

EMERGENTISM AND COMPLEXITY IN MICHAEL POLANYI'S THOUGHT

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ABSTRACT: Starting from a relatively brief --but hopefully understandable-- description of Michael Polanyi's ideas about emergentism and complexity, we will present a perspective of scientific knowledge under the aegis of two of his most relevant maxims: i) we know more than we can talk about, ii) in general, we employ more ideas than we define concepts. We will propose a conception of science from his views on the inexact, tacit knowledge, the self-regulation of science, the network, and the society of explorers in order to show that complexity and emergentism (almost always synonymous with novelty) are guiding threads, rarely visible, that organize such a conception. Complexity and emergentism are theses that express some of the most relevant features of Polanyian thought, since they help to understand the relations between scientific knowledge and the way the society of explorers carries out its actions based on an intertwining between knowledge network and tradition.

KEYWORDS: Complexity; Emergentism; Tradition; Pluralism; Tacit knowledge.

INTRODUCTION

The philosophical thought developed by Michael Polanyi does not allow an easy and straightforward classification. We believe that it would not be appropriate to speak of a philosophy of Michael Polanyi, since he called himself post-critical, an expression with which he wanted to indicate an attitude refractory to simplifying and, therefore, misleading qualifications. Polanyi has never been affiliated to any school of philosophical thought. Even so, he defended philosophical theses, which leads us to place him in front of models of thought close to his own. Many reasons contribute to this. His scientific background in medicine and physical chemistry is one of these elements. His scientific practice, exercised for about three decades in applied fields, is another. Besides these two elements, there is a

third, namely: Polanyi dialogued with different schools of philosophical thought, often perceived as mutually exclusive.

Polanyi's thought, besides having as a characteristic his non-inclusion in any defined philosophical school, is also considered complex and difficult, since he explicitly considers it necessary to include that the world is in crisis. What would be the solutions for a world in crisis? For him, any solution in view will be immersed in the totality of life, thought globally, taking into account everyone and everything in its diverse characteristics. At the same time, we are not able to foresee everything, to know everything, all the elements, all the relations between the elements.

Polanyi has no trace of theoretical bias. His objective was to construct adequate arguments to justify the theses he was advancing. For the thinker of Hungarian origin, any philosophical thesis, any scientific idea, or even any artistic conception, could be useful in his endeavor. Polanyi also used to conceive ideas rather than define concepts, including those that he himself created.

His attitude in seeking inspiration and ideas in the most varied fields of science, philosophy, in short, in any and every domain that was considered relevant makes the commentator's task arduous. In addition, there is Polanyi's attitude that he was more interested in proposing new theses than in proving them. The result of these two "characteristics" is a thought that is at once deep, complex, and entangled: each and every notion allows one to traverse the length and breadth of his thought.

Over about four decades, this scientist and philosopher developed a set of ideas, which, nowadays, are understood to be part of the domain of emergentism.¹ In search of a better understanding of the notion of knowledge and the agent responsible for its creation --the human being-- Polanyi developed a critical position in relation to the mechanistic and reductionist view of science. He advocated a non-reductionist position in science, before it became a widespread and acceptable perspective,² whether in the natural sciences, the humanities, or even in the philosophy of science. Complexity and emergentism are not only important foundations for understanding Polanyi's philosophy, they

¹ Michael Polanyi. 'Personal Knowledge: Towards a Post-Critical Philosophy'. New York, Routledge, [1964] 2005.

² Part 4 of Polanyi. *Personal Knowledge*, 2005 is an example of this aspect of Polanyi's thought.

constitute the core of Polanyian thought itself.

Emergentism, in general terms, is the emergence of the new without having been foreseen, or yet, it is the unexpected, that which was not planned. An important characteristic in the characterization of the new, according to Polanyi, is that it does not presuppose the destruction of what preceded it, what will come to be understood as “old”: the new does not imply the disappearance of the old.³ Polanyi’s thought stands for the impossibility of forecasting and total planning, as well as for the preservation of tradition as a condition for the advent of the new.

Science is Polanyi’s starting point for thinking about nature, for example, but this does not mean that scientific knowledge is the most important among all forms of knowledge ever produced by mankind. A broader idea of what science, scientists and their tasks are seems indispensable to think about knowledge based on Polanyi’s ideas. Elaborating a hierarchy, according to which science would be the most relevant element, would mean simplifying the understanding of the processes, of any and all kinds, that really happen, whether in nature or in human society. Science maintains relations with other types of knowledge besides scientific knowledge. Knowledge does not have a defined path or a single methodology, there is no way to imagine that there is a best path. In short, there is no single, homogenizing methodology; therefore, the path is peripatetic.

According to Polanyi, to be an emergentist is to walk through knowledge, through philosophy, accepting changes of course, often brought about by new ideas. Emergentism is also complex, since it analyzes a worldview and investigates the phenomena that exist in the life world. We can think of a second level, or second type, of complexity because certain phenomena exist and cannot be explained by a single scientific analysis.

In this article, we intend to carry an analysis of the set of ideas and theses about the notion of emergence, present in some of Polanyi’s works, mainly in *Personal Knowledge*.⁴ Our goal with this description is not only to clarify some

³ We find a discussion that attempts to define emergentism by analyzing various authors, including aspects of emergentism in Polanyi’s thought in Clayton, Philip. ‘Conceptual foundations of emergence theory’. In: Paul, D. & Philip, C. (Eds.), *The re-emergence of emergence: The emergentist hypothesis from science and religion*, Oxford, Oxford University Press, 2018, pp. 1-31.

⁴ We find the idea and use of the concept of emergence throughout Polanyi’s work, for example, Michael Polanyi. ‘The study of man’. Chicago/Illinois, The University of Chicago Press [1959], Martino Publishing/Mansfield Centre, CT, 2014, p. 58; Michael Polanyi. ‘The Tacit Dimension’, Chicago and

aspects of his ideas about this notion, at the same time obscure and subtle, but also to offer an explanation for Polanyi's adoption of a non-reductionist, pluralist, complex and emergentist perspective in philosophy of science. For him, complexity is not restricted to the philosophy of science, it is plural, and in his thought, it has a central place, even if more implied and proposed than exactly defined as an explicit methodology. This step will allow us to verify to what extent it gives insights for an adequate understanding of the conception of culture developed by him, and how it would be possible to bridge the gap between culture and science. Polanyi wants to ground an interrelationship between scientific and political thought, both maintaining areas and points of interconnection, dialog, and influence. The structure that maintains science and its activity going is the same that keeps the society itself in which science is inserted. This being so, and freedom will be as important for science as for society as a whole.

