"From Epistemology to Ontology to *Epistemontology*"

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ABSTRACT

According to Tihamér Margitay, Michael Polanyi held a strong "correspondence thesis" between the structure of tacit knowing and the structure of ontological emergence. In agreement with Margitay, this article finds a one-to-one correspondence implausible, given our tacit ability to integrate various clues into the apprehension of the same object and given the multiple realization of object types via different components. It is acknowledged, however, that such a correspondence is encouraged by an analytic, scientific approach to understanding *objects (as* Bedeutungen*), when held distinct from linguistic modes of* identifying *objects (via* Sinne*). It is then shown how the epistemological and ontological interweave at a deeper level in Polanyi's participatory or enactive realism. This notion of* epistemontology *counters a second set of Margitay's criticisms. It re-affirms a pluralist ontology by demonstrating how machine types, as comprehensive entities, resist a reduction to material parts and lower level physical laws, without violating such laws.*

In "From Epistemology to Ontology: Polanyi's Arguments for the Layered Ontology," Tihamér Margitay offers insightful criticisms of two of Polanyi's key ideas.[1] First, Polanyi held that there is a parallel structure between tacit knowing and identifiable beings, such that the tacit clues that come together in our knowledge of a comprehensive entity are structurally similar to the way that the parts of an entity come together into a whole. Second, in dual control systems, such as machines or living beings, the higher ontological level and the principles of its operation are irreducible to the lower level and its laws. Here Polanyi provided the example of how a machine's engineering principles are irreducible to the laws of chemistry and physics. These two ideas bolster Polanyi's conviction that the universe is layered hierarchically: just as focal meanings are irreducible to their tacit clues, so emergent comprehensive entities are irreducible to their lower level parts.

Margitay criticizes the first idea by showing how there is no direct correspondence between how we know and what we know. This, for Margitay, undermines any epistemically-based support for the idea of an ontological hierarchy, at least with regard to things such as planets, cobblestones, and wristwatches that are not "knowledge-like" entities (M1, 131). Margitay then criticizes the second idea, which would provide an independent basis for a layered ontology. By looking at solar systems and watches, Margitay blurs the hard line Polanyi established between (on one side) inanimate nature and (on the other) dual control systems. This greases a slippery slope to reducibility, for at least machines and most organisms. Margitay then nudges us down that slope by defending the idea that machines can be identified through their physical properties.

In his criticisms, Margitay is conscious of his agreement with Polanyi that (1) there is indeed a hierarchical structure in knowing, and (2) there is indeed a strong correspondence between knowing and being in knowledge-like entities, such as minds and persons. Margitay also (3) appears to hold on to a conviction in the freedom and irreducibility of persons, as real entities; persons are not reducible to their constituent parts, although one wonders how Margitay maintains this, since, short of an outright dualism, it seems contrary to his conviction that "physics is complete"(M1, 133-4).[2]

To indict Polanyi on these counts may seem an indictment of all that is valuable in Polanyi's understanding of nature. But, as I see it, Margitay's thoughtful criticisms point out some limitations in Polanyi's thinking and call us to understand, in a Polanyian way, the relation between tacit knowing, emergent being, and the hierarchical—or perhaps plural—structure of each. It also challenges us to set Polanyi's ideas in the context of current discussions about the nature of explanation and the ultimate nature of nature.

In response to Margitay, I will agree with his first point. Margitay is right to de-couple knowing and being, but only when it comes to the naïve idea that there is simple one-to-one correspondence of knowing to being at the macro level, which Polanyi might have held at least at some points in the development of his thought. Here I will point out that analytic assumptions regarding the identification of an object in science—for better or worse, and probably for better—continued to shape Polanyi's thinking. However, I will also point out a deeper connection between knowing and being that Margitay misses—or fails to emphasize properly. That deeper connection I call Polanyi's "epistemontology."[3] Here I hope to bring proper emphasis to the unity between knowing and being that Polanyi endeavored to promote, in spite of his inability to shake completely loose from the dualistic divide between knowing and being that encourages a simple correspondence picture.

I will then show how Margitay falls short in his criticism of emergence in dual control systems, (1) in part because of the model for understanding scientific reduction that he seems to presuppose; and (2) in part because of what he misses when he decouples knowing from being. More specifically, he misses the way in which meaning is integrated into the fabric of reality, and this becomes apparent when he criticizes a semantic defense of hierarchy. But in spite of our disagreements here, I want to emphasize that Margitay raises interesting questions that require further investigation

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The (Too) Strong Correspondence Thesis

Margitay criticizes what he calls the "correspondence thesis" in Polanyi. This is the idea that there is a correspondence between the *from-to* structure of tacit knowing and the part-whole structure of complex entities. Margitay first considers a *strong version of the thesis*: the idea that reality is layered ontologically *because* our knowing of it is layered. Margitay quotes Polanyi to show how Polanyi himself may have espoused this strong version: "the structure of tacit knowing determines the structure of comprehensive entities" (TD, 55).[4] In other words, says Margitay, Polanyi believed "the world has a hierarchical ontological structure *because* our knowledge about this world is hierarchical. The ontological structure of a particular entity follows from the way we know it" (M1, 131).

Taken as a one-to-one correspondence, especially with a causal direction going from knower to thing (without consideration of how the thing itself, and clues from background contexts, inform our knowing of it) and from parts to wholes (without a consideration of environmental pressures or the functioning of the whole), the thesis is clearly false, and Margitay does a splendid job showing us how.

