

# Emergence and Steps Toward Neo-Polanyianism

## A Fifty Year Celebration

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[1] *Emergence is “the appearance of new properties or species in the course of development or evolution.”*

Dictionary.com

[2] *“Emergence refers to the development of complex, unprogrammed behaviors and capabilities in a large and interconnected system. These emergent behaviors cannot be predicted or easily explained by analyzing the system’s individual components alone.”*

Microsoft Copilot AI

[3] *I have grown suspicious of the word emergence and the concepts it designates. More often than not, the term seems to serve as a deus ex machina whenever other models or theories cannot account for a certain new aspect or object. Emergence is then used as though it were based on a concept or a theory, when all the term does is label something as complex, unpredictable, and only comprehensible after the fact.*

Wibke Schneidermann<sup>1</sup>

[4] *I think a good case can be made that science has now moved from an Age of Reductionism to an Age of Emergence, a time when the search for ultimate causes of things shifts from the behavior of parts to the behavior of the collective.*

Robert B. Laughlin<sup>2</sup>

[5] *Self-organization is “a dynamical and adaptive process where systems acquire and maintain structure themselves, without external control.”*

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<sup>1</sup> Wibke Schneidermann, “The Trouble with Emergence.” *On\_ Culture* issue 1 (Spring 2016): <https://doi.org/10.22029/oc.2016.1099>.

<sup>2</sup> Robert B. Laughlin, *A Different Universe: Reinventing Physics from the Bottom Down* (New York: Basic Books, 2005), 208.

[6] *[I]t is not the emerged higher form of being, but our knowledge of it, that is unspecifiable in terms of its lower-level particulars. We cannot speak of emergence, therefore, except in conjunction with a corresponding progression from a lower to a higher conceptual level.*

Michael Polanyi<sup>4</sup>

[7] *A system exhibits emergence when there are coherent emergents at the macro-level that dynamically arise from the interactions between the parts at the micro-level. Such emergents are novel with respect to the individual parts of the system.*<sup>5</sup>

No phrase is more commonly—and aptly—associated with Michael Polanyi’s mature thought than “tacit knowing.” The concept of tacit knowing includes his theory of the from-to structure of consciousness and the distinction between subsidiary particulars and focal meaning. These interrelated terms are epistemic in nature. However, Polanyi is just as concerned to characterize the ontological status of what is known as he is to describe the process of knowing. Epistemology and ontology are tightly connected in his thought. They emerge in tandem. This closeness is rather surprisingly expressed. He explicitly identifies “emergence with tacit knowing” (TD 88).

If Polanyi sees tacit knowing to be identical with emergence, then it seems imperative to devote much more attention to how he understands emergence than has been the case in the past. This article is an attempt to rectify that apparent neglect. A thorough examination will necessarily require the study of such associated terms as “comprehensive entities,” “dual control,” “levels,” and “stratified universe.”

To adequately portray an understanding of what Polanyi is referring to when he speaks of emergence, it will be necessary to compare his notion with the several

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<sup>3</sup> Tom De Wolf and Tom Holvoet, “Emergence Versus Self-Organization: Different Concepts but Promising When Combined.” In Brueckner et al., eds. (ESOA 2005), 7.

<sup>4</sup> Michael Polanyi, *Personal Knowledge: Towards a Post-Critical Philosophy* (New York: Harper Torchbooks, 1964), 393-394.

<sup>5</sup> Tom De Wolf and Tom Holvoet, “Emergence Versus Self-Organization,” 3.

ways it has been described in recent literature. This requires more than a brief survey. One outcome of the investigation will be noticing that throughout his career Polanyi dealt with concepts that, while not named “emergence,” are closely associated with current notions of emergence. Unfortunately, once he started using the term “emergence,” he lost precision in his thought by using it to refer to such apparently different processes as the origination of life, the evolution of species, and the from-to creation of explicit entities from their tacit roots. Polanyi usage is not clearly related to current scientific understanding of emergence. Polanyi’s notion of emergence and the associated terms mentioned in the previous paragraph require at least clarification if not modification that edges toward Neo-Polanyian thought.

### **What Is Emergence?**

The seven opening quotations reveal how controversial the notion of “emergence” is in scientific and philosophical discourse. A brief survey of how the term has been and, especially, now is used will provide a context within which Polanyi’s understanding can be understood.

In an influential earlier understanding of emergence theory, Lloyd Morgan argued that emergence has a fundamental role in science. For instance, he stated that “When carbon having certain properties combines with sulfur having other properties there is formed, not a mere mixture but a new compound, some of the properties of which are quite different from those of either component.”<sup>6</sup> The example refers to a shift from the individual properties of its components to a combined product that is novel with respect to its components as noted in quotations [1] and [7]. But many such shifts involve chemical processes that are predictable and controllable by outside agents. Thus, carbon disulfide (CS<sub>2</sub>) as an integrated product belongs to the same chemical world as its components sulfur and carbon, so the language of chemical synthesis seems more appropriate than describing the change as an unpredictable shift in kind from a lower to a higher ontological level. As we shall see, the notion of emergent levels is more usefully

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<sup>6</sup> C. Lloyd Morgan, *Emergent Evolution* (London: Williams and Norgate, 1923), 3, quoted in Brian P. McLaughlin, “The Rise and Fall of British Emergentism” in *Emergence: Contemporary Readings in Philosophy and Science*, Mark A. Bedau and Paul Humphries, eds. (Cambridge: MIT Press, 2008), 32.

relevant to biology and the world of human contrivances than to the realms of physics and chemistry.

In quotation [4], Laughlin offers a dramatic claim about the importance of emergence in scientific understanding of the world. In his telling, emergence theory replaces reduction as the driving force for scientific advance. If that is so, why has there been so little attention devoted to emergence in physics classes? Understandably, basic college physics textbooks routinely cover established laws and facts generated in the history of scientific research. Reductive analysis from wholes to particulars to other more elementary components has played a vital role in explaining the principles, structures, and processes that constitute the physical world. That usage is legitimate. Emergence theory, in asserting the autonomous nature of a higher level, ensures that reduction has not been misapplied to eliminate the notion of ontologically distinct levels. It also denies claims that any phenomenon can be adequately explained in terms of its simpler parts alone.

Quotation [3] by Schneidermann articulates a common reaction against the adequacy of emergence talk. She sees emergence as a fuzzy notion that has no explanatory force. This view explains, at least in part, why emergence is so little discussed in educational circles. She accurately suggests emergence is often used as a descriptive rather than an explanatory term. Nevertheless, it serves a useful role. It at least identifies events and consequents that elude explanatory adequacy. Moreover, it can be affiliated with a helpful model of emergent outcomes based on identifiable context, process and structure.

Quotation [7] in combination with quotation [2] make the following points about a scientifically adequate understanding of emergence. An emergent entity or behavior has properties and relationships distinctly different from the properties or behaviors of any of its parts and therefore has its own autonomous integrity. But unlike the overly simplistic definition [1], the scientific understanding of emergence requires that its outcome is a novel product created by the interaction of its parts. On this basis it is inappropriate to call the shape of a pile of sand emergent because the grains of sand are not changed chemically or in any other way in the pile. The pile is a result of conglomeration rather than integration and emergence.

The introductory quotations do not make clear a distinction that tends to be overlooked in discussions of emergence. Emergence may be understood as a *process* in distinction from being seen as the *product* of a process. The dynamic details of the process have event-like qualities. Sometimes the outcome of the process is theoretically analyzable in mereological part-whole terms.