THE INEXACT AS A FIRST APPROACH TO PHILOSOPHY

In 1936, in *The Value of the Inexact*, it is already possible to find clues about the reasons that lead Polanyi not to defend planning, positioning himself in favor of a notion that is like its antipode, namely: emergentism. According to Polanyian thought, the human being is not capable of knowing and predicting everything, that is, all the elements and all the relations between the elements, hence the impossibility of planning, be it science or society. Inaccuracy would imply, among other consequences, anti-reductionism and complexity.⁵

With the intention of facilitating the understanding of Polanyi's thought, we propose a small chronological scheme of his works, for better visualization of the thematic interests, which indicate the complexity of his thought.

Between 1914 and 1919, still in Hungary, Polanyi devoted himself to medicine,

London, The University of Chicago Press, [1966] 2009, chapter 2; Polanyi. *Personal Knowledge*, 2005, in part 4.

⁵ "It is easy to prove that no completely exact statement can be of any value in natural science, but when applied to physics the argument always appears to be a combination of far-fetched trivialities and sophistry. Of course, the mere fact that there is no absolute security for the validity of what we consider exact natural laws should lead to the conclusion that these laws are only valuable in combination with the element of uncertainty in them, which is compensated by the supreme sanction of validity, which is faith". Polanyi, Michael. 'The Value of the Inexact'. *Philosophy of Science*, vol. 3, no. 2, Apr. 1936, pp. 233-234. p. 233.

his initial training, publishing his first article on adsorption. Between 1920 and 1932, already in Germany, at the Kaiser Wilhelm Institute of Physical Chemistry, he was an investigator involved in scientific research on adsorption, crystals, and reaction kinetics.

Between 1933 and 1936, a refugee in England due to the Nazi regime, Polanyi worked with physical chemistry, but also with issues related to economics and social analysis. As early as 1936 he began to direct his interests toward philosophy, an involvement that became predominant from 1940 on, only ending with his death in 1976. Over these more than thirty years, Polanyi's range of philosophical interests broadened, incorporating themes of theology and aesthetics.

It was from the mid-1930s that he published what are recognized as his most important written works: *The Value of the Inexact* (1936); *On Popular Education in Economics* (1937); *The Contempt of Freedom* (1940); *Full Employment and Free Trade* (1945); *Science, Faith and Society* (1946); *The Authority of the Free Society* (1949); *The Logic of Liberty* (1951); *Personal Knowledge* (1958); *The Study of Man* (1959); *On The Modern Mind* (1965); *The Tacit Dimension* (1966); *Meaning* (1975).

THE INEXACT AND THE PERIPATETIC METHODOLOGY AS A FOUNDATION OF THOUGHT

In his first text considered to be authentically philosophical,⁶ Polanyi tried to position his thought in relation to scientific and philosophical schools in order to define his view of reality as anti-essentialist, understood by him as being in opposition to the idea that a representative essence of reality would be possible, an essence capable of unequivocally exposing the core of the real. Perceived reality should be understood by means of an anti-reductionist and polycentric model.

The idea of inexact developed by Polanyi in this letter about inexactness can be seen as a first approach to complexity and emergence, insofar as it aims at proposing a philosophical and scientific thought in a position contrary to reductionism, embedded in emergentist conceptions about reality and in a complex worldview. Polanyi's letter to the journal *Philosophy of Science* in 1936 was motivated by the enigma of the physical existence of hypothetical and short-

⁶ Polanyi, *The Value of the Inexact*, 1936.

lived chemical substances, this theoretical-experimental question caused Polanyi to reflect on the differences and similarities between chemistry and physics.

Michael Polanyi wrote this article based on his philosophical reflections in the field of physical chemistry, an unusual topic for the journal he chose. Polanyi points out that the contrast between the concepts of chemistry and physics was fascinating to him, showing how the idea of inexactness was of great importance and value. Using a new vocabulary (affinity, tendency, inclination, and expressions such as relative stability, general expectation, and behavioral descriptions), Polanyi presents new meanings in describing how theories and experiments in chemistry are carried out. Chemistry is presented as an art,⁷ or even a science of behavior.⁸ In this way, Polanyi's motto in this work can be seen in the following thesis: "There is not a single rule in chemistry which is not qualified by important exceptions".⁹

Also in 1936, Polanyi stated that if chemists were more concerned with the terms employed by physicists to define the reality of experiments, they, as well as chemistry itself, would be doomed to failure. Such behavior could even spell the beginning of the end for chemistry as an autonomous area of scientific knowledge. In other words, the working methodology of chemistry could not be based on the postulates of physicists, nor on the methodology of physics, much less on the search for exact results for the development of scientific research in chemistry. After all, neither the synthesis of chemical compounds, nor the characterization of substances can be obtained by a reductionist scientific method by one that would nurture expectations of obtaining experimental accuracy: "Just link up two or three of the atoms of physics, and their behavior becomes so complex as to be beyond the range of exactitude".¹⁰

⁷ A theme that Polanyi reiterates in later essays and lectures, especially in *Personal Knowledge* and *The Tacit Dimension*.

⁸ This is because of the idea of tacit knowledge. We are not separate from the world, we live with our bodies in the world, so it is conceivable from this perspective that all experiences are important for understanding about reality. Therefore, art, like any area of knowledge, participates in the worldviews and conceptions about reality that are personally proposed by researchers. In this way, chemistry and art could complement each other as a more enhanced knowledge about certain issues worked on and ideas developed. To this, later in the article, we will refer to Polanyi's idea of "neighborhood," border points between the various areas of knowledge that, when interconnected and related, advance research and knowledge itself.

⁹ Polanyi, *The Value of the Inexact*, 1936, p. 233

¹⁰ Polanyi, *The Value of the Inexact*, 1936, p. 234.