Margitay points out that we use tacit knowing to comprehend things that are not emergent, for instance, a planet (M1, 132). Those things *are* fully reducible to their parts, according to Polanyi, but a comprehensive meaning is *not* reducible to its clues, and so a one-to-one correspondence that supports a layered ontology could not hold here. But even when we take an example of a purportedly irreducible entity, the correspondence does not hold. Margitay uses his watch as an example of something that we might easily identify without knowing anything about its parts and their relations. This example shows that our perceptual system integrates clues into a phenomenal entity in a way that may be different from the way the parts are integrated into a whole, and both may be different from the way we learn to *identify* an object in different contexts.

There is an assortment of different cognitive and semantic clues we might indwell in order to apprehend a comprehensive entity. As Margitay says, "We use some clues to recognize this object as a watch and usually rely on other clues for other kinds of knowing, e.g., for understanding this watch, for using it, for developing it etc." (M1, 132). This runs counter to the correspondence thesis, but Polanyi's understanding of tacit knowing does indeed allow for such identifications in a variety of contexts. The linguistic and pragmatic contexts, Polanyi might say, provide tacit background clues that contribute to our identification and understanding of the watch. In Frege's language, different *Sinne* (senses) can point us to the same *Bedeutung* (referent).

The "because" version of a strong correspondence may thus somewhat distort Polanyi's ideas, since *of course* he believed that we were *discovering* entities and not simply making them, and *of course* he would recognize *contextual clues* as bearing upon our knowledge of a thing. But Polanyi, to an extent, might have been distorting his own ideas because of his tendency to give pride of place to a scientific understanding of the object, and because of a neglect of the distinction between senses (and contexts in which we identify objects) and references (the objects themselves).

As a step toward understanding Polanyi's epistemontology, we can note that Polanyi blurs the line between linguistic meaning and the thing we are talking about, but never at the expense of the reality of the individuated thing. Polanyi is convinced that we are, or should be, talking about the *same thing* in the variety of instances in which we use the word "watch" and that this thing on Margitay's wrist can be understood and investigated. The scientific context preserves its unity as an entity for investigation where other contexts may disavow it. This point takes us beyond any warrant the later Wittgenstein gives us to focus only on sense, and draws us back to Frege's notion of a *Bedeutung* (aptly enough from a Polanyian perspective, "*Bedeutung*" means both the meaning *and* the referent itself).[5] Words have both a *Sinn* and a *Bedeutung*. *Sinne* can get us to the same thing in a variety of ways, e.g., we may have a different sense of the word "Venus." For you it may be *the morning star*, for me it is *the evening star*, but they both direct us to the planet. The senses can be different means of identifying the same referent, which is the entity or meaning of the word. If separate contexts and different cognitive clues are pointing towards the *same sort of entity,* there are features of the entity that would need to be in place in order for this particular item to qualify as *that* sort of thing. The entity is *picked out* by contextual clues (e.g., a *Sinn*) but is considered independently from them as its own entity (e.g., the *Bedeutung*) subject to scientific study. It is from the privileged position of the scientific understanding of the thing that the analogy between tacit integration of the clues into a comprehensive unity and the functioning of the parts into an emergent entity is strongest.

So although there are many ways to locate an object and to understand its pragmatic role, Polanyi may be justified in privileging the way in which we know it via the integration of parts to wholes as this seems the best way to understand an object qua object and the surest way to know our identification is correct (e.g., that it is a watch and not a cleverly disguised bracelet). When we dwell in those clues that let us know that this indeed is a real watch and not an imitation, we are likely dwelling in the tacit clues that correspond to the functional parts of the watch. In this tacit integration we are more likely to move from the parts as *Bedeutungen* to the whole as a *Bedeutung* rather than from various senses (*Sinne*) that point us to a focal whole.

The strong version of correspondence is clearly wrong. In fact, even before Margitay shows us his watch, his depiction of the unspecifiability of tacit clues in Polanyi's theory (M1, 128) foreshadows why the knowing-to-being relation cannot be this sort of one-to-one correspondence: Margitay tells us that according to Polanyi, "[Clues] are logically unspecifiable... Different clues under different integrations may lead to the same whole" (M1, 128). If there is multiple realizability of the whole via a different organization of clues—and, indeed, if the real entity can reveal itself in unforeseeable ways in the future (*TD*, 32)—it

seems we are already well on our way to a de-coupling knowing from being—even for knowledge-like entities; we cannot *determine* (in either an epistemic or ontic sense of "determine") an entity via dwelling in its parts as clues. There is a connection, an interconnection, even an interweaving, between knowing and being, but it is not one-to-one at the level of medium-sized dry goods (to turn a phrase of Quine's) which we typically encounter. The over-determination or multiple-realization of comprehensive entities shows us that our knowing doesn't always connect up with being as well as Polanyi's science might like.

The (Too) Weak Correspondence Thesis

After successfully dismantling the strong correspondence thesis, Margitay presents the weaker thesis that the correspondence is "only" a heuristic device. From this view, Polanyi is not claiming that the strong relationship between knowing and being holds, but instead is merely claiming that a strong analogy holds. Margitay suggests the correspondence thesis "says no more than that the similarity between the structure of knowing and the structure of reality consists in that the lower level *partially, but not fully* determines the higher level in both cases and the higher level laws determine it. That's it" (M1, 134).