Let us look at the process aspect of emergence as it culminates in novelty. I believe the following description provides a useful structure for understanding different varieties of emergence. Through analysis one can distinguish 1) a specific material environment within which 2) a trigger can initiate 3) a process involving 4) interacting components in 5) a structure that results in 6) a novel holistic higher-level outcome. When that outcome is understood to be predictable and reducible in theory, even if complete explanation is not known at present, the event is generally called an example of weak emergence. The quotation [6] by Polanyi is an example of the stance of weak emergence. It is not, however, the only stance Polanyi takes in this regard. When novel wholes emerge apart from any plausible reductive or causal explanation—that is, where there is an unbridgeable explanatory gap—this is termed an example of strong emergence.

The process of emergence involves *change* and (re)*ordering*. Understanding how *novelty* arises in the cosmos is a first prominent outcome of studying emergent processes. Emergent novelty and creativity are more than merely the outcome of the well-understood laws of deterministic natural science. Emergence is not just a matter of change in general. The earth continually changes its physical face to the sun, but the routine pattern of day and night is not emergent in terms of the systemic definitions given above. However, quotation [1] does assert a key notion that is found in any and all definitions of emergence; it forms an entity or phenomenon whose properties are different in kind from the properties of its antecedent parts.

The novel difference between parts or particulars and higher-level wholes is expressed in terms of distinct ontological or epistemic *levels*. The higher-level whole has properties different from the properties of its lower-level components. Note that to be emergent the lower-level components must interact in some way to create the higher-level; they don't just exist side by side or at different non-interactive levels. The higher-level outcome may be a new *property*, *pattern*, or *process*. Common examples include swarms, traffic jams, and ant signaling

networks as higher level phenomena in contrast to the individual actions of bugs, cars, or ants. Polanyi made considerable use of the notion of levels. We will examine the various types of level later in this essay.

We have already noted that emergent process(es) generally *fail to offer* the complete *prediction and explanation* of their outcome. This observation leads to another aspect of emergence that is different in kind from the aspects already described. Events that are called emergent typically involve an element of *surprise*. This phenomenological point of view involving novelty occurs when specific change is not anticipated or understood. While the qualities of a cake are different from the qualities of its ingredients, an experienced baker is confident that she understands the outcome of mixing and then baking those ingredients, It is not ordinarily seen as an amazing emergent process. From a phenomenological perspective, what is emergent should be enveloped in mystery or at least lack of understanding. Obviously this is not a measurable, scientifically based view of emergence, but it can be useful in avoiding such extravagant usage that the term becomes otiose.

Members of the Santa Fe Institute, famous for their development of complexity theory, have for the past forty years proclaimed the crucial importance of emergence theory for understanding everything from quantum theory to social behavior to the Big Bang—see quotation [4]. Complexity theory includes the abstract phenomena of chaos theory with its attractors and other mathematical structures. Its development is reliant on the repetitive iterations that computers make possible. It provides insight into why large-scale changes are unpredictable in their details. Predicting weather becomes less and less reliable the farther in the future the prediction ventures. Such systemic change is not subject to thorough causal explanation. In the complex nonlinear processes characteristic of many systems of being, understanding the change that will occur is not only unknown, it is impossible to predict. Complexity theorist Melanie Mitchell notes that [8] “the presence of chaos in a system implies that perfect prediction *à la* Laplace is impossible not only in practice but also *in principle*, since we can never know [initial conditions] to infinitely many decimal places.”<sup>7</sup> The butterfly case. Both emergence as embedded within complexity theory and emergence as described in definition [7] are acceptable scientific understandings of the phenomenon.

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<sup>7</sup> Melanie Mitchell, *Complexity: A Guided Tour* (New York: Oxford University Press, 2009), 33.

Because the indeterminate tacit origins of human thought and action make impossible full comprehension of any initial physiological state, the seemingly remote, abstract nature of complexity theory can plausibly be applied to the rise of our individual experience. If so, the applicability of complexity theory to human experience opens up a broad range of body-based cultural phenomena that can be called emergent. Novelty, indeterminate future manifestations (rather than reliable prediction), and analysis in terms of levels therefore justifiably have a place as emergent phenomena in analyzing human thought and behavior. In accordance with seeing such widespread complexity in human experience, complexity guru Stuart Kauffman speaks of emergent phenomena in varied ways that stretch from agency and autocatalytic sets to legal language and new ways of making a living.<sup>8</sup> The phenomenological criterion of surprising results can usefully prune from discussion occasions that could be called emergent, but whose outcome is well understood and often controllable.

Self-organization (quotation [5]) differs scientific emergence theory per se because its results need not be unexpectantly novel, involve the production of a new level of being, or involve complexity theory. To perceive that a process is self-organized, it is important to discern that the process's systemic boundaries are not violated so that the system operates autonomously. The significance of self-organization will become evident later in this essay.

In summary, the term “emergence” is used in a variety of sometimes inconsistent ways. Let us examine Polanyi's understanding to see where it fits in the array of versions, and further to see if it provides insights other versions do not.

### **Polanyi on Emergence: Scientific Background**

Michael Polanyi really only began making explicit use of the notion of emergence in the 1950s. He focused on it toward the end of his career in the 1960s. But in fact, he made use of processes and structures earlier in his career that are consistent with processes and outcomes that have been termed emergence by scholars for a century. His interests shifted as the winds of cultural and social

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<sup>8</sup> Stuart Kauffman in *Reinventing the Sacred* (New York: Basic Books, 2008) employs this broad usage of emergence. He states that the “existence of multiple examples leads to the conclusion that emergence is not rare. It is all around us” (p. 119).

import waxed and waned. While he explicitly discussed emergence prior to the full development of complexity theory, his long-term interest in change and order is pertinent to any discussion of emergence. His thought includes reflections that reach from physical chemistry to economics, political theory, philosophy, and the arts—in short, the many ways meaning is constructed. The reach of his thought forms a useful base from which to assess which notions of change and ordering are most aptly called emergent.

I have found it useful to think of Polanyi's thought as developing in three overlapping phases.

The first phase (roughly 1915-1940) arose from his career as a physical chemist. While a medical student, he wrote and published a paper on thermodynamics. That work expressed what became his lifelong interest concerning change, order, and processes of equilibrium. Einstein's positive response to the paper inspired him to launch his career in physical chemistry. He worked with crystals, seeing them as intelligible ordered patterns that stand out in contrast to randomness (see *PK*, chapter 3). Emergence theory is all about ordered processes and results. His pioneering insights into adsorption, kinetics, and especially chemical reaction rates could be interpreted in terms of emergence. From the time of his earliest ponderings on thermodynamics, he approached scientific inquiry and discovery as a rationalist. He imagined and intuited rational patterns of reality awaiting discovery. That is, he found empiricism to be an inadequate basis for the discovery of forces and laws. Rather he saw experimentation and measurement of empirical data to be a matter of confirmation rather than the leading edge of discovery. His view that coherent ideas have priority for insight over sensory data was evident when he submitted his thesis for a Ph.D. for review and it was found his result seemed right, but his derivation was faulty. He admitted that even in philosophical thought "one must shoot here first and ask questions afterwards, as I have always done—for better or worse."<sup>9</sup>

Polanyi noted that the complexity of chemical processes often resulted in ill-defined results that stand in contrast to the clarity of calculations in physics. This point is indicated in the following comment from his 1936 letter to the journal

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<sup>9</sup> Michael Polanyi commenting in *World Authors 1950-1970*, ed. by John Wakeman (New York: H.W. Wilson Co., 1975), 1152.