According to Mary Jo Nye,¹¹ it is possible to state that the laboratory experiments conducted by Polanyi throughout his career, both in Berlin and Manchester, provide clues regarding his philosophical conceptions of science that reveal themselves in his thesis on the value of the inexact.¹² Two of these revealing experiments would be the work on gas adsorption and X-ray diffraction, which, once published, were strongly resisted by the scientific community, and only confirmed years later:

It is indeed obvious that if at any time chemists would have been so ill-advised as to let themselves be frightened by physicists into abandoning all vague methods, and to restrict themselves to the field where exact laws (or what are supposed to be such by the physicists) pertain, the development of chemistry, would, at that moment have stopped dead, and its most valuable parts would have melted away in the rays of such foolish criticism.¹³

According to our author, the scientific and scholarly culture¹⁴ disseminated in the universities and research centers existing in Berlin until the rise of National Socialism was fundamental to structure his own thinking, besides contributing to the formulation of his first philosophical interpretations of science. The work carried out theoretically and in chemistry and physics research laboratories is the basis for Polanyi's vision of the role of the scientist and the community of explorers. The scientific practice as a physical chemist was the starting point and the core of Polanyi's philosophical thinking before the outbreak of World War II. From this beginning, he was concerned with developing an interpretation of the psychological and personal aspects of knowing in science¹⁵ effectively employed

¹¹ Nye, Mary Jo. 'Michael Polanyi and his generation: Origins of the social construction of science'. Chicago and London, The University of Chicago Press, 2013., p. 143.

¹² Inexact in reference to peripatetic, to changing ideas along the way, to complexity, to emergence, to the new... The idea is the peripatetic path. The point of departure and arrival without having to follow the original route. Both the path, the walking, and the ideas about this experience can change and advance without obeying any total planning of the experiment.

¹³ Polanyi, *The Value of the Inexact*, 1936, p. 233-234).

¹⁴ The scientific and scholarly culture would be the culture of a specialist. However, in Berlin, for Polanyi, science would be involved in an atmosphere of sharing of ideas, because there were systematic meetings between several scientists to present ideas, reveal discoveries and propose problems and questions. This would be the scientific and scholarly culture.

¹⁵ The issue that most attracted Polanyi in mid-1915 was the controversy over the chemical nature of isotopes. In *Personal Knowledge*, he proposes principles of his philosophy that seem to have been motivated by characteristic aspects of scientific history itself about the defenses of theories about isotopes. For Polanyi, interpretative frameworks underlay intellectual passions, scientists made personal commitments during

by the scientist.

For Polanyi, chemistry was closer to human behavior than to physics.¹⁶ For him, the idea of exactness would be a problem for physics because he considered that physics, without the reductionist assumptions, would end up being unfeasible, since his colleagues believed, at the time, that the condition of possibility of physics as a science lay in reductionism. In short, inaccuracy would constitute chemistry.

These epistemological issues added to the cultural reality found in England lead, according to Nye¹⁷, Polanyi to disappointment since he was not able to build in Manchester the same productive and inter-relational environment that satisfied him so much in Berlin, no avail in his efforts in the 1930s to make everything a success. His interest in science was very small throughout the 1940s as his attention and commitment to the problems and issues of economics and politics and the development of his philosophical thinking grew.¹⁸

COMPLEXITY AS THE CONTEXT OF POLANYIAN THOUGHT

Polanyi is a realist; each and every scientist needs to believe in the existence of reality. Without this belief, there is no way she/he can embrace science. However, Polanyi's realism should not be understood as if it were a defense of the conception of that which exists because it is associated with empirical data. He is not an advocate of objectivism. Reality eludes any theoretical and practical reductionism of human beings' experience with the world. To think the world, the experience with the world in an objectivist format, would rob the world of

laboratory investigations, controversies over objective questions tended to take on an intensely personal tone. An example of the issues involved solving puzzles about atomic structure, the organization of the periodic table, the differences in atomic weights and chemical properties of the elements, Rutherford's 1911 discovery of the atomic nucleus, electric charges, protons, the number of neutrons in the nucleus, physical differences, and radioactive properties. See: Scott, William Tausig and Moleski, Martin X. 'Michael Polanyi, scientist and philosopher', Oxford, Oxford University Press, 2005, p. 38.

¹⁶ "Chemistry, indeed, leads us so far away from physics, (or let us say, that physics appears, when we look at chemistry, so far remote from everything else in the world) that the description of chemical substances and the art of dealing with them lies quite near, by comparison, to the types of human behavior and the art of commanding human behavior. The mythological language of the alchemists persists in chemistry and is still characteristic of its most vital element" Polanyi, *The Value of the Inexact*, 1936, p. 234.

¹⁷ Nye, Michael Polanyi and his generation, 2013, p. 143.

¹⁸ "All these fields of high complexity gain real profit only from the discovery of specific tendencies of behavior incorporated in their functional outlines". Polanyi, *The Value of the Inexact*, 1936, p. 234.

our ability to perceive the new, insofar as it would remove from the human being a whole tacit universe of lived experiences. The world is not reduced to a physical model, nor to a set of objective representations. An objective reality would transform into failure the possibility of the human being to become.

In order to assure its existence, knowledge presupposes a personal action inserted in a democratic and educated community for the constant debate and exchange of research results, as well as of concepts and methodologies employed in the acts of discovery. To think about knowledge would be to maintain the constant conviviality and dialogue among those involved in the discoveries, in all areas of knowledge. This structure would establish an interpretive framework that, fed back by the very system of sharing of ideas, would conform as a socially interesting and stimulating environment for those immersed in their own practices. This structure is at the same time eclectic, multicultural, transcultural, and operational from autonomous points guiding the management of the inscrutative paths, enabling intercultural contacts, mutual understandings, and institutional control:

It might seem impossible to compare the complex scientific value of marginal contributions over such different areas as, for example, astronomy and medicine. Yet I believe this is in fact done, or at least is reasonably approached in practice. It is done by applying a principle that I have not seen described elsewhere, although it is used in various fields; I would call it the principle of mutual control. It consists, in the present case, of the simple fact that scientists keep watch over each other. Each scientist is both subject to criticism by all others and encouraged by their appreciation of him. This is how scientific opinion is formed, which enforces scientific standards and regulates the distribution of professional opportunities. It is clear that only fellow scientists working in closely related fields are competent to exercise direct authority over each other; but their personal fields will form chains of overlapping neighborhoods extending over the entire range of science. It is enough that the standards of plausibility and worthwhileness be equal around every single point to keep them equal over all the sciences. Even those in the most widely separated branches of science will then rely on each other's results and support each other against any laymen seriously challenging their authority.¹⁹

The mutual control intended by Polanyi besides being a facilitating ingredient of communication among the members of the Republic of Science also functions

¹⁹ Polanyi, *The Tacit Dimension*, 2009, p. 72.

as a guarantor of reliability in the structure:

[...] each scientist who is a member of a group of overlapping competences will also be a member of other groups of the same kind, so that the whole of science will be covered by chains and networks of overlapping neighbourhoods. Each link in these chains and networks will establish agreement between the valuations made by scientists overlooking the same overlapping fields, and so, from one overlapping neighbourhood to the other, agreement will be established on the valuation of scientific merit throughout all the domains of science.²⁰

The suggested network model is based on the ability to deal with multiple approaches to the same topic in such a way that instead of finding a paradigmatic field, what is found is a vast interconnected multicultural network with open borders for explorers well equipped for the journey.