The analogy of epistemology with ontology, according to Margitay, is thus fine as a *heuristic*, but then the idea of a truly layered ontology needs independent support. So Margitay turns to his second line of criticism, which acts to undermine the difference between any physical system and a machine. But I think he moves on too quickly and thus misses the importance of the interconnection between knowing and being that I call Polanyi's epistemontology.

Knowing doesn't "determine" being in the way Margitay sets up the problem, but neither is the process of knowing a separate convenient analogy for examining the process of how things come into being. Although I recoiled at the way Margitay used "determines" to imply a *because*—i.e., to imply that one structure (knowing) was determining a separate structure (being)—there is a deeper sense in which "determines" might be the right word to use. The *way we know* inextricably conditions *our very experience of the thing*, perhaps even to the extent that the thing we are talking about is a *creation* of our interaction with it, as well as a *discovery* of its reality. Knowing and being, one might say, mutually determine each other.

On to Epistemontology

Here I can only sketch how I understand the deeper interweaving of knowing and being in Polanyi's thought. Some clues to epistemontology are found above in exploring Frege's distinction between *Sinn* and *Bedeutung*. Another fundamental place to see the deep connection between knowing and being, which I will briefly touch upon, is seated at the level of how concepts or universals are formed.[6]

For Polanyi, concepts are created through the *from-to* tacit integration of *indeterminate* clues (the *from*) into a joint comprehension (the *to*). Joint comprehensions can themselves become clues to further tacit integrations, and the main job of a concept is to work as a tacit clue to understanding focal objects. Polanyi says concepts or universals, denoted by general terms, have a "curiously *unsubstantial character*"(*KB*, 168). This is because concepts are joint comprehensions that are in turn seen *through* in order for us to see the formerly indeterminate clues as determinate particular things. The concept (originally a *to)* becomes a *through* and the particular focal object the concept lets us see is the final *to*, so we have a *from-through-to* structure. For example, before the tacit integration of clues into the concept *cow*, we might see indeterminate black and white blurs on a field; after the formation of the concept, we look *through* it and the black and white objects are now seen as cows. We see *through* concepts to the objects we experience. There is *no entity without identification*, as Margitay notes citing Quine, but there

is *no identification without tacit integration*. Concepts or universals function tacitly in the background to allow us to identify and understand an object. Words have background senses (*Sinne*) that allows us to identify and experience the reality of their referent. Not only are intuitions without concepts blind, there is no intelligible structure to the sense intuition—even in experience—without the senses or concepts.

In response to Kyle Takaki, Margitay acknowledges this deeper sense in which our knowing "determines" our reality, and he recognizes the Kantian roots. Takaki discusses how our models in science condition our understanding of the entities we posit: "there is no direct access to Nature except by way of our models (theories, data, etc.)" and, he says, "tacit knowing primarily 'determines' the structure of these models" (M2, 36 & 51). For Takaki and me, noting that science uses models to understand the objects and their relations is married to the notion that similar tacit structures condition the objects we perceive, name, and understand. The *Sinne* that show us the *Bedeutung*, or concepts that show us objects, or the universals that allow us to identify particulars, may seem purely cerebral, but they also involve bodily skills and are the fruition of engagement with the world. Theoretical structures, networks of beliefs and conceptions, condition, if not determine, the very objects that those scientific theories posit, but not in a one-way trajectory from knowing to being. Knowing and being condition one another in a self-correcting feedback loop, much like the feedback loop we experience whenever we undertake to develop a skill through repeated performance, analysis, and recalibration.

Margitay agrees with Phil Mullins that "'you cannot split ontology from epistemology'" (M2, 45), but while Margitay affirms this interweaving, he shies away from what he calls Takaki's "radically realist" approach to Polanyi's ontological levels. Margitay quotes *Personal Knowledge* to defuse the radical suggestion: "strictly speaking, it is not the emerged higher form of being, but our knowledge of it, that is unspecifiable in terms of its lower particular levels" (*PK*, 393; M2, 53). But, as Mullins points out, in *PK* Polanyi only applied the term "comprehensive entity" to living things and later broadened his use of the term.[7] This is significant because in a comprehensive entity the joint comprehension of meaning (our knowing) is inextricable from its unity and identity (as a being); these are the knowledge-like entities for Polanyi that Margitay restricts to persons. Mullins argues that Polanyi's thought developed to more closely tie the conceptual and the existential, so we might expect that when he came to discuss dual control and machines after *PK*, which Margitay cites, Polanyi was indeed affirming the more radically realist ontology. This expansion of the notion of a comprehensive entity is important for the understanding what a machine is and why it cannot be reduced to its component parts.

Indwelling *that by which*

Polanyi is especially good at showing the interweaving of knowing and being in *indwelling*. He does it with acts of perception, cognition, with the exercise of skills and more. Our bodies as well as ideas extend out into the world; we can dwell in tools in order to understand and experience the shape of a room, or dwell in a theory in order to appreciate the movement of the stars. Here I want to emphasize two points that highlight the importance of the interconnections of knowing and being that Polanyi brings to the foreground and show how Polanyi is fighting an uphill battle against metaphysical assumptions we have been steeped in for several hundred years. One point goes back to at least to medieval debates that show how we dwell in our concepts to experience reality; another is a current "hot topic" in philosophy that shows how we dwell in objects to experience reality. Together they show how a sharp distinction between concepts and objects—one on the side of mind, the other on the side of reality—cannot be maintained.