*Science*: “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.”<sup>10</sup> The letter indicates that because of the indeterminacy of initial conditions in chemistry he would have been fully sympathetic to the version of robust complexity emergence described above (see quotation [8]). Scientific discovery does not come from simply applying the laws of physics to changes, but requires sensitive rational assessment of highly complex systems of interacting entities. His work in physical chemistry prepared him to understand later the difference between deterministic emergence in physics and complex environmental emergence in biology, with chemistry falling somewhere between these two disciplines with respect to indeterminacy.

Throughout his career, Polanyi idealized the stability and productivity he experienced while working at the Kaiser Wilhelm Institute in Berlin. There a community of scholars and researchers were united in their understanding of scientific tradition and its values, especially the pursuit of truth. In his appreciation of the bonding together and commitment to truth of physical scientists, he prepared the way for a relatively smooth transition from the first phase of his career to his inquiries in the social sciences, the second phase, and ultimately to the arts and humanities of his third phase.

In 1933 Polanyi moved from Nazi infested Germany to England. There he encountered English scientists who, influenced by Marxist idealism, argued that funding for science should be restricted to planning for social welfare. Technology and applied science have their places, but Polanyi saw that the pure scientific research he had practiced would be neutered if tied to a preexisting purpose. In a nonlinear world of indeterminacy and change, scientific discovery must be attuned to where the evidence leads, not shackled to some predetermined end. Finding interesting problems to investigate and problem solving are themselves acts of emergent insight; they are not produced through logical paths of deduction.

### **Polanyi on Emergence: Social Relations**

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<sup>10</sup> Michael Polanyi, “The Value of the Inexact,” *Tradition and Discovery* 18:3 (1991-1992), 35.

The second phase of Polanyi's thought (overlapping with his scientific work at first and lasting roughly from 1935 to 1950) involved seeking to remediate the first half of the twentieth century's social order within which the disasters of depression, totalitarian rule, and world wars occurred. He attempted this renovative mission by proposing a more ideal functioning of Liberal society. He devoted special attention to the significance of faith and tradition for sustaining social welfare as well as being necessary for scientific progress. His remarkable 1941 essay, "The Growth of Thought in Society," develops ideas that continued to percolate during the following phases of his thought. He states, "The purpose of this essay is to analyze the part played in society by the ideal of Science and the ideals of other aspects of truth. We shall trace the principles of organization which are appropriate for the service of these ideals, and through which the intellectual and moral order of society is established and developed further."<sup>11</sup> An *emergent* higher-level notion of social order is at stake in his inquiry. In moving from the physical sciences to the social sciences, he introduced the notion of *purpose* into his reflections on order and emergence theory.

Polanyi addresses social order by contrasting a) order designed and imposed top down on individuals through enforced laws with b) order in a system of constraints that, in applying to all equally, allows for order to arise spontaneously by participants free to interact with each other. At stake is how best to structure society so it allows for life enhancing responsiveness to *emerge* in the face of changing circumstances. Imposed order is important in military and police operations. Two types of top-down order can be distinguished. Direct action can be commanded, as when a general orders a soldier to report to, say, Manila, or orders a unit to oppose the enemy at a certain area. The individual so ordered has no lawful freedom to do anything other than follow the order. But top-down command can also set up authoritative structures that allow individuals freely to interact in relation to set purposes. The market ideally flourishes when imposed regulation establishes fair constraints affecting all participants, and spontaneous order is established bottom-up within that constrained context by individuals creatively responding to shifting conditions.

Top-down decisions may be arrived at by an authority figure or group through their emergent processes of discernment. But imposed rules, fiats, or

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<sup>11</sup> Michael Polanyi, "The Growth of Thought in Society," *Economica* 8 (November 1941), 429.

injunctions themselves are overly rigid in the faces of changing circumstances. They would constrain actions in service to an inflexible result rather than be the indeterminate emergent outcome of multiple factors interacting. Conversely, Polanyi sees political and economic Liberalism centered in the regulated marketplace to be a structure within which pliable emergent results can prosper. In a social order, interaction between individuals with their own set of interests and values results in what Polanyi called “dynamic order” using Köhler’s terminology. Polanyi portrayed scientific advance, rule by Common Law, and market activity conducted among equals as examples of dynamic order. He insisted that such varied cultural systems as the arts, medicine, and agriculture also operate as expressions of dynamic order.<sup>12</sup>

The guide-rails provided by well-formed social structures ensures that dynamic orders do not operate randomly. Regulation based on commonly agreed upon purposes, rules, and values is needed to ensure the efficient and just operation of dynamic orders. Scientists, for instance, operate as implicit members of a guild in which such values as truth-telling and the authority provided by refereed journal publication must be honored. Scientific values operate in a guiding, supervisory manner rather than as restrictive laws. Such values coalesce into protective *traditions* guiding and stimulating the emergence of new insights. Polanyi believes society as a whole requires such guidance. This is provided in part by governmental regulation, religious and moral codes, and more deeply by individuals volunteering themselves for public service and the common good. People choosing such careers as teaching, medicine, and social service ideally dedicate their lives to the “public liberty” that helps a society thrive.

In sum, Polanyi in *The Contempt of Freedom, The Logic of Liberty*, and *Science, Faith, and Society* describes a free society “which is not an Open Society [referring to Karl Popper’s ideal], but one fully dedicated to a distinctive set of beliefs.”<sup>13</sup> His most basic concern from the mid-1930s until early in the 1950s is to avoid totalitarian destruction of freedom and demonstrate how the higher-level purpose of social flourishing is best able to *emerge*.

## **Polanyi on Emergence: Evolution**

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<sup>12</sup> Ibid., 438.

<sup>13</sup> Michael Polanyi, *The Logic of Liberty* (Indianapolis: Liberty Fund, 1998 [1951]), xviii.

The third phase of Polanyi's thought (roughly 1950-1970) came about as he realized that to counter the positivism and what he called moral inversion that impaired personal and social health in the twentieth century, he needed to develop a philosophical position that showed how the reliable knowledge needed for prosperity emerges and can be sustained. Consequently, he focused less on social issues and more on persons as agents involved in the pursuit and achievement of the understanding and knowledge necessary for flourishing. Seen as a polymath excited about learning, problem solving, discovery, social welfare, and faith, Polanyi was invited to give the prestigious Gifford Lectures. These were instigated to show how natural theology and reason might advance the sort of goals Polanyi honored. His publication in 1958 of *Personal Knowledge* based on those lectures culminated in an account of what he called anthropogenesis. He believed an account of evolution is needed to explain how human cognition emerged to be a reliable source for surviving in a challenging world. His goal was to show how we as persons actually attain reliable knowledge balanced to include both scientific inquiries as actually practiced and humanistic concern for advancing the quality of life. Does his account of emergence accomplish his goal?

In *Personal Knowledge*, Polanyi states that no "richly endowed new reality can be seen emerging in the inanimate domain" (PK 394). Meaningful emergence is restricted to the processes of life and its development. Polanyi begins his account of the "inherently unformalizable processes" that account for the rise of higher-level life from the lower-level meaningless realm of physics and chemistry by referring vaguely to a "kind of active emergence" (PK 382). His insistence on the indeterminacy of the process indicates he acknowledges that predictability is impossible in principle. These points suggest that his theory of evolutionary emergence is compatible with the unpredictability of strong emergence or quotation [8]. However, to be revelatory and useful, emergence theory ought to deal with more than lack of predictability. The course of world affairs is such that from year to year or even from moment to moment, the status of how things exist changes. If one called "emergent" all the unpredictable and unknown changes occurring constantly," the term would lose its revelatory capacity. The prodigious evolution of life over many eons of time during which cataclysmic events occur is certainly not an example of emergence as understood in the narrow scientific sense of quotation [7]. That narrow sense assumes that emergence takes place within a bounded system over a relatively brief period of time. Polanyi's use of the term

“emergence” papers over rather than explains how the vast, vast number of unknown parts that vary from place to place in many sorts of environments are to be comprehended. Far more fine-grained approaches, including such disciplines as paleontology, are needed to provide real insight. Still, the creation of life brings about such a dramatic new phenomenon in the universe that in the phenomenological sense of emergence, at least, there should be no hesitancy in calling evolution an emergent phenomenon, even if Polanyi’s description goes no deeper than the relatively uninformative sense of quotation [1].