Polanyi called himself a “post-criticist.”²¹ But how can we understand Polanyian post-criticism? In our understanding, it is a knowledge which has the claim that its foundations are universally valid. However, and here is a point that takes Polanyi beyond the boundaries of modern rationalism, this same knowledge, although it does not repudiate reason, is validated by belief, since it is structured from ideas and less from concepts:

It appears, then, that to know that a statement is true is to know more than we can tell and that hence, when a discovery solves a problem, it is itself fraught with further intimations of an indeterminate range, and that furthermore, when we accept the discovery as true, we commit ourselves to a belief in all these as yet undisclosed, perhaps as yet unthinkable, consequences.²²

Belief, and not reason, is the foundation of knowledge.²³ Imagination would make the perception of reality possible, just as belief in the truth of knowledge

²⁰ Polanyi, Michael. ‘The Republic of Science: Its Political and Economic Theory’. *Minerva* no. 1, 1962, pp. 54-74, p. 58.

²¹ The very title of Polanyi’s book makes reference to this: *Personal Knowledge: Towards a Post-Critical Philosophy*. Polanyi. *Personal Knowledge*, 2005.

²² Polanyi, *The Tacit Dimension*, 2009, p. 23.

²³ Is faith and belief the same thing for him? They are, but on different (tacit) levels. Polanyi does not discuss this openly, but we realize that faith encompasses beliefs that can be in various things, people, and knowledge. Belief would ground all knowledge and interpretive modes of the world, while faith would encompass belief at a higher level of understanding, dealing with what he called “truth.” Belief could be grounded in data and experiments; faith comes from this relationship of the human being in time dealing with the representation horizons of the world. Faith is a level that emerges from these relations of human beings to the world in time, which are given and reported and taught by tradition, according to interpretative frameworks (results, aspirations, expectations of the future...).

would make rational understanding of reality possible. Belief is to imagination what reason is to the perception of reality. This structure would be the result of the emergence from subsidiary levels of reality to higher levels of reality. Therefore, post-criticism does not exclude the possibility of knowledge being founded on belief about external reality. The latter is independent of the human being. The possibility of discovering it lies in the discovery of its levels of emergence, which uncovers that they are inhabited.

It is undeniable that there is an elitism²⁴ in Polanyi's conception of knowledge, because, although it is widely accessible to all human beings, it is necessary to perceive reality in such a way that one can recognize what one is seeking. Thus, it is necessary to be inserted within a tradition,²⁵ since contact with masters, who can teach one to find what one seeks, is required. Without this education, one cannot distinguish what one is looking for. Therefore, without tradition, there is no possibility of knowing what is possible, or not, to discover anything, this in applied knowledge, as well as in that which is considered pure.

For Polanyi, there is a tradition that sustains the whole structure of science, and it is in the hierarchy of this public and plural structure that the duly qualified scientist can freely exercise research, particularly pure research. The young apprentice, the future scientist, needs to receive a proper education, available at the university, where the training is placed under the care of an experienced scientist: "The teaching of science in schools is controlled likewise. And, indeed, the whole outlook of man on the universe is conditioned by an implicit recognition of the authority of scientific opinion".²⁶

In the interaction between master and apprentice, everything that is

²⁴ Why is there a certain elitism in Polanyi's conception? The idea is that if you are outside an area of knowledge, you may find it very difficult to understand a specific problem in that area. In other words, there is a knowledge elite in each area of knowledge as well as one that is able to move through the network between several other areas, encompassing a greater capacity to understand and comprehend problems and proposed solutions. Not taking these truths into consideration could mean not accepting the diversity of knowledge and its implicit logics, which could greatly hinder the development of research and not considering the values accepted and defended in society: there are ethics in relationships.

²⁵ Polanyi did not define a concept of tradition, but the idea of structure for him is defining of it. Polanyi uses the term "interpretive framework" as a summary image for culture, which would be complex, dynamic, and in some sense paradigmatic (thinking about the idea of neighborhood for example; the borderlines/neighborhoods between the various areas of knowledge that form the network) and which are in the larger structure composed of tradition.

²⁶ Polanyi, *The Republic of Science*, 1962, p. 58.

impossible to be explained in books is learned. There is a tacit component of scientific knowledge that the apprentice will learn, in everyday practice, to become a real scientist, following the examples given by the master.²⁷ The master-apprentice relationship is fundamental for the continuity of scientific tradition. Polanyi points out that even when expert scientists die or move away from the community of explorers, their ideas and thoughts remain in the network, being transmitted from one generation of scientists to another²⁸ in the development of the activities of the society of explorers. Always according to Polanyi, in the Republic of Science there is a collective scientific morality, which is better than an individualized morality. This is directly related to his combat against the moral and ethical model of European nihilism:

And in the present connection I think that the term “nihilist” might be used to cover all people prepared to act --or at any rate to go a long way towards acting-- on the belief that man is governed purely by material interests... As against this, reports from Central Europe often speak of widespread nihilism, meaning a lack of public spirit, the apathy of people who believe in nothing.²⁹

Scientists believe that there is a reality of things, without the belief in realism the collectivity of scientists would not be able to do science and this common belief is one of the characteristics of the society of exploiters. Science is a collectivity, organized in such a way that it preserves the possibility of recognizing who are the individuals that make it up and how they interact with each other.