C.S. Peirce, like Polanyi, claimed that universals are real. In the medieval debate between the nominalists and the realists, Peirce sided with the realists. Mullins points out that Peirce saw the heart of the debate was built around how we should understand the relationship between *our knowing* and

the *world as it is*.[8] The nominalists, like the moderns, presuppose a strong divide between our mental faculties and what is out there to know; the realists, in contrast, identified reality with the judgments we are warranted to make, and ultimately with the judgments we would all agree on in the long run. This, as Mullins shows, has clear connections with Polanyi's participatory realism, the unity of knowing and being in tacit integration, and Polanyi's notion of personal judgment and universal intent in the context of a scientific community.

The first point I emphasize is how, like the medieval realists, Polanyi takes us out of our heads to show how our ideas, concepts and conceptions bring us to reality. Another medieval notion rides together with Mullins' observations. Thomas Aquinas asked whether or not ideas (i.e., intelligible species) are *that which* we know or that *by which* we know.[9] He argued that they are that *by which* we know, implicitly siding with the medieval realists. Thinkers of the modern era, like the nominalists, primarily saw ideas as *that which* we know.[10] This nominalist/modern approach deepens the rift between knowing and being and sets the stage for representationalist and objectivist approaches to meaning in language, in which a word stands for an idea in my head and that idea represents the thing "out there." Polanyi overturns this view by implicitly agreeing with Peirce and Aquinas: ideas and universals are the *through*—that *by which*—we experience and understand the world (though we may indeed attempt to shift our focus to the tacit *by which* and turn *it* into a focal *that which*[11]) and those universals are conditioned by a more indeterminate experience of reality.

The second point I emphasize is the notion of an "extended mind" that has become popular in the work of Andy Clark. The idea here is that the mind is part of the physical environment outside the skull. This notion echoes and develops Polanyi's understanding of how tools and behaviors are *dwelt in* when one has focal awareness of things in the world.[12]

Ideas are our window into reality and we reach *through* them, but we also reach through things (muscles, probes, television cameras) to understand and experience reality. When we know something—even when we identify something—our knowing and its being are "always already" (as Heidegger or Merleau-Ponty might say) inextricably intertwined at some level, though not necessarily at the level of one-to-one correspondence between the clues we use to identify the thing and the parts that comprise it. Some correspondence at the level of sentences and facts is required for the concept of truth, but the idea of a strong one-to-one correspondence between knowing and being already presupposes a deep rift that needs to be crossed at the object level.

Polanyi's epistemontology carries forward the spirit of the early pragmatists who see primary experience as both true to the world that effects us and yet fused together with our conceptions. A tacit integration comes first, and this is fundamentally different than a reversible logical inference. John Dewey adopts William James' expression: "Experience is 'double-barreled' in that it recognizes in its primary integration no division between act and material, subject and object, but contains them both in unanalyzed totality. 'Thing' and 'thought,' as James says in the same connection, are single-barreled; they refer to products discriminated by reflection out of primary experience."[13] Similarly, Dewey attacked the presumed distinction between facts and values: "if experience actually presents esthetic and moral traits, then these traits may also be supposed to reach down into nature, and to testify to something that belongs to nature as truly as does the mechanical structure attributed to it in physical science."[14]

We see Polanyi also making strides in overcoming strong dichotomies between thought and world. But Margitay is right: showing the inextricable fusion of knowing and being, subject and object, value and fact, does not at this point produce an argument for a layered ontology. Margitay, responding to Takaki, does do a good job of showing how this more fine-grained, yet general, interweaving of epistemology

and ontology does not help Polanyi support a hierarchy at the coarse-grained level (M2, 51). Margitay can claim that the epistemontology at work behind the focal thing applies just as easily to cobblestones and planets as it does to living things and minds. So how might this notion support Polanyi's layered ontology? Polanyi needs both epistemontology and dual control.

From a Polanyian perspective, although the experience and conception of a planet, or any object, is the product of irreducible tacit integration, the conception of a planet is fully explained by the conception of planet parts and physical laws (here is where a reversibility of clues points us to the same ontological level). But according to Polanyi's notion of dual control, when it comes to living things and machines, the conception of the whole (its *Bedeutung*) is not reducible to the conception of the parts (*Bedeutungen*), when those part are conceived simply as objects subject to the laws of physics (here is where irreversibility points to an ontological difference). Add that the focal conception of the machine, organ, or living being reflects our access to an epistemontological reality—and so the meaning (*Bedeutung*) is not merely (as Kant proposed) a subjective projection or a regulative idea[15] —and we see the idea of dual control as evidence for ontological emergence.

Polanyi needs to show that in some systems, physics is insufficient: we must appeal to higher or different laws in order to show how the *Bedeutung* of the parts comprise the *Bedeutung* of the comprehensive entity. In *The Tacit Dimension*, Polanyi brings this intertwining of tacit knowing and being forward in his example of knowing a frog. And the frog will show us why Polanyi's understanding of dual control holds true.