Perhaps Polanyi provides deeper insight into the mechanisms of emergence through his concern to ascertain higher level principles that drive the process of evolution. “I shall try to establish an ordering principle of evolution, by distinguishing the *actions* of such a principle from the *conditions* which *release* and *sustain* its actions” (PK 382, italics his). And how does the ordering principle come into being? “I shall acknowledge that the *ordering principle* which *originated* life is the *potentiality* of a stable open system; while the inanimate matter on which life feeds is merely a *condition* which *sustains* life, and the accidental configuration of matter from which life had started had merely *released* the operations of life” (PK 383-384). He describes the relationship between the ordering principle and the conditions that release the ordering principle in terms of levels. “Lower levels,” he states, “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*” (PK 382, italics his).

It is important to note that in some of his comments Polanyi does not describe his so-called ordering principle to be an external law imposed externally on all that exists. In an interview with the graduate student Ray Wilkins in 1966, Polanyi states that “we are not attracted by abstract declarative affirmations of this or that principle; that is impossible. These principles are implicit in our discoveries, in our originality, in our contributions to human society . . . [T]hey are subsidiary, and . . . if we then bring them out, these principles, and make them into explicit statements, then they are meaningless.”<sup>14</sup> On this basis, Polanyi could see evolution as emerging from an *intrinsic* ordered principle (see PK 39), but this postulation of

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<sup>14</sup> Ray Wilkins interview, April 6, 1966, mimeographed page 13 of audio file on the Polanyi Society web site.

an immanent principle would seem to require him to reject the notion of the transcendent higher-level principle quoted above. In any case, the language of principles perhaps involves him in the category mistake of imputing a principle of physics and chemistry into what is truly a biological process.

In an alternative biological view, success is tied, both for individual and species, to the *purpose* of growth and survival. While purpose cannot account for the creation of life on a naturalistic basis, once life is established, the purpose of survival functions as a higher-level goal that can help explain how a species (and let's just focus on human beings) evolves to adjust to changing circumstances. I will return shortly to the claim that animate purposeful intention is effectively the highest-level driving both anthropogenesis and ordinary from-to consciousness.

The Darwinian notion of natural selection is generally accepted as a genetically based formula for how successful adaptation to changing environmental circumstances is gradually assured. Polanyi does not accept that argument, for he believes gradual change cannot account for the qualitative change in kind exhibited by different species. Therefore, he rejected Darwinian natural selection (*PK* 390). Polanyi wrote before all the current refinements in evolutionary theory were developed, but even at the level of the Neo-Darwinian Modern Synthesis he was familiar with, his rationalistic scientific preference for distinct types of order that served him well in the first phase of his career betrayed him when applied to biology with its gradualism and hybridity (see his commitment to the “rational core of science,” *PK* 16). Nevertheless, there are resources in Polanyi's own thought to accommodate modified Darwinian thought. He, accepting the contingencies endemic to biological change, could well view evolutionary processes in probabilistic or molar terms. He notes “there exist rules which are useful only within the operation of our personal knowing” (*PK* 31). Indeed, his statement that we understand evolutionary change only at a conceptual level without comprehending the actual process of change (quotation [6]) leaves space for an updated Darwinian account.<sup>15</sup>

My criticism of Polanyi on his insensitivity to biology focuses only on the way he deals with Darwinism. For within the organic domain of human biology as described in *Personal Knowledge*, Polanyi moves beyond any controlling ordering

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<sup>15</sup> Polanyi in effect follows Kant's confessional acceptance of teleology in nature as expressed in his *Critique of Judgment*.

principle and describes developmental change as a process of *maturation* (PK 395). He states that neither ontogenetic nor phylogenetic development requires some outside causal force for development or maturation to occur. Without explicitly saying so, he is in effect arguing that the biological development of individuals is a matter of self-organization (see quotation [5]). The physical and mental development of a human individual is embedded within an inherited genetic plan guiding the process of change. Polanyi therefore quite properly views ontogeny as a process of maturation and self-organization. But does it make sense to see phylogeny as a process of maturation? No such quasi-deterministic process guides speciation as a whole. The current expansion of Darwinian theory beyond selection and mutation to include such factors as epigenetics, genetic drift, horizontal gene transfer, gene flow, and so on, provides far stronger vehicles for understanding evolutionary processes than a reference to maturation or to the need for an ordering principle. Contrary to Polanyi's view, the environmentally sensitive theory of enhanced Darwinian evolution remains the best account of phylogenetic change.

But let me be clear. Whether or not evolution is accurately to be called "emergent" is largely beside the point. Polanyi's use of evolutionary development to further the understanding of epistemology and ontology is an especially important approach to those complex topics. For essential to the biological emergence of new species is the grafting of novel practices upon existing processes. The tacit processes that are central to Polanyi's epistemology are largely inherited from the ancestors of language using humans. Language can be seen as an emergent feature humans built upon the inarticulate understanding that apes and other animals used to survive and thrive. Sign, trick, and latent learning form the tacit background out of which language based explicit conception arises (PK 71-77). Tacit knowing, then, is an emergent feature in two senses. It applies both to species and to individuals. Within evolutionary history, the tacit knowing of humans emerged from inarticulate abilities developed earlier in the chain of evolution. From inherited tacit processes, explicit thought now *emerges* in individuals through indeterminate processes of evocation and integration. "All human knowledge is now seen to be shaped and sustained by the inarticulate mental faculties which we share with the animals" (SM 26). The process of thinking seems to fit snugly within both self-organization [5] and scientifically understood emergence [7].

What can be problematic, however, is how Polanyi sometimes treats the outcomes of emergent processes. To the full structure of tacit knowing and its outcomes we now turn.

### **Polanyi on Emergence: Tacit Knowing and Problem Solving**

Fortunately, tacit knowing fits less ambiguously into emergence theory than Polanyi's view of biological evolution. Recall that Polanyi identifies "emergence with tacit knowing" (*TD* 88). Maturation is the only form of emergence Polanyi describes in the cognitive development of a human (ontogenesis). In his view of tacit knowing maturation unfolds through two complementary and often simultaneous processes. The *a fronte* form evokes development through the lure of ultimate standards to which a person is committed with universal intent. Maturation also occurs *a trego* as an embodied drive at the personal pole fueled by "the tacit component which participates decisively in all articulate thought" (*PK* 397). He insightfully states, "Action and submission are totally blended in a heuristic communion with reality; determinism and spontaneity mutually require each other when embodied in the universal and personal poles of commitment" (*PK* 396).

What motivates humans to direct *a fronte* their process of tacit knowing toward the lure of ultimate standards? Polanyi posits a parallelism between the evolution of inanimate processes on earth and the development by humans of ever-increasing knowledge. He describes three aspects of emergent development in the inanimate world as follows: "(1) We see forces driving toward stabler potentialities; (2) catalysts or accidental releasers of friction-locked forces cause them to actualize these potentialities; and (3) such accidents may be uncaused events, subject only to probable tendencies" (*TD* 89).<sup>16</sup>

The parallel effort in the mental world to inanimate evolution found in the physical world is gained in human experience through purposeful striving to solve problems by using imaginative choices grounded in tacit processes.