This self-coordination of independent initiatives leads to a common result that

²⁷ “Thus, the standards of scientific merit are seen to be transmitted from generation to generation by the affiliation of individuals at a great variety of widely disparate points, in the same way as artistic, moral or legal traditions are transmitted” Polanyi, *The Republic of Science*, 1962, p.64.

²⁸ The tacit structure of knowledge gives us the philosophical condition to think that although there is no disinterested or pure perceptual experience of the world, we remain interconnected to the world multifacetedly with the body throughout the process of knowing. Even if we agree that there is no pure perception, our sensibility and the meanings given to the horizons of representation will be imbricated in the process of knowing, where from the less comprehensive levels knowledge is made explicit to the more comprehensive ones. In this process, the perceptual capacity is filled with the world and the personal relationship between the body and the world. We can say with this that perception is impregnated by personal experience in the world from a tacit level of knowledge.

²⁹ Polanyi, Michael. ‘Authority of the free society’, *The Nineteenth Century and After*, no. 146, pp. 347-360, December, 1949, p. 353.

is not premeditated³⁰ by any of those who create it. Their coordination is as if it would be guided by “an invisible hand” toward the joint discovery of a hidden system of things.³¹ The coordination of its members takes place in the system of interaction in which the added efforts of each one, together compose a mutual presentation of results: “[...] the community of scientists is organized in a way which resembles certain features of a body politic and works according to economic principles similar to those by which the production of material goods is regulated”.³²

The personal and independent initiatives of each explorer in contrast to other personal and independent initiatives of other explorers move the network, causing the system to articulate itself in a spontaneous operation. Again, in this system a collaborator cannot predict the outcome of the whole, which is generated.

In the daily activities in laboratories and research institutes, the most experienced scientists consolidate their personal criteria for evaluating what is, or is not, interesting for their work. These same criteria, forged in the day-to-day of scientific practice, are based solely on the personal capacity of each veteran scientist to perceive which data, problems, and observations are interesting enough for the development of research that may result in some innovation. In Polanyi’s thought, this knowledge is not explicit, but tacit, and cannot be taught, only learned by experiencing it in the several daily tasks in laboratories and research groups. This action of knowing, Polanyi calls “indwelling.”

Indwelling would be a way of punctuating the counterpoint Polanyi makes between indwelling in the sense of interiorizing and dwelling as inhabiting. “Indwelling” translates the idea of dwelling inwardly, interiorizing; while “dwelling” refers to inhabiting. The model of knowledge that Polanyi proposes is based on tacit knowing contrasted with explicit knowing. We know tacitly because of the absence of articulated mechanisms in language, dwelling inwardly,

³⁰ Here we could in a way think of Serendipity. Thinking freely about this possibility we would have: chaos, Brownian motion, and the field = knowledge, information, data, insight, rationality, boldness, knowledge exchange (trans/interdisciplinarity), “chance” = serendipity (innovation and knowledge management) = we can see Polanyi in this structure, even if a little caricatured or readapted for other areas of knowledge, especially if we have in mind the practical use of his ideas.

³¹ Polanyi, *The Republic of Science*, 1962, p. 58.

³² Polanyi, *The Republic of Science*, 1962, p. 54.

knowing what we cannot articulate or say explicitly: it is an unarticulated or formal mechanism of knowing.³³ The society of explorers, in doing science, makes use of this unarticulated mechanism of knowing:

Such a tradition assures the independence of its followers by transmitting the conviction that thought has intrinsic powers, to be evoked in men's minds by intimations of hidden truths. It respects the individual for being capable of such response: for being able to see a problem not visible to others, and to explore it on his own responsibility. Such are the metaphysical grounds of intellectual life in a free, dynamic society: the principles which safeguard intellectual life in such a society. I call this a society of Explorers.³⁴

The set of research areas, institutions, groups of scientists and leading scientists³⁵ forms an inter-personal network of knowledge, practices and methodologies that underlie and make up what we call science or scientific research. As scientific research advances, it needs financial resources, increasingly large ones, which can cost the autonomy and freedom of pure science. For Polanyi, investment is made according to the needs encountered during the course of research and not before. Since, for him, it is not possible to plan things in advance, it would not be possible to plan everything necessary for scientific research beforehand, although research is not done without a traditional structure either. Personal commitment involves all research and all action undertaken. The idea would be that throughout the process of discovery the scientist would be personally involved not only with the theories, but also with the data presented and collected, the dissemination of the work, the choice of materials employed in the research, and the laboratory and experimental dimensions used. In other words, there is an ethic involving the whole process that makes the scientist expected to be committed and responsible to the network and to society:

By studying the way tacit knowing comprehends human performances, we saw that what is comprehended has the same structure as the act that comprehends it. The relation of a comprehensive entity to its particulars was then seen to be the relation between two levels of reality, the higher one controlling the marginal conditions left

³³ We can find these references to Polanyi's thought in the preface to the Torchbook edition of *Personal Knowledge*, 1958, and on pages 59, 198, 199 among others.

³⁴ Polanyi, *The Tacit Dimension*, 2009, p. 82, 83.

³⁵ We could call the most important and awarded scientists leaders.

indeterminate by the principles governing the lower one. Such levels were then stacked on top of each other to form a hierarchy, and this stacking opened up the panorama of stratified living beings. This stratification offered a framework for defining emergence as the action which produces the next higher level, first from the inanimate to the living and then from each biotic level to the one above it. This holds both for the development of an individual and for the evolution of living things. Thus emergence took over from tacit knowing the function of producing fundamental innovations; but, as emergence continued to scale the heights leading on to the rise of man, it gradually resumed its encountered form of human knowing. So in the end we were confronted again with the mind of man, making ever new sense of the world by dwelling in its particulars with a view to their comprehension.³⁶

This quotation deserves a commentary since it help us to express clearly the connexion between epistemology and ontology in Polanyi's thought. The concept of hierarchy allows Polanyi to shape his notion of emergence in his ontology, and how this latter notion is connected to his own epistemology. This connexion is signaled by two possibilities. The first one means that the act of knowing and the knower are structured as hierarchies of increasing complexity. The act of knowing is hierarchical through the levels of integration that were reported. The knower's being is hierarchical in its biological-psychological structure as stated by the theory of evolution. The consequence for Polanyi's ontology is the following one: what is understood is an entity with a stratified composition: a subsidiary level on which the higher level depends, and the higher level is the meaning of the subsidiary. In this viewpoint of entities with stratified compositions, meaning cannot be taken from a description of their parts or constituents materials. The second link ("emergence took over from tacit knowing") leads Polanyi to defend that integration operates within one act of knowing. In other words: emergence works in an ontological hierarchy. However, this integration does not mean that determinism is reintegrated into Polanyi's philosophical perspective.

