there are persons as well as things. But the persons are as seen from outside. They are complex objects, but objects all the same. As Polanyi, the writers are convinced that their knowledge is personal and that there is a bond of conviviality linking them with other persons. However, the discoveries they make relate to entities that are objects and not subjects.

Secondly, the entities are akin to Newtonian particles. They act on each other and can be used as building blocks. Moreover, these particles can also be considered in isolation. A recurring theme is the complexity that is supposedly the hallmark of entities at a higher level. The term complexity implies that the complex object consists of pieces like a construction kit. The Newtonian notion of interacting particles was dominant in science until Faraday and Maxwell questioned it. It is still a common assumption in popular accounts of science. The spatial terms of higher and lower and the frequent allusion to a hierarchical ordering carry the same Newtonian message.

Thirdly, the writers separate time from space in the Newtonian manner. Simultaneity seems to be assumed. Real entities are located in a conceptual space. Of course there is a lot of truth in such a view. Any observation or measurement is necessarily static or quasi-static. All numbers are static. Even the terms 'event' or 'process' are quasi-static terms describing what has happened, not what is happening. What is missing in this picture is the irreversibility of time. Time without its arrow may give information, but it cannot give adequately meaningful personal knowledge to human persons immersed in time.

## **Polanyi's Attitude to Technology**

Technology was not one of Polanyi's primary concerns. The Society for Freedom in Science, which was one of his great interests, attracted some eminent engineers like E B Moullin, who later became President of the Institution of Electrical Engineers. However, its object was to defend pure science against those who wanted to subject science to a criterion of social usefulness enforced by central planning. Polanyi held that technological knowledge was vastly inferior to scientific knowledge. The latter was true discovery of reality, whereas technology at best was concerned with inventions leading to material advantage. He wrote that such inventions have no permanent value, but are subject to fluctuations in the market place. "In science originality lies in the power of seeing more deeply than others into the nature of things, while in technology it consists in the ingenuity of the artificer in turning known facts to a surprising advantage" (*PK*, 134) More damning still is Polanyi's remark that technology is akin to trick learning in animals, while scientific work is a kind of latent

learning involving interpretation.

In view of this critical attitude to technology, it is not surprising that Polanyians have paid little attention to technology or engineering in their analysis and use of Polanyi's epistemology and ontology. Equally, it is not surprising that engineers have taken little interest in his ideas.

### **Polanyi's Technological Analogies**

As a successful research chemist, Polanyi was well aware that scientific discovery was not an algorithmic procedure. One of his great insights concerned the role played by tacit knowledge. He also describes vividly the sense of an attractive force exerted by a solution to a scientific problem. Moreover, the solution once found has unforeseeable consequences that confirm that there is contact with an external reality. From an engineer's point of view, Polanyi's description of the act of discovery is overly individualistic. True, he speaks of a 'society of explorers', but the communal role of this society relates more to the conservation of tradition and to the accreditation of discoveries than to the actual process of the discovery. In engineering, research and development are closely coupled. Invariably, this involves a group rather than an individual, although, of course, some individuals make more valuable contributions than others. Creativity in engineering is a communal property. Apart from this difference between science and engineering, Polanyi's account of discovery fits well into the practice of engineering, not only in research and development but also in the central activity of engineering design. It is likely that his concern for the defence of pure science, which was essentially political rather than scientific, prevented him from seeing the wider applicability of his ideas.

Polanyi's description of the process of discovery exhibits the irreversibility of time, which is missing from the Newtonian world-view. The Newtonian universe is closed causally. Polanyi's universe is open in the sense of allowing progress in science. The possibility of progress is due to his insertion of the personal pole of knowledge into science. Polanyians cannot be Newtonians!

Although Polanyi was dismissive of technology and engineering in the context of knowledge, he very skilfully used engineering analogies. One of these is the concept of the operational principles, which define the value of a machine. Such principles can be embodied in patent specifications. Polanyi observes that patents are always written in the widest possible terms in order to try to cover as many embodiments of the operational principle as possible. The parts of the machine are important only in their relation to the whole and have no independent significance. That is a very important insight. There is an asymmetry in the relationship between the parts of the machine and the machine as a whole. This asymmetry is related to the irreversibility of time involved in personal knowledge. An operational principle applies to a complete entity and not to an assemblage of parts. A house is different from a pile of bricks. The statement that a house is made of bricks is profoundly different from the assertion that it consists of bricks. Polanyi points out that the failure of a part of a machine will lead to the failure of the whole, but the converse is not true. Successful operation is a property of the entire machine. He also draws the conclusion that natural laws like the laws of physics and chemistry cannot specify operational principles. That conclusion plays havoc with his ordering of the superiority of pure science above engineering and results in great difficulties for his ontology.