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<sup>16</sup> By calling evolutionary processes "accidents" that are "uncaused," Polanyi seems in effect to be anticipating Kauffman's notion of "the adjacent possible" as a circumstantial factor triggering unpredictable evolutionary change. However, Polanyi's claim that the system of evolution is driven toward increased stability appears questionable when one considers the anti-entropy that characterizes the development of increased order in life.

These choices resemble quantum mechanical events in being uncaused and at the same time guided by a field that leaves them largely indeterminate. But discoveries differ from inanimate events in three ways: (1) the field evoking and guiding them is not that of a more stable configuration but of a problem; (2) their occurrence is not spontaneous but due to an effort toward the actualization of certain hidden potentialities; and (3) the uncaused action which evokes them is usually an imaginative thrust toward discovering these potentialities. (*TD* 89)

The paradigmatic importance to Polanyi of problem solving is manifest in all three stages of his career. He roots the human process of problem-solving in tacit animal intelligence. A rat, having acquired a mental map of a maze through latent learning, can quickly figure the shortest route out to fetch food even after the former best way has been blocked (*PK* 74, 399). This exhibit of novelty could be called instinctual if the rat's solution were analyzed as follows: the problem of blockage triggers a deterministic tacit process that causes a novel action as the outcome of the process. But on Polanyi's terms, that wording is an overly reductive, objectivistic description that ignores the true cause of the response for two reasons.

First, a frozen, deterministic response is not flexible enough to allow an animal to respond adequately to all the changing problems that pop up in ordinary existence—problems like the blockage of a known route. Survival requires creative adjustments of behavior as needed. The rat is a sentient being with heuristic powers. Rats can trigger appropriate responses as responsible achievements.

The second reason the suggested emergent reaction is inadequate is more subtle. It depends on the often-ignored distinction between causation and evocation. How the rat's responsible action is carried out must be understood with care. If the response were understood as directly caused by the rat as a higher-level purposive being, this reasonably sounding claim would shift decision making away from creative tacit processes and in effect postulate the existence of a little homunculus in the rat's brain whose causal actions still needs to be explained.<sup>17</sup>

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<sup>17</sup> Terrence Deacon helpfully describes how homunculi undermine adequate explanation. However, I am examining the potential problem at a higher level rather than the lower level he places it. I think an acute theory of tacit knowing overrides any concern about a lower-level

Rather, the rat as a purposeful being *evokes* tacitly a response consonant with its overall purpose and intention—that of getting at the food to eat it. It’s as if tacitly indwelt purpose and intention themselves have evocative powers. Abstractly stated, the rat as a purposeful whole evokes the supportive parts rather than the tacit parts create the action automatically apart from incipient responsibility for the action. The purpose driven rat is not solely a purveyor of instinctive acts; it is also an evoking creative agent.

The importance of evocation can be illustrated in human language-based creativity. When we want to clarify linguistically a still vague notion or feeling in our minds, we do not cause the appropriate words to appear. No, they appear almost magically. Our tacit intention to clarify and communicate thought effectively *evokes* the apt words. Polanyi cites William James to describe how human action, not just thought, is evoked. “He explained the way we deliberately move our body as the work of our imagination. We start imagining the action that we are about to perform, and this forward thrust of our intention evokes the muscular contractions which will implement it.”<sup>18</sup>

Once both rat and human are recognized to be responsible beings, they are also recognized to inhabit systemic wholes in which *self-organization* (quotation [5]) is a more revelatory label than emergence in general for their production of autonomous behavior. That is, in the understanding of emergence found in natural science (quotation [7]), the trigger could be an external event. But for animals the triggering event is *its* response to events, not the events themselves. Self-organization, it may be recalled, is a designation applied to systems that maintain themselves apart from external manipulation, yet whose outcomes may be well understood (as is often the case with thinking and acting). Of course, humans and other animals experience many forces that attempt to exert control, but the notion of responsibility indicates that the acceptance of outside influence is authentically determined by the self. We as active centers are responsible for our responses.

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homunculus. See Deacon’s *Incomplete Nature*, 47.

<sup>18</sup> Michael Polanyi, “The Body-Mind Relation” in *Michael Polanyi, Society, Economics & Philosophy: Selected Papers*, ed. R.T. Allen (New Brunswick, NJ: Transaction Publishers, 1997), 326. Similarly, John Kaag astutely claims that “*any* given organism has its vital basis in a force and a dynamic this is best described in terms that have been historically reserved for the concept of the imagination” (*Thinking Through the Imagination: Aesthetics in Human Cognition* (New York: Fordham University Press, 2014), 19.

The coherence we seek in self-organized thought can be seen as an immanent principle luring us to imagine the potentialities that make for mental order. Without the attractive pull of curiosity related to interests, to solving problems, and to the vectorial push of commitments, we are not creative. Polanyi speaks of this drive toward comprehension as a manifestation of intellectual passion (*PK* 133ff). He sees this emotionally fueled intentional force to be driving both anthropogenesis and ordinary from-to consciousness. It is the higher-level purpose that fires the imagination and produces the knowing and acting that solve problems. I affirm this claim.

### **Polanyi on Emergence: Meaning and Ontology**

Polanyi writes, “Intellectual acts of a heuristic kind make an *addition* to knowledge and are in this sense irreversible, while the ensuing routine performances operate within an *existing* framework of knowledge and are to this extent reversible” (*PK* 77). Heuristic acts are the bearers of emergent novelty, while habitual actions, still products of tacit knowing, lack emergent novelty. He describes the outcomes of emergent processes as occurring in at least five different overlapping ways, some bearing the imprint of emergent thought more than others. The first, identifying and then solving a problem, has already been discussed as a heuristic enterprise. Second, creative tacit knowing is interpreted by Polanyi as producing “comprehensive entities.” Third, the purposeful higher-level control of lower-level boundary conditions produces an imposed type of outcome exhibiting dual control. This leads, fourthly, to his vision of a stratified universe. The general term he uses for the product of intentional thought and action is “meaning,” a fifth type of outcome that comprehensively includes the other four types.

Are some of the epistemic processes and imputed outcomes more reliable than others at revealing the nature of reality within which we dwell? The discussion of the different proposed outcomes of tacit knowing and their relation to reality can be aptly nested in the last described outcome: meaning. Polanyi writes, “Man lives in the meaning he is able to discern. He extends himself into that which he finds coherent and is at home there.”<sup>19</sup> These comments give rise to two notions that are worthy of note.

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<sup>19</sup> Michael Polanyi and Harry Prosch, *Meaning* (Chicago: University of Chicago Press, 1975), 66.

One is “living in the meaning” or what Polanyi often calls participation or indwelling. He refers to “the unavoidable act of personal participation in our explicit knowledge of things: an act of which we can be aware merely in an unreflecting manner” (*SM* 26). Note that he is referring to participation in knowing, not in reality as such. Essentially indwelling involves an embodied process of internalizing and remembering in which we participate according to our interests. We can think and act “from” indwelt embodied material deemed salient to purposeful thought and action. But “indwelling” is a brute concept that offers none of the interpretive depth of memory research. There is extensive literature describing such different types of indwelling as working memory, fleeting sensory memory, semantic memory, implicit memory, and episodic memory. Actually, “tacit knowing” is similarly sweeping in its generality. Here I have articulated one of my most pointed criticisms of Polanyi’s epistemology. Terms such as “integration,” “subsidiary,” and “comprehensive entity” are employed without connection to considerable bodies of work in psychology and epistemology, work containing specificity of description and insight lacking in Polanyi’s terms. His often-idiosyncratic vocabulary tends to puddle into a slough divorced from the great river of academic discourse and study. His true contribution of conjoining Brentano’s intentionality, the “to” of thought, with the “from” of deep embodied processing has been thereby too often ignored.