Polanyi is interested in knowledge as pure and applied, the first is mainly theoretical and the second practical, not being contrary, but independent, originating distinct areas of knowledge such as quantum mechanics and agriculture. According to the area of knowledge we would have the possibility of

³⁶ Polanyi, *The Tacit Dimension*, 2009, pp. 55, 56.

creating theories about the cosmos,³⁷ in practice, we could develop interventions in the life world. Science is divided by him into pure and applied sciences.³⁸ In this perspective, the cosmos would emerge as a space of multivision and would also be multifaceted. Teilhard de Chardin calls it the Noosphere,³⁹ which is followed by Polanyi in his horizon of expectations about⁴⁰ life.⁴¹ Polanyi maintains in his philosophy this notion by Teilhard de Chardin and also assumes an intellectual commitment to pluralism, considering the emergentist conception of knowledge and denying the reduction of life phenomena to chemistry or physics, not accepting the conceptions of physicalist biology.⁴² As Polanyi puts it, “This implies the emergence of a new feature: for by imputing to an animal the capacity to err, we presume that it is controlled by a rational centre. The appearance of such a centre clearly opens up a new level of existence, lying above the machine-like automatism or ‘regulative’ processes that constitute life on the lower, physiological, level”.⁴³

Some, like Thomas Kuhn,⁴⁴ could confuse this space of multivision or worldviews as models of incommensurable knowledge, or else not see any

³⁷ It is the collection of everything that exists, from the microcosm to the macrocosm, from the stars to the subatomic particles.

³⁸ Polanyi, Michael. ‘Ciência e Tecnologia: uma seleção de textos’, Transl. Eduardo Beira, Inovatec, Portugal, 2013, p. 46.

³⁹ Polanyi uses Teilhard de Chardin’s concept of the noosphere. According to this notion, we can think of three spheres, all located topographically or physically in the same place, but conceptually concentric, with outer spheres emerging from inner spheres. The innermost (internal) sphere is the geosphere, the physical material that makes up the earth, the next sphere is the biosphere, life emerging at a new ontological level from the geosphere. The next sphere, emerging from the biosphere and forming an ultrabiological level of existence, is the noosphere: an articulated context that constitutes our cultural heritage and that sustains and is sustained by a vast interdependent network of intellectual fulfillment of the human individual.

⁴⁰ Teilhard de Chardin, Pierre. ‘Le phénomène humain’, Paris, Éditions du Seuil, 1955.

⁴¹ We find references to the noosphere mainly in Polanyi, *Personal Knowledge*, 2005, pp. 410, 411, 416, 418.

⁴² Roughly speaking, physicalist thought compares animals to machines and explains natural phenomena from precise mathematical models; it also defends the metaphysical thesis that everything is physical or a form of ontological monism of substance in philosophical opposition to dualism and pluralism. The word “physicalism” was introduced into philosophy only in the 1930s by Otto Neurath and Rudolf Carnap, members of the Vienna Circle. Neurath, Otto. 1931, ‘Physicalism: The Philosophy of the Vienna Circle’. In: R.S. Cohen, and M. Neurath (eds.), *Philosophical Papers 1913–1946*, Dordrecht: D. Reidel Publishing Company, 1983, pp. 48-51 and Carnap, Rudolph. ‘Psychology in Physical Language’. [1932/33] In: A.J. Ayer (ed.), *Logical Positivism*, New York, The Free Press, 1959, pp. 165-198).

⁴³ Polanyi, *The study of man*, 2014, p. 58.

⁴⁴ Kuhn, Thomas S. ‘The Structure of Scientific Revolutions’, Chicago, UCP, 1970.

possibility that this could actually occur, defending the commensurability between the possible worldviews. Polanyi thinks differently. For him, there is effectively neither commensurability nor its opposite, but rather the intersection between knowledge models, ways of seeing the world or between fields of knowledge marked by an archimedean point⁴⁵ where the various fields of knowledge are amalgamated. For Polanyi, science is structured from this network of intersections between the most varied fields of scientific knowledge:

And, of course, each scientist who is a member of a group of overlapping competences will also be a member of other groups of the same kind, so that the whole of science will be covered by chains and networks of overlapping neighborhoods. Each link in these chains and networks will establish agreement between the valuations made by scientists overlooking the same overlapping fields, and so, from one overlapping neighbourhood to the other, agreement will be established on the valuation of scientific merit throughout all the domains of science. Indeed, through these overlapping neighbourhoods' uniform standards of scientific merit will prevail over the entire range of science, all the way from astronomy to medicine. This network is the seat of scientific opinion. Scientific opinion is an opinion not held by any single human mind, but one which, split into thousands of fragments, is held by a multitude of individuals, each of whom endorses the other's opinion at second hand, by relying on the consensual chains which link him to all the others through a sequence of overlapping neighbourhoods.⁴⁶

This way of conceiving science and its structure sometimes seems to be an ideal, thinking about how everything should be, and sometimes it is linked to personal experiences lived by Polanyi himself, giving a descriptive aspect to the scientific environment and its practices. In the network, the spaces for specialized knowledge and those that are more comprehensive will also be defined.⁴⁷

⁴⁵ Archimedes. 'The works of Archimedes'. Transl. Thomas L. Heath. New York, Dover Publications, [1912] 2002. Kant, Immanuel. 'Kritik der Reinen Vernunft', Hamburg, Felix Meiner Verlag, 1998. Philosophical current concerning Archimedes, which says that every thought has a fixed point from which the thinker has a vision of the whole, to relate things among themselves. Rational criterion, a parameter established by realism, pointed out by Kant as one of its strong points. Does Polanyi use this expression? He does not use it clearly, but he is certainly influenced by this idea, even for having opted at one point for phenomenology and before for Aristotle and the Greek physicists.

⁴⁶ Polanyi, *The Republic of Science*, 1962, pp. 59-60.