Polanyi uses the notion of operational principles in many different contexts. He applies it to the uses of language and also to evolutionary processes in living beings. It is in fact a vital feature of his entire theory

of knowing and being. By means of this central idea, he is able to refute the theory that analysis is the road to knowledge and the Cartesian insistence on the role of doubt as a means of attaining certainty. Moreover, he demolishes the Newtonian idea of a universe of particles.

## **The Ontological Equation**

As Dr. Jha shows in her paper, Polanyi's engineering analogies are a strength in his epistemology, but they present difficulties in his ontological speculations. I am not qualified to comment on the philosophical aspects of Dr. Jha's critique. What I can do is to offer some remarks from an engineering point of view.

Polanyi attempts to construct a meaningful universe using the insights of his theory of knowledge. It seems to me that these insights are insufficient for his purpose. His ontology comprises a hierarchy of increasingly complex entities subject to an evolutionary process of emergence. Let us consider some of the terms used in this explanatory scheme.

Complexity is invoked not only as a descriptive term, but also as being in some sense teleological. However, there is no logical connection between operational principles and the complexity of the structures in which the principles are embedded. In engineering, there is no virtue in complexity. For example, a jet engine for aircraft propulsion is less complex than the reciprocating engines that preceded it and an optical fibre cable is less complex than the copper cable used previously. Complexity of structure may be necessary for a particular solution of an engineering problem, but it can never be regarded as desirable. Nor can it be thought to lead to an operational principle. As Polanyi realised, there is an essential asymmetry involved in any discovery or invention. These cannot happen without creativity.

Nor can increasing complexity lead to a hierarchy of entities. Polanyi seeks to construct such a hierarchy by invoking a set of interlocking operational principles connected through their boundary conditions. To an engineer, this makes no sense at all. The use of boundary conditions is analytical and not synthetic. They divide an entity into separate domains. In any case, Polanyi's hierarchical structure of reality is far too simple to serve his purpose. There is an unspecifiably complex system of connections between all entities involving tacit links.

Another important term used by Polanyi is emergence. In engineering, this term is occasionally used to describe a temporal process of development. Polanyi uses emergence in this descriptive manner, but he also relates it to the operational principles of living beings. In that context, emergence is located outside time. The inherent difficulty of this double use is noted by Thomas Nagel in his book *The View From Nowhere* in the context of a discussion of the explanatory power of the theory of evolution through natural selection. Polanyi seems to be aware of the difficulty and tries to meet it head-on by a defence of a modified kind of vitalism.

It seems to me that Dr. Jha is right in questioning the transference of the engineering analogy of operational principles from epistemology to ontology. In his epistemology, Polanyi is successfully relying on personal factors such as tacit knowledge and passionate commitment. There is, however, no straightforward way in which he can transfer these ideas to an impersonal reality. His ontological equation does not carry conviction.

## **An Anthropomorphic Universe?**

In Polkinghorne's evocative and often repeated phrase, 'epistemology models ontology'. The absence of an ontological equation does not necessarily sever the connections between epistemology and ontology. Let us consider whether there are such connections in Polanyi's thought.

The best place at which to start is the recollection of the strengths of Polanyi's epistemology. By his discovery of tacit knowledge, Polanyi showed that apart from persons there could be no such thing as knowledge. Popper's third world of well-tested hypotheses stored in libraries could not provide the objective knowledge claimed by its author. On the other hand, personal knowledge is no mere 'construction of reality' as described by Arbib and Hesse, or as denounced by Feyerabend. The unforeseen consequences of scientific discoveries suggest that personal knowledge makes contact with a hidden reality. There is a connection between the knowing human persons and the external world.

Polanyi's world is an open world in time. It accommodates the irreversibility of time as well as the passage of time. Unusual among philosophers of science, Polanyi is able to distinguish between wholes and parts. His idea of the separation of operational principles from their embodiment enables him to include technological development as well as scientific discovery in his scheme. He is aware, if reluctantly, that scientific laws cannot give a total account of human experience. This means that he is able to include human beings in his theory. It stands in sharp contrast to popular accounts like Hawking's *A Brief History of Time* (1988), which seek for a total explanation in terms of natural laws. Polanyi's epistemology is truly anthropomorphic. That is its strength.

Dr. Jha rightly suggests that a transference of these ideas from epistemology to ontology may encourage a theistic interpretation of reality. Polanyi does not grasp this nettle. Instead, he seeks refuge in such impersonal abstractions as emergence. He tries to explain personal knowledge by an appeal to an impersonal reality that supposedly generates and supports it. This is equivalent to an attempt at deriving an operational principle from its embodiment. It reverses the arrow of time.

If there is to be a connection between knowing and being, then Polanyi's anthropomorphic epistemology points towards an anthropomorphic ontology. Such an account of reality is given by the Judaeo-Christian view of the world, in which man is created in the image of God and God is revealed in human form as the incarnate Word. Of course an acceptance of that ontology must be, as Polanyi has taught us, a matter of passionate commitment rather than detached objectivity.