During his career as a physical chemist, Polanyi ranked rational insight over empirical evidence in the production of scientific knowledge. However, he also claimed that the process of theorizing is most truly based on perceiving as a model. Consequently, there is tension in his thought regarding whether perception or reasoning most advances knowledge. Solving problems as a scientist satisfied him, but he came to believe that science did not address the most pressing problems of his time. He shifted his attention to social and philosophical issues because they struck him personally as addressing a much more significant level of meaning. He articulated his transition in terms of a shift from a lesser to a greater reality when what really drove this distinction is the difference between what is of greater and lesser significance *to humans*. He claimed mind is more important and therefore more real than stones (*TD* 32-33). The origins of such a plastic notion of reality go back to his rationalistic interpretation of progress in scientific knowledge. He argued that Copernicus’s heliocentric view of the solar system was true and superior to Ptolemy’s system because it led to the further scientific insights of

Kepler and Galileo (*PK* 6-7). On this basis he correlated “reality” with “any meaningful entity that is expected to manifest itself in unexpected ways in the future.”<sup>20</sup> Ongoing rational understanding of reality is what satisfies, not mere momentary perception. Theories that promise continuing relevance and inspiration in the future in addition to momentary feelings of coherence are what satisfy most of all. Polanyi’s shift from his earlier scientific realism to an emphasis on participation in what feels most satisfying and significant to a person—an idealism of beginning philosophical analysis from conscious interpretation of what is real—is thereby established.

The second important aspect of meaning that Polanyi cites above is “coherence. He usually treats his notion of reality as involving “indeterminate future manifestations” as an ontological claim concerning what exists in the external world. Yet in connecting reality to what is meaningful, expected, and marked by a judgment of coherence, it makes sense to see Polanyi also—and perhaps primarily—attributing reality to what makes sense to a knower, to what has been *indwelt* for potential future usage. On this basis, coherence can be seen as a crucial mediator between the two poles of personal knowing: personal (meaning) and universal (existence).

Beyond his emphases on indeterminate future manifestations and coherence, let’s look at another route Polanyi takes toward articulating what is real.

One result of Polanyi’s expanded view of ontology with its different degrees of reality is that epistemology and ontology become entangled. The most deleterious result of their perplexing interrelationship is his claim that we *deduce* what has ontological standing from our process of tacit knowing (*TD* 13). We thus plant our knowledge of what is real in mental argumentation. Here I am tempted to resurrect Samuel Johnson’s famous kicking of a large stone to refute Berkely’s idealism. The resistance provided by the stone and the resulting pain in his foot remind one not to forget the witness of our bodily experience of otherness as

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<sup>20</sup> *Ibid.* In linking reality to “indeterminate future manifestations,” Polanyi effectively diminishes his original scientific realism to prioritize what is potentially of interest to humans—problems over stones. In such an anthropocentric view, personal potential meaning overpowers perceptual presence. The implication is that we become disciples of Protagoras: “Man is the measure of all things.” But “man” exists in a world; the world does not exist in us. Better yet: humans dwell in a world of meaning; meaning exists in a yet more encompassing world.

foundational for ontology—bodily knowledge akin to skill, not intellectual knowledge, which clarifies what is given. The ontological independence of the world is especially evident to us through touch, not through deduction. Independent reality resistant to our will stands as the evidence to which we must submit for our understanding of it.

Nevertheless, the way we dwell in that encompassing world is what most matters to us. Again, “Man lives in the meanings he is able to discern.” Consequently, I would like to propose a new dualism—horrors! It is *between* the encompassing and largely mysterious cosmic reality of which we as embodied beings are aware of through perception and embodied signals of otherness *and* each person’s world of meaningful experience richly endowed with sensitivity to other persons, to cultural imperatives and opportunities—to interpreted and clarified experience which we find meaningful. That is, the distinction retains the primacy in ontology of existence. But in ascertaining what exists beyond the limits of our perception as aided by technology (empiricism), we enter a messy zone of hybrid understanding. For it is clear that the arena of existence includes intangibles like relationships, the actuality of human experiencing, and the existence of cultural institutions and influence. Beyond the hybrid zone of interpreted existence there lies the realm of humanly constructed largely mentally-based phenomena. Linguistic constructs, cultural practices, interpersonal relations, opinions and preferences, the built environment, etc. are best interpreted in terms of purpose and meaning. The realm of meaning includes all that has been produced by humans and what is currently being imagined, perceived, valued, and enacted—the false as well as the true. There is considerable overlap between what exists and what events and objects have meaning for us. Polanyi’s notions of creative emergence and of different ontological levels provides a basis for sorting out the incredibly complex relationships that different types of meaning add to existence.

I am well aware of the potential problems presented by dualisms of any sort, most famously existent in Cartesian thought. I base my ontological dualism on what the emergence of life implies. For the first known time in cosmic history there arise entities subject to success or failure. They have the possibility of achievement. They have an inside and an outside. They have purposes independent of the laws of physics and chemistry. All this is, of course, very Polanyian. The advent of life is emergent in the most profound, even if most abstract, sense. In the previous paragraph I have merely placed in ontological terms the difference

between mere existence and emergent purposeful existence culminating in human experiences of meaning, whether pragmatic or pathological.<sup>21</sup>

### **Polanyi on Emergence: Integration, Dual Control, Comprehensive Entities, Levels, and Stratified Universe**

Let us return to Polanyi's account of the various outcomes of emergent processes. Beyond the solving of problems, a second outcome of tacit knowing produces what Polanyi calls "comprehensive entities." Here is a typical example of what he claims: "We can see then two complementary efforts aiming at the elucidation of a comprehensive entity. One proceeds from a recognition of a whole towards an identification of its particulars; the other, from the recognition of a group of presumed particulars towards the grasping of their relation in the whole" (KB 125). With regard to the second aspect of tacit knowing, I am not convinced by the gestalt thesis Polanyi relies upon stating that the identification of perceived objects requires a grand act of integrating particulars. Contemporary psychology of visual perception states that objects are identified through perceived *patterns*. Retinal receptors are particularly sensitive to the boundary lines and orientation of objects that together constitute recognizable patterns.<sup>22</sup> AI's identification of persons through facial patterns supports the importance of pattern identification and effectively belies the integration theory. A pattern is a whole known directly; it does not require the gathering together of parts. Think of facial recognition as an act of knowing. We do not gather together and integrate a memory of nose, eyes, hair style, complexion, etc. to identify a person.

To see if the process of integrating parts can sometimes be helpful, let us examine more carefully acts of *synthesis* in tacit knowing rather than analysis. Sometimes the subsidiaries he mentions are like the similar items one sees on the same shelf in a supermarket—parts well known like the two gases that when

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<sup>21</sup> The distinction between existence and meaning has implications for Christian theology. God the Creator is about the mysterious process whereby a world of meaning becomes possible through the emergence of life. In the realm of meaning, one can distinguish between the evolution of moral standards that ensure social thriving, those that best exemplify living according to those standards (Jesus as Christ), and personal indwelling of those ideals (Holy Spirit).