⁴⁷ The notions of *focal* and *distal* define what knowledge and the expert knower is from those who are neither expert knowledge nor are the experts. Reflecting on how Polanyi was trying to lay out his ideas philosophically, perhaps in creating the terms *distal* and *proximal* he was using terms from anatomy to guide

THE STRUCTURE OF TACIT KNOWLEDGE AND THE CULTURE OF CONVIVIALITY

For Polanyi, knowledge is also understood as an ability to use what is supposed to be known. We know the entity not when we visualize it, but when we understand the whole that gives it meaning. Such a complex structure is conditioned by the interiorization of the subject in the particulars, in the proximal, observing for itself and being, for this very reason, aware of its relations with the comprehensive entity formed by the set of proximal and distal terms. However, if we examine the details that make up the set, its meaning is undone and, thus, we lose the sense of the more comprehensive and understanding entity.

Polanyi organizes tacit knowledge into two acts of attention: one focal and one subsidiary.⁴⁸ As an example, we can say that when we look at any object, we pay focal attention only to what is observed and not to all the particular elements that make up the object. That is, we give focal attention to that which significantly defines what was observed as a whole.⁴⁹

In addition to the observable object, the human mind retains reminiscences of previous contacts with the observed object resulting from lived experiences. Here we find what for Polanyi is called subsidiary attention. The two types of attention, focal and subsidiary (distal and proximal), are mutually exclusive: when we pay focal attention, we don't pay attention to what is subsidiary and vice-versa. For Polanyi, these types of attention given to the experienced are not about perception. As an example, we could think of the visual perception of something. In this sense, when we perceive something, we will give focal or subsidiary

his ideas, making them explicit. Anatomically, "distal" is the furthest part of the trunk or point of origin and the opposite of "proximal". Taking one of the hands as an example, it is the distal end of the upper limb, the arm. The word proximal is applied in anatomical description to indicate that the referred part of the body is located closer to a center, a joint, a trunk or a midline.

⁴⁸ There is a rhythm in Polanyian thought intermingling here the ideas of focus, something outside the body and explicit, and, subsidiary, something inside the body and not explicit. The focusing and blurring, the convergence or not of what is seen, seem to guide us to this curious understanding. Nowadays, in the administration field we find the idea of focus linked to that of coordination of activities. A single point of contact, or "point of contact" (POC), is terminology used to represent a person or department that serves as the coordinator or focal point for information about an activity or program.

⁴⁹ "I shall adopt a variant of this usage by saying that in an act of tacit knowing we *attend from* something for attending *to* something else; namely, from the first term *to* the second term of the tacit relation. In many ways the first term of this relation will prove to be nearer to us, the second further away from us" Polanyi, *The Tacit Dimension*, 2009, p. 10.

attention to what is seen, and the attention is then given either to the context where everything happens or to the object that is in a context; by giving attention to the context, we lose the object and vice-versa.

From these two types of attention paid in the act of knowing, we will have two terms of tacit knowledge: proximal and distal. “The two terms of tacit knowing, the proximal, which includes the particulars, and the distal, which is their comprehensive meaning, would then be seen as two levels of reality, controlled by distinctive principles.”⁵⁰ The first term, proximal, is subsidiary, involving biological, psychological, and epistemological processes at inner levels of the emerging structure of the human mind. The second, distal, refers to the explicit knowledge of all that is experientially observed, involving the meaning of things in the world at the horizons of possible representations.

We may say, in general, that we are aware of the proximal term of an act of tacit knowing in the appearance of its distal term; we are aware of that from which we are attending to another thing, in the appearance of that thing. We may call this the phenomenal structure of tacit knowing.⁵¹

The proximal and distal are related both functionally and semantically in tacit knowledge. As an example, we can think of a person’s face that is recognized by us in everyday circumstances, taking into account favorable lighting conditions and distance. When we recognize someone’s face, we give it focal attention, recognizing the person’s features in their entirety or as a whole. We rely subsidiarily on the various unique features that together make up the recognized face. If we gave subsidiary attention to the proximal term, such as the nose, the eyes, the mouth, the ear, the hair, the eyebrows, we would lose the larger conforming set of the face, and thus we would not recognize the face, having only clues and not certainty about the person. This kind of relationship between the proximal and distal terms is functional, because what matters is the recognition of the face by the confidence held in the set of subsidiaries that form it, therefore the focal attention is intended and not the subsidiary one. Since the distal term, revealed by focal attention, imparts explicit knowledge to the experienced, it is the distal that gives meaning to what is proximal, making this relationship

⁵⁰ Polanyi, *The Tacit Dimension*, 2009, p. 34.

⁵¹ Polanyi, *The Tacit Dimension*, 2009, p. 11.

between distal and proximal terms a semantic relationship, replete with meanings that vascularily irrigate the perceived with explicit knowledge. Perception amalgamates the particulars in a meaningful way for the one who personally coexists (“convivial relations”) in the world and intends to make discoveries in this conviviality.⁵² In this sense, the meaning of things in the world can be creatively imagined and visualized by the human mind. “The image of consecutive levels, unaccountable by the principles governing the levels below them, offers us a sharp definition of creativity. It defines creativity as the emergence of a new, irreducible higher principle”.⁵³

A telling case is that of a pianist, who, when playing a song on the piano, is focused on acting in such a way that all the rehearsals and studies of the score can be put into practice while playing the keys of the instrument. The musician knows that his or her body will make pertinent movements and intends intentionally, imbued with the many hours of training and study, that his or her body will execute the movements naturally. Keys and fingers compose a set with the rest of the body, making the piano keys become like parts of the musician’s body while playing music. The pianist is not focused on the movement of the fingers, she/he doesn’t follow with his own eyes the movement of hands and fingers, because if she/he does, that is, if she/he focuses on the particular movements of each finger of each hand, she/he will end up getting lost in secondary situations, not being able to inhabit the comprehensive experience of the music being played. The set of hand and finger movements with the piano keyboard, added to the study and rehearsal of the execution of the piece of music, form a more comprehensive and comprehensive whole which is the pianist’s musical concert.

A second example: you can know how to use a machine without knowing exactly how it works or how it was designed and built. A theory about “how to drive a car” will not turn its scholar into a race car driver. But the ability of someone recognized as a great car driver cannot also be replaced by a driver-

⁵² Conviviality is an act, an action, and in this way the action would be to convivialize. The idea of conviviality brings in itself notions that also incorporate the idea of collectivity and humanities, counterpoints to individualism and uniqueness in Polanyian thought. Besides the interdisciplinarity and the non-philosophical affiliation of Polanyi, expressive in his thought.