Emergence and Dual Control

By bringing out the epistemontology of Polanyi I hoped to show that Margitay moves too quickly to the idea that ontological emergence has to stand on its own with no help from tacit knowing. Now I want to look at Margitay's criticisms of Polanyi's notion of dual control as a ground for a hierarchy of emergent levels. Here I will emphasize that dual control is not the "purely ontological argument" for emergence it appears to be (M1, 134). Purposes, or meanings, are built into the notion of a dual control system so that Polanyi's ontological layers are infused with meanings that cannot possibly be explained purely in terms of physical and chemical laws.[16]

For Polanyi, emergent entities start with *life* and *machines*. The illustration of dual control shows how the laws of physics and higher order freedoms might be compatible. A machine's operational principles, says Polanyi, are not reducible to the laws of physics.[17] Living things also maintain an order that allows them to manipulate the boundary conditions of lower levels for their continued functioning. According to Polanyi, the lower order cannot determine the higher order because from the perspective of the lower order one cannot even tell whether the higher level machine or organism is broken or working.

Margitay provides a wonderful example to show a possible weakness here in Polanyi's thinking. He provides an example of design-like functioning in systems that are, according to Polanyi himself, fully explicable by their parts and the laws of physics. Take the solar system. Margitay says that we here have something machine-like that "has a particular shape, material and arrangement; and, as Polanyi said earlier, no higher principles are needed to determine them" (M1, 135). The physical laws and the initial values of the material constituents are enough "to determine in its entirety the physical structure of the solar system." But Polanyi, according to Margitay, does not explain "why the physical level can completely determine the physical structure of the solar system but cannot the physical structure of, say, my watch" (M1, 135).[18]

If there is a slippery slope between (on one hand) the solar system and (on the other) a machine or

living system, one might slide either way. One person's *modus tolens* could be another's *modus ponens*. Margitay says that if machines are emergent then the solar system must count as emergent, too. It does not, and so machines are not emergent (in the sense of operating by higher principles). But if pressed by Margitay's argument, Polanyi might take the route of seeing solar systems as comprehensive entities and admit to higher-level organizing principles in some inanimate systems. Hints of this inclination are found towards the end of *Personal Knowledge* where Polanyi speaks of a "generalized field" at work in organizing and developing natural systems (*PK*, 398). One might take Margitay's logic seriously and one might come to agree, for instance, with Gregory Bateson, who sees mind as extending into some inanimate systems, as well as organic systems and brains.[19] One might even come to agree with Peirce, who held no strict divide here, but spoke of physical systems and material objects as mind "hidebound with habits."[20]

Margitay says Polanyi gives no indication of the difference between the solar system and a machine, but as Gulick points out (M2, 14), for Polanyi emergent things are "telic." A key to seeing that a thing is telic, and therefore emergent, is that there are parameters for what constitute proper development and functioning. For Polanyi, like Gregory Bateson, how semantic *information,* i.e., differences that make a difference, works to order constituent parts is an important clue: life has DNA and a genetic code; machines have purposes ordered by their operational principles. Bateson sees mind extending into nature because he sees "intelligent" knowledge-like behavior there: patterns are maintained by processing information. So Bateson sees standards of correctness in ecological systems, just as Polanyi sees them in machines. He reaches more broadly into nature, seeing there a wider sort of semantic robustness that Polanyi sees only in living organisms and artifacts.

Margitay thus raises an interesting question by emphasizing "knowledge-like" entities as a *sine qua non* of emergence. How deep below, or how far around, the level of human purpose into inanimate nature does emergence go? Peirce goes deeper than Polanyi, Bateson goes wider than Polanyi. Polanyi himself holds the baseline at the biological and artifactual. Margitay suggests emergence begins only at higher stages of mental development, not even at the level of cognition, but at the level of mind and person (M1, 139). Is his ontology too stingy?

But whether or not Margitay's slippery slope slides emergence further down into nature or propels it further up, I think that Polanyi is right to hold that the lower level laws and initial material conditions would not be enough to determine that the physical structure on Margitay's wrist *is a watch*. The purposes that make a thing a type of machine are not recognized at the lower level, so some configuration of constituents describable by physics might be there on Margitay's wrist but it wouldn't be a watch**.**

Margitay seems to see a machine as a projection of human meaning rather than an entity integrally comprised of meaning. Polanyi, however, says that nothing is a machine "unless it serves a useful purpose, and living organs and functions are organs and functions only to the extent to which they sustain life. A theory of knowledge based on tacit knowing does not require that we purify science of references to mind or to the finalistic structure of living beings" (*KB*, 157).

But is Margitay right to suggest that the higher ontological level and its laws are fully reducible to the lower levels and their laws when it comes to systems such as machines and biological organisms? The problem here—and all the better for Polanyi's argument—is that the notion of mechanistic explanation forces together the mechanical and the organic. Could Margitay stick with the reducibility of machines only, his claim might have more rhetorical force, but he implicitly must slide from machines to biological systems, and so Margitay moves to a ground where there is less science and more supposition on his side.

Here is where the understanding of what counts as a reductive account makes a difference. As

philosophers like William Wimsatt who are serious about the study of biology point out, mechanistic accounts of organisms should not encourage any confidence in an ontological reduction.[21] These sorts of explanations do not eliminate the higher level; they rely on its existence, even as they attempt to work out conditions on which it is dependent. Mechanistic explanations provide interlevel and not ontological reductions, and an "[i]nterlevel reductive explanation, successful or not, is never eliminative. Eliminative (interlevel) reduction is a mythic invention reflecting older aims of ontological economy since abandoned."[22]

The ontological economy "abandoned" here is described by Marjorie Grene as an attempt on the part of logical empiricists to unify science by reducing all phenomena to physics and its laws.[23] The attempt to reduce one *theory* to another can be a step towards accomplishing this goal. Ultimately, the hope was to reduce all theories—chemical, biological, psychological, etc.—to physics. The supposition was that when a theory was reduced, the ontology was also reduced. There are instances in which intra-level theoretic identities have been established and ontologies, as well as theories, have been reduced. But this "successional reduction," in which one theory is succeeded by another, is far less common than has been supposed, especially in the realm of biology. To reduce one theory to another, we need to find correspondences that show an identification of one entity with others. But Wimsatt says, "as we proceed we are given not correspondences, but pieces of mechanisms" and the correspondences we can construct turn out to be "richly context-dependent."[24] In other words, instead of a successional theory and ontological reduction what we find are explanatory mechanisms, or operational principles.[25]

Polanyi uses the notion that the lower level does not contain the concepts of the higher level as a means of showing that the higher level cannot be reduced. Margitay understands this and does something interesting by attempting to show that a reducing theory need not fully capture the concepts of the reduced theory (M1, 137). Margitay believes this weaker conception of reduction is enough to undermine an ontological emergence; it need not be as strong as the reduction of phenomenological to statistical thermodynamics purports to be.[26] To make a bid for ontological reduction, Margitay here shifts to the notion of identification rather than identity. He claims that "a proper identification of something as something by virtue of its parameters" is enough, and "only this is required for ontology" (M2, 54).

Two things to note here are, first, that the concepts and meanings of the higher level are left unreduced and, second, that Margitay takes the picking out of the machine by physical and chemical properties to be an adequate identification of the machine. Margitay is in effect saying that we can *identify* the machine without *recognizing* it as the sort of machine it is terms of its meanings. This, of course, is meant in opposition to Polanyi's claim that the semantic unity and function that constitute the machine itself are invisible at the level of its constituents and their laws (*KB*, 176).

According to Margitay, industrial standards show us actual instances of our ability to identify machines, which are emergent things for Polanyi, merely in terms of the constituent level of physical and chemical parameters (M1, 138). Margitay might even believe that we can develop industrial standards for identifying and distinguishing working steam engines from broken ones by basing our search parameters on lower level laws and concepts only. To an extent this might be right. But the real question here is whether or not Margitay is illicitly importing the knowledge of the purpose and function of the machine that we gain at the higher level *in order to write those parameters* into the lower level search. Polanyi points out a similar move when he accuses the behaviorists of illicitly importing the meanings of the behaviors into their studies, which they claimed were purely descriptive: "Behaviourist psychology depends on covertly alluding to mental states which it sets out to eliminate" (*KB*, 216).[27]

Margitay says, "the lack of concepts is not enough to show the impossibility of identification and to establish ontological difference thereby" (M1, 138). We might agree that he might be very successful in

identifying a machine by these standards, but that does not establish an *identity* between one level and the other.

By moving to this notion of identification, rather than the establishment of an identity, Margitay is reaffirming an observation he made earlier. As I put it: we can identify an object (*Bedeutung*) via various contexts (or *Sinne)*, i.e., we can locate it using different maps with differing degrees of success. But it is still the case that in order to best locate a comprehensive entity on any map we need to have some understanding of what type of thing we are looking for. If we seek to identify a machine, the understanding of what we are looking for, and what lower level features would best identify it, come from the tacit knowledge that allows us to identify it consistently. Polanyi gives us a biological example:

> in order that we may formalize the relations that constitute a *comprehensive entity,* for example, the relations that constitute a frog, this entity, i.e., the frog, must first be identified informally by tacit knowing; and indeed, the meaning of a mathematical theory of the frog lies in its continued bearing on this tacitly known frog (*TD*, 20-21).

Polanyi builds on his frog example when he discusses machines. In the case of machines, operational principles are the better way of formalizing the concepts that tacit knowing secures.

> Physics and chemistry … include no knowledge of the operational principles of machines. Hence a complete physical and chemical topography of an object would not tell us whether it is a machine, and if so, how it works, and for what purpose. Physical and chemical investigations of a machine are meaningless, *unless undertaken with a bearing on the previously established operational principles of the machine* (*TD*, 39; my italics).

The most important question in assessing Margitay's analysis of dual control systems is whether or not we can get necessary and sufficient conditions from the lower level and its laws alone.[28] Margitay suspects we can, since he is committed to a strong version of the idea that "physics is complete,"[29] but he is conscious of the fact that he does not show that we can. His strategy then becomes an attempt to show that *both* the functional explanation provided by the engineering principles and the standards provided by chemical and physical parameters *are inadequate* to the meaning of the machine. One can raise the objection that the "industrial standards" for catching frogs will inevitably miss many frogs. Margitay responds thus: "no explicit description—be it physical or functional—can provide a definition of the class of referents of a linguistic expression in terms of necessary and sufficient conditions. We learned this from Wittgenstein, but Polanyi would hasten to acknowledge it" (M1, 138).

We did and he would. But that does not change the fact that the higher level operating principles better catch and display the tacit meaning we recognize in the machine. And the lower level techniques, such as industrial standards, must somehow *simulate* (or "covertly allude to") the meanings generated by the higher level concepts. So I disagree with Margitay when he claims that lower level descriptions, uninformed by higher level meanings, could be "just as successful" when it comes to identifying machines (M1, 138). I disagree not because industrial standards can never be as successful as functional descriptions, but because they won't be as successful unless the parameters built into the industrial standards already attempt to simulate the boundaries set by the meanings we receive in advance via a tacit integration to a comprehensive entity. I can become better and better at finding frogs by specifying in more detail frog parts, but it is only in light of *the frog* itself that I come to my physical description of *its* parts.

As Margitay notes, both the functional and the physical parameters can fall short of the goal of finding instantiations of the machine type. As Wittgenstein shows, there is always a way to go wrong. But

the ability to pick out a machine by its lower level material properties does not negate the subservience of the materials to engineering principles that can better specify their proper ordering in the service of a purpose. Tacit meanings dominate both higher/functional and lower/material levels of search, but the higher engineering principles are the true lieutenants; they still stand above and order the foot soldiers so that they may move about in purposive motion.

Gergely Kertész brings a similar objection to Margitay's criticisms. He claims that the approach via industrial standards misses the unity of the object and the explanation of that unity. In reply, Margitay says that identification is enough and we don't need "unity and the explanation of unity for an ontology" (M2, 55). I hope I have shown why the sort of identification made possible by industrial standards is inadequate for collapsing ontological distinctions. Such standards rely on search parameters tacitly derived from a higher level of unity. I further hope that my foray into epistemontology shows that a conceptual irreducibility of a thing to its parts should be considered a *pro tanto* indication of ontological irreducibility. The burden of proof should be on the ontological reductionist in cases where there is no epistemological reduction. Margitay, also in response to Kertész, acknowledges that the irreducibility of a *conceptual* comprehension can be deployed as an epistemological argument for the emergence of entities.[30] What seems to hold him back from seeing the full force of his own argument here is his commitment to the completeness of physics, which he sees as "inconsistent with the theory of dual control" (M2, 50).

Here Polanyi could cite the specialization of sciences themselves as epistemological evidence for an ontic plurality, if not hierarchy. Polanyi, in effect, does this with dual control by showing how the laws of different fields of investigation build upon each other and are irreducible to laws of physics, though they are not in violation of those laws. The ideal of the unity of science, which promotes a theoretical reduction of all the sciences to physics, and thus requires that the laws of physics be complete in a strong sense, has been seriously called into question as scientific investigation has advanced beyond the armchair assumptions of the positivist.[31] Another reason to expect a *disunity* is precisely the reliance of different fields of science, motivated by different questions, on idealized models that can be *in principle* incommensurable.[32] An inability to reduce one field of science to another (e.g., by providing a conceptually adequate explanation of one in terms of the other) should imply that no ontological/metaphysical reduction is possible as well.[33] The conceptual irreducibility of the sciences provides a negative epistemological argument against reduction and for ontological diversity. Steven Horst thus sees a pluralistic ontology legitimately advancing from a "Negative Epistemology-to-Metaphysics Connection" argument.[34] The disunity of the sciences thus calls into question the metaphysical hope that "physics is complete." The laws of physics are not broken, but neither are they sufficient to explain more complex, or different, emergent phenomena.[35]

Conclusion

Polanyi emphasized, at least at times, a strong structural correspondence between knowing and being, perhaps because of the privileged place scientific investigation has in understanding a thing, and perhaps because of lingering analytic assumptions that make an analysis to parts essential for understanding and identifying whole entities. Polanyi, in denying an ontological reduction, does not claim that machines are in explicable; quite the contrary, they are only explicable in terms of the meanings that they have and the operational principles that enact those meanings. And these are not *merely* meanings *given by us,* since machines are *real* in Polanyi's terms just as organisms are.

The analytic presuppositions that led Polanyi to hope for a strong correspondence between clues and parts may also have pushed Polanyi towards an understanding of ontology as a simple hierarchy, rather than a complex plurality, since parts must be "lower" than wholes, which can form parts of even

"higher" unities. But ontological layering may also be a mistake engendered by too analytic and linear a way of thinking. Marjorie Grene, in "Merleau-Ponty and the Renewal of Ontology,"[36] notes that while Merleau-Ponty's early work originally displayed an ontology that bore resemblance to Polanyi's hierarchy, he later moved to a pluralistic ontology, which Grene seems to have preferred to Polanyi's stratification. She describes Merleau-Ponty's later ontology as a plurality of "real centers of being" that is less an ascent and more a "multiplicity of forms."[37]

But the analytic presuppositions of correspondence and hierarchy may be benign and even beneficial taken the right way. The first might go toward *understanding* a thing better (e.g., the *Bedeutun*g) rather than merely identifying it (via *Sinn*) and the second might go toward grouping pluralities in a way that shows the general structure of important dependencies.

Margitay brings up interesting and important issues in a thoughtful manner that encourages dialogue, but I can only raise here a few questions: What counts as an explanation in science? Do mechanical explanations count as reductive explanations? In what ways are the laws of physics complete? Is indeterminancy or randomness a *real* feature of the universe? How deeply does mind or purpose reach into the inanimate? Are there structural realities that emerge through the interactions of things? Is there a reality to scientific laws and theory? To what degree do we participate in the constitution of reality, and how can that be best expressed?

I could go on, but I see by *my* watch (which looks an awful lot like a smart phone and contains much of my memory) that the time I have to engage Margitay's ideas is, for now, finished.

Endnotes

[1]Tihamér Margitay, "From Epistemology to Ontology: Polanyi's Arguments for the Layered Ontology" in Tihamér Margitay, ed., *Knowing and Being: Perspectives on the Philosophy of Michael Polanyi* (Newcastle upon Tyne: Cambridge Scholars Publishing, 2010), 128-140. References to this work are prefixed with "M1." An exposition of Margitay's paper can be found in Margitay, "Polanyi's Ontology *from Inside*: A Response to my Critics," *TAD*, 39:2 (2012-13): 42-58. References to this *TAD* are prefixed with "M2."

[2]Mihaly Héder also raises this as a problem and Margitay acknowledges the difficulty (M2, 52-53). But, oddly, Margitay still does not quite see how his critics might see him as espousing reductionism (M2, 46). Apczynski says, the notion of dual control was deployed to show the limits of physics, i.e., the limits of a "reductive materialism," and to allow for domains of freedom, i.e., "human reality and values" (M2, 28). The criticism of dual control at this level and the notion of the completeness of physics that Margitay espouses can efface distinctions that support the notion of emergent ontological levels for knowledge-like entities as well as machines.

[3]My first use of the term is in Lowney, "Re-Thinking the Machine since Descartes: On the Irreducibility of Bodies, Minds and Meanings," *Bulletin of Science Technology and Society*, 31:3 (June 2011), 179-192), 182. The ideas behind it go further back, especially to my paper "The Tacit in Frege," *Polanyiana*, 17:1-2 (2008), 19-37, which shows how background clues figure deeply into our identification as well as understanding of objects. Kyle Takaki brings out a similar emphasis by showing how "emergence occurs within an epistemic-ontology" (M2, 38). See also Takaki, "Enactive Realism," *TAD*, 38:1 (2011-12): 43-59.

[4]Walter Gulick, M2, 10-11 and John Apczynski, M2, 27 suggest this strong correspondence is not Polanyi's, but Marjorie Grene also worried that Polanyi made too strong a correspondence between epistemology and ontology in his *TD* manuscript. See Phil Mullins, "Scattered Thoughts," *Polanyiana*, 19:1-2 (2010): 64. Robert Cohen voices similar worries in "The Tacit, the Social and the Hopeful." In *Interpretations of Life and Mind Essays around the Problem of Reduction*, edited by Marjorie Grene (London: Routledge and Kegan Paul,1971), 38-64.

[5]See Michael Beaney, *The Frege Reader* (Oxford: Blackwell Publishers, 1997), 36-46, for a discussion on the proper translation of *Bedeutung*.

[6]See Lowney, "The Tacit in Frege," 24-28.

[7]Phil Mullins, "Comprehension and the 'Comprehensive Entity': Polanyi's Theory of Tacit Knowing and Its Metaphysical Implications," *TAD*, 33:3 (2006):30.

[8]Ibid.

[9]St. Thomas Aquinas, *Summa Theologica*, Part I, Question 85, Article #2, http://www.newadvent.org/summa/1085.htm#article2. Accessed 12 December 2012.

[10]See Mortimer J. Adler, *Ten Philosophical Mistakes* (New York: Macmillan Publishing, 1985).

[11]Aquinas shows how the universal is understood as we look back at the concept that we looked through: "…since the intellect reflects upon itself, by such reflection it understands both its own act of intelligence, and the species by which it understands. Thus the intelligible species is that which is understood secondarily; but that which is primarily understood is the object, of which the species is the likeness" (also Article #2).

[12]See Paul Lewis' review of Andy Clark, *Supersizing the Mind in TAD,* 36:2 (2009-2010): 85-86.

[13]John Dewey, *Experience and Nature* (Chicago: Open Court, 1997), 10-11.

[14]Ibid., 5.

[15]For Kant, the telic structures were merely regulative ideas. See Kant's *Critique of Judgment* trans. J. H. Bernard (New York: Hafner Press, 1951).

[16]Here I make a criticism along the lines of David Agler (M2, 22-28) and Gergely Kertész (M2, 16-21).

[17]It is interesting that for Polanyi scientific laws are also emergent realities; they are real by his definition just as universals are real. While Margitay sees knowledge-like unities in the *personal*, the laws of science and natural kinds would seem to bring it into the *natural* as well.

[18]Gulick provides the response that solar systems are *not telic*, and belong to inanimate nature for Polanyi, i.e. what Gulick describes as the "dynamo-physical world" (M2, 11). Designed entities and organism are, in contrast, telic. Gulick makes a further distinction in ontological levels between the "biological world" and the "human world." This tri-part general ordering of emergence fits nicely with a Polanyian scheme, in which inanimate things, living things, and persons have important and real gaps between them. But the genius of including machines together with living organisms can blur any sharp distinction between the meanings we generate in the human world and those found in nature. This does not dispose of Gulick's hierarchy, but speaks of areas of important overlap. The meanings we come to in the long run, in response to the "hardness" of the world, as C.S. Peirce might say, would be the human meanings with the greatest ontological charge.

[19]See Bateson, *Mind and Nature* (New York: Bantam Books, 1980). Bateson did, however, limit the use of "mind" to systems that include living things. He develops a definition of mind that makes precise, but diverges somewhat, from what we ordinarily mean by mind (see page 102) but this definition does not seem to preclude the possibility of inanimate minds.

[20]C.S. Peirce, "Law of Mind," *The