<sup>22</sup> For one summary of current theories of visual identification, see Bruce Bridgeman, "Pattern Vision and Perception," EBSCO online, 2024.

integrated form water. But other times he speaks of subsidiaries in a broad way that includes much of the produce in the store. Thus, he states that “our subsidiary awareness of the particulars of a comprehensive entity is fused, in our knowing of the entity, with our subsidiary awareness of our own bodily and cultural being” (KB 134). He acknowledges that often many of the subsidiaries upon which we rely are unspecifiable. Polanyi’s notion of solving a problem is broad enough to include composing a poem to express latent feelings, inventing a machine for a certain purpose, as well as making a scientific discovery. “Such problems,” he states, “are intimations of the potential coherence of hitherto unrelated things and their solution establishes a new comprehensive entity, be it a new poem, a new kind of machine, or a new knowledge of nature” (TD 44). In several articles, Phil Mullins carefully traces how Polanyi gradually increased the scope of his notion of comprehensive entities to the point that integrations of particulars seem to underlie creation as such.<sup>23</sup> Mullins helpfully reminds us of the importance of communal assessment of what is real. Polanyi emphasized the constructive importance of interpersonal conviviality and the sociality of scientists. I end up wondering what he thinks can’t be called a comprehensive entity. If that is the case, what use is there in adding to term “comprehensive” to the general term “entity”? More to the point, I have already argued that pattern recognition of wholes does not depend on the integration of parts, even if sometimes integration of parts does occur.

All of this is to say that a progressive Polanyian theory requires the development of much more clearly articulated theory of tacit knowing. At the very least, the embodied “from” dimension of from-to knowing includes autonomic physiological processes, memories of various sorts, a flexible set of frameworks (each with assumptions guiding integration), sensory input, and tacit intention. The latter can evoke the language that brings to explicit expression the requisite tacit process in ordinary human consciousness and behavior. “Integration” is a far too simplistic term to describe all the processes occurring at the tacit level.

Perhaps looking at another way persons create meaning synthetically (the third way mentioned in the first paragraph of this section) will provide a more positive view of integration, comprehensive entities, and stratification. Polanyi

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<sup>23</sup> See, for instance, Phil Mullins, “Comprehension and the ‘Comprehensive Entity’: Polanyi’s Theory of Tacit Knowing and Its Metaphysical Implications” (*Tradition and Discovery* 33:3 (2006-2007), 26-41. Would the dominance of pattern recognition rather than integration eliminate widespread use of the term “comprehensive entity?”

invokes the purposeful use of properties and principles, setting them in a theory of dual control. He observes that the world is replete with many principles that have open boundary conditions.<sup>24</sup> In his rather physicalistic language, he says a principle may exhibit qualities that may be utilized by other principles without affecting the ongoing functions of the principle having the boundary conditions. Principles with boundary conditions “can be laws of nature, like the laws of mechanics, or be principles of operation, like those of physiology, as for example those controlling muscular contraction and co-ordination; or they can be principles laid down for the use of artifacts” (KB 216). Their unfettered boundary conditions are available to being used or controlled by other principles—higher ones. Hence, “the boundary conditions of muscular action may be controlled by a pattern of purposeful behavior, like that of going for a walk” (KB 217).

Rather than speaking of gauzy principles, I find it clearer to speak of the properties of things that may be utilized for certain purposes, such as for the construction of machines or simply as tools. Importantly, when a person imposes an active higher-level purpose on the inert lower-level properties of an entity, the higher-level purpose cannot be defined in terms of the lower-level qualities on which it depends. Nevertheless, the lower-level properties establish the conditions and constraints that cannot be violated by the higher-level. Thus, Polanyi speaks of dual control of the novel creation. Since the lower-level parts function as constraints rather than as the higher-level control characteristic of the whole, I prefer Polanyi’s term “marginal control” to his “dual control.” But even “marginal control” is not quite adequate, since it most directly refers to the control exerted by the whole over the properties of the parts. “Wholistic control” would be the most accurate term. And since the lower-level principles or properties conceivably function as wholes controlling yet lower-level principles or properties, Polanyi posits that the universe is stratified with layer upon layer of interdependent comprehensive entities.

Let’s see if Polanyi can justify his theory of the stratification of the universe. In the first of two examples of stratification Polanyi offers in *The Tacit Dimension*, Polanyi states he will study brick making, a process view of emergence. But then he abruptly shifts to an essentially bottom-up description of supposedly

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<sup>24</sup> In his analysis of machines, Polanyi asserts that boundary conditions exist as the properties of materials used in the construction of the machine, not as principles.

interdependent strata. “Above the brickmaker,” he states, “there operates the architect, relying on the brickmaker’s work, and the architect in his turn has to serve the town planner” (*TD* 35). Polanyi’s example of stratification is untenable if examined as an emergent process, for the art of making bricks and building with them does not cause architects to design buildings. Neither do well planned towns emerge from architects using bricks in a way analogous to how cognition emerges from neural activity. Bricks can be used in different ways, many not requiring an architect’s involvement. The levels Polanyi identifies are several among many possibilities. They reveal more about Polanyi’s interests and experiences than about any necessary ontological dependency.

Polanyi speaks of levels in several different ways. Machines exhibit three interdependent levels. A lower-level of materials with physical properties is organized according to a higher-level operational principle that in turn is regulated by yet higher level judgments of regulation assuring that the machine responds to changing conditions so as to preserve its highest-level purpose(s). Within the realm of physics and chemistry, mereological analysis can be used to identify lower-level parts that interact to establish an emergent higher-level whole. The dependence of molecules on lower-level atoms and molecules is an example of mereology, as is the dependence of consciousness on neural activity. Finally, the language of level can be used to refer to conceptual distinctions arrived at through *analysis*. Polanyi’s example of brick making, architecture, and town planning is such a type. He has identified strata that can be coherently related to each other in discussion but that have no ontologically necessary relationship, no causal connection. Like most entities in the world, they exist independently of each other because of different scope or neighborhood of existence. Levels selected by analysis may or may not have more than conceptual existence. And as selected by analysis, they may or may not refer to a coherent phenomenon or strata.

Let me turn to Polanyi’s second example of emergent stratification to see if it better justifies the notion of universal stratification. He identifies five hierarchical levels that are involved in giving a speech. It is worth quoting it here for analysis.

It includes five levels; namely the production (1) of voice, (2) of words, (3) of sentences, (4) of style, and (5) of literary composition. Each of these levels is subject to its own laws, as prescribed (1) by phonetics, (2) by

lexicography, (3) by grammar, (4) by stylistics, and (5) by literary criticism. These levels form a hierarchy of comprehensive entities, for the principles of each level operate under the control of the next higher level. . . Thus each level is subject to dual control: first by the laws that apply to its elements in themselves and, second, by the laws that control the comprehensive entity formed by them. (TD 35-36)

This example evokes a series of questions concerning imputed emergence and the justification of interdependent stratification.

1. Does this hierarchical view of giving a speech offer us an example of an emergent process creating something new? No. A basic problem with the concept of a stratified universe is discerning what the layers are and how far they extend. While the order in which they are presented suggests Polanyi is presenting items as they emerge through a process from the bottom up, in fact he derives these possible contents of a speech by a top-down analysis. The typical speech writer or giver does not build a speech by beginning with voice and adding to it word and then sentence, then style. No, the writer begins by musing about the aim of the speech and the most effective way of communicating that desired meaning. Clearly Polanyi's list of voice, words, sentences, style, and literary composition, each subject to its own laws and limits, is more an analysis of independent aspects of a speech rather than a description of how a speech emerges.

2. In general, Polanyi's example is not an emergent unity amenable to mereological (structural) analysis, for a speech is not a whole with necessary components or even clearly interacting parts. Rather, Polanyi's analysis, like many others, is driven by his experience and interests that represent many different mentally consolidated levels. His analysis of a speech could just as well focus on such levels as the origin of the speaker's ideas, or the relevance of the speaker's past experience to how he expresses his ideas, or his political aspirations, and so on. The speech is best analyzed as a literary product organized to promote specific goals.

3. Even when Polanyi's dual pairs are looked at specifically in the quotation concerning stratification, the example does not hold up as a persuasive example of mereological analysis in which parts create a whole. Take a (3) sentence as the higher level of the word-sentence pair. Do laws of sentence order and completeness

(grammar) depend upon and emerge from the laws governing how the words are defined? There is a plausible relationship, even though words in themselves do not create grammar. What of the preceding pair: do the laws of word definition depend upon the phonetics of vocal expression? No, vocalization can issue in many different kinds of sounds.

4. In fact, Polanyi's example is an exhibit of reductionistic analysis, not bottom-up causation or top-down control. A person's *purpose and analytic creativity* is a causative agent in the selection of levels, which is quite different from the physical laws controlling the relation between molecule and atom or consciousness and neural activity. Scientific reductionism is revelatory in a way that cultural reductionism often is not.<sup>25</sup> The latter results in relativistic accounts depending on an agent's interests and experience. Mereology is properly rooted in scientific study, not cultural analysis.

## Conclusion

I have rather brashly labeled my critical analysis of Polanyi's thought as a step toward Neo-Polanyianism. This term is meant as a celebration of what Polanyi achieved along with a rallying call for its further development now *fifty years* after his death. I see this move as essential to ensure that the studies of Polanyi's thought do not become ossified and simply a matter of nostalgic recall. So in this

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<sup>25</sup> In this paper emphasizing the importance of emergence in Polanyi's thought, I would be remiss not to mention the work of Charles Lowney, a Polanyian who has dealt thoughtfully with emergence theory's capacity to counter heedless reductionism. His article, "Epilogue: Robust Realism: Pluralist or Emergent" (in Charles Lowney, ed., *Charles Taylor, Michael Polanyi, and the Critique of Modernity: Pluralist and Emergentist Directions* [Cham, Switzerland: Palgrave Macmillan, 2017]) offers the most helpfully focused account of Polanyi's thought in relation to recent philosophical developments of which I am aware. But I don't find his argument that emergent theory overcomes cultural relativity or social antagonism to be convincing (see especially p. 253). Given human nature, cultural relativity seems to be inevitable; ontological existence ought to exist beyond subjective construal. Each level of cultural meaning may be true and real to its proponents, but those proponents may still doubt the legitimacy of the claims of others that their level is more real. It is more fruitful to construe the conflict in terms of meaning than in terms of ontology. Group A would likely be more tolerant of group B's claim to meaningfulness (a self-reverential claim) than if group B claimed its views to be more real (a universal claim). Actually, Lowney recognizes the potential importance of the self-referential form of emergence when he claims that "different emergent forms of individualism also set the ground for different ways of being together in society" (232).

conclusion I will emphasize enduring aspects of Polanyi's insights and suggest ways of expanding his thought and influence. A further task is deleting or replacing those parts of this thought that now seem unnecessary or problematic.

1) Early in his career, Polanyi accepted a notion of scientific realism as the ultimate ground of ontology. One of Polanyi's greatest achievements is showing how knowledge of both science (the discipline that explores existence in its various manifestations) and the humanities (the discipline that explores all the forms of human meaning) came into being through a complex process of evolutionary emergence. Scientific realism must have room for a theory like emergence to account for the cosmos's capability of spawning life and its accompanying types of increasingly complex meaning. But ontology must not get twisted into different degrees of reality to accommodate what is significant to humans; significance is an emergent phenomenon. Polanyi is shown to use "emergence" quite loosely with respect to evolutionary change and in a suggestive way compatible with contemporary understandings of emergence when describing tacit knowing. His distinction between emergence and maturation is important.

2) In the second phase of his career, after recognizing how the advent of life brought purpose into being, Polanyi began underscoring how purposeful commitment influences individual action and social dynamic order. The abiding importance of purposeful meaning became congealed in his notion of a fiduciary framework which fosters the growth of thought as a means of increasing human welfare. Social authority is held together by faith, tradition, social conviviality, and commitment. A resulting challenge: how is scientific realism to be reconciled with human experience in which authoritative meaning and significance outstrip in importance the mere fact of existence? My "Neo-Polanyian" answer: by building upon an ontological distinction between *existence*, recognized through perception and given theoretical expression in emergent science, and purposeful *meaning*, flowering through emergent processes that contribute in many ways to human flourishing. We exist as bodies; we dwell in meaning.

3) Another of Polanyi's great intellectual achievements is his exposition of how humans themselves create meanings within which they dwell. This achievement is both an emergent process and an example of self-organization. It is tacitly rooted in the ways other animals learned to understand and manage their environments. Humans create mental meanings and intentional physical actions

through a from-to framework of conscious activity. Humans can also contrive all sorts of technological and artistic creations by seizing and manipulating inert lower-level properties and processes for imagined outcomes. This summary of Polanyi's growing interest in meaning invites further development. The types and functions of meaning in human society and culture are alluded to in his barely broached notion of the human noosphere. The book *Meaning* is a step in that direction even if its categories need rectification and development.<sup>26</sup>

4) A limitation of Polanyi's novel theory of epistemology arises from the heavy burden Polanyi imposes on the "from" level of the from-to process. Its tacit processes are relied upon to produce explicit meaning with little description of what goes on at the tacit level. Reference to indwelling and the integration of subsidiaries is suggestive but weak in its precision. Neo-Polanyian thought has an opportunity to open up the black box of tacit functioning and make creative use of such unsystematically integrated features of the tacit dimension as memory, language, frameworks, and intention. The use of language is such an important factor in making the tacit explicit that I have often suggested that the from-to be expanded to the *from-via-to* in which the "via" is language usage as the crucial interpretive and communicating agency in thought and expression.

5) Linguistic usage facilitates the creation of meaning in several ways, of which imagination, synthesis and analysis are especially important. The integration of what is perceived with what is remembered and what is intended results in synthesized meaning. Reflection and analysis are important means of organizing and clarifying thought. Levels identified through analysis include the active higher and contributing lower level of marginal control, the causally connected levels of part-whole relations, and different conceptual levels of disciplines.

6) I have suggested that some of the concepts Polanyi employs in discussing the outcome of tacit knowing are confusing or problematic. Some of my suggestions for change are merely a matter of clarifying Polanyi's idiosyncratic terminology, interpreting his thought in more mainstream vocabulary. But more problematic are such candidates for elimination or reconstruction as "comprehensive entity," "stratified universe," and "dual control."

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<sup>26</sup> See my "Polanyi's Theory of Meaning: Exposition, Elaboration, and Reconstruction" (*Polanyiana* 2:4 and 3:1 [1992-93]), 7-42 as a first attempt toward such rectification..

7) Lurking behind many of the issues just discussed are the elements of emergence: triggers, processes, structures, and outcomes. They underlie and support perhaps Polanyi's greatest achievement: his ability to identify and describe the role of the person, arguably the most meaningful product of emergence in the cosmos to date. Clustered together in his view of meaningful existence are such powerfully interrelated notions as post-critical thought and behavior, faith and commitment, and overarching responsibility. These are enduring insights in philosophy that deserve to be protected and advanced.