⁵³ Polanyi, Michael. ‘Society, economics, and philosophy. Select Papers’, Edited by R.T. Allen, London and New York, Routledge/Taylor & Francis Group, 2017, p. 327.

training education system or a theory about automobiles. The knowledge we have of our body is not the same as having knowledge of physiology. The examples could be multiplied, but the two discussed above are sufficient to provide an overview of how Polanyi structures his thinking as a function of tacit knowledge being related to complexity and emergence.

The structure of tacit knowledge takes place in the function between that from subsidiary to a focal one, which is why it is referred to as a from-to knowledge. Knowing is a personal act and it is from this (personal) point of view that the subsidiary parts are integrated into the focus, making the knowledge explicit. The structure of this process can be understood as a “triadic” formation, where we have the person who knows; the focus, represented, for example, by the object; and the subsidiary parts, which are the proximal term. The subsidiary parts together conform what is represented by the distal term when focal attention is given to the object. Both the triadic structure of personal knowing and the tacit from-to process in the act of knowing change and are lost every time personal focal attention ceases, either because of another focal attention or even a subsidiary attention in progress, and something then goes from subsidiary to focal, depending on the attention personally elaborated in the act of knowing.⁵⁴

Subsidiary particulars are essentially “non-specific” and therefore, according to the focal or subsidiary attention, make it possible for the aggregation of meaning to occur, as well as the loss of meaning during the process. Because tacit knowledge is composed of proximal and distal terms, and, furthermore, because in this from-to process there is the apprehension of the broader entities that are ultimately conformed by the particulars, we will consequently have both the unveiling of reality in the truth format of knowledge and very difficult reconstructions of the subsidiaries that make up the structure of what is recognized during the process. These would be the logical conditions acceptable if knowledge and its novelties were achieved according to the tacit operability

⁵⁴ “The mind itself includes an ascending sequence of principles. Its appetitive and intellectual workings are transcended by principles of responsibility. Thus, the growth of man to his highest levels is seen to take place along a sequence of rising principles. And we see this evolutionary hierarchy built as a sequence of boundaries, each opening the way to higher achievements by harnessing the strata below them, to which they themselves are not reducible. These boundaries control a rising series of relations which we can understand only by being aware of their constituent parts subsidiarily, as bearing on the upper level which they serve” Polanyi, *Ciência e Tecnologia*, 2013, p. 141.

of personal knowing.

Knowledge is this personal act, conformed by personal experiences, by perceptual capacity, and by the tradition in which conviviality is called to evolve. Dwelling in the particulars allows the meaning of the observed in the context of experience, without the perceptions of subsidiary singularities interfering with the focal attention given to the object treated in approaches about reality. Therefore, this knowledge is neither objective nor subjective. “Our body is the ultimate instrument of all our external knowledge, whether intellectual or practical.”⁵⁵ Thus, Polanyian thought, while giving the knower responsibility for his work because of the universality of the claims of the knower, also removes any superhuman capacity from those who develop knowledge. The scientist, just like any other person, is not capable of making impartial and objective observations about the world, although, like any other specialist, he or she has greater capacity, that is, he or she may even be the only one who has the capacity to deal with certain problems when they are discovered from specific and exclusive theories and processes of research.

The scientist participates personally in the discoveries she/he makes, she/he acts relying on this amalgam between the subsidiary and the focal, on the clues he finds and on the explicit knowledge learned from an interpretative tradition of the world, and much of what she/he knows and claims she/he cannot make explicit, since a good part of the tacit knowledge process is inexpressible, and ideas are much more used than exactly presented in a conceptual form.⁵⁶ Once again: we use more ideas than we conceive concepts.

CONCLUSION

To compose his understanding about complexity and emergentism in the interactions between human beings and nature, Polanyi draws on both his experiences in laboratories and in society. He believes that the interaction

⁵⁵ Polanyi, *The Tacit Dimension*, 2009, p. 15.

⁵⁶ “It determines also the manner in which the ‘happy thought’ eventually presents itself as something inherently satisfying. It is not one among a great many ideas to be pondered upon at leisure, but one which carries conviction from the start. We shall see in a moment, from a closer analysis of this process, that this is a necessary consequence of the way a heuristic striving evokes its own consummation”. Polanyi, *Personal Knowledge*, 2005, p. 13.

between human beings and nature is complex, and from this interaction culture and tradition emerge. In thinking about things in the world, this complexity is inevitably taken into account, since it cannot be denied that each and every experience in the world will be personal and complex. Decisions and their consequences must take this epistemological foundation into account. Complexity is therefore inescapable.

Such a conclusion was so fundamental and relevant to our thinker that he goes so far as to justify, not only science, but also criticism of economic and political systems such as, for example, capitalism and communism, because they simplify ways of seeing the world and their decisions. Both systems fail to respect the complexity that inherently constitutes the interactions between humans, culture, and nature. Reductionism becomes a problem both for science and for interactions in the world whatever they may be.

From the recognition that everything emerges complexly, crises will be inevitable, even unavoidable, and must be faced without simplistic or reductionist solutions, because there would be no ideal, perfect, and unscathed answers to be accepted and shared. Thus, the peripatetic walk makes sense, because what Polanyi is telling us is that because we cannot eliminate what is bad, what is evil, or some disease, we must learn to live with it. We must work with what is possible, and not with what is ideal, always maintaining creativity as the essential characteristic of the researcher and the inexactness of what is known as its foundation.

The notion of inexactness is inserted in contemporary discussions about diversity, about how homogeneity is a danger to human development, about how we can live with diversity, about the emergence of the new in a traditional environment and traditional practices, and how all these ideas are also valid for science and its development: the new is the fruit of the knowledge tradition and not something inexistent until then. Complexity for Polanyi is not restricted to the philosophy of science. With this he also intends to point out how important values, tradition, humanity, diversity and pluralism are in the understanding structure about life and how emergentism is not secondary in his epistemology.

In addition, there is also Polanyi's attitude, always more interested in proposing new theses than consolidating them. The result of these two "characteristics" is this: his one thought is at once profound and entangled. Each and every notion allows one to traverse the length and breadth of his thought.

Polanyian philosophy proposes itself as an inter and transdisciplinary amalgam.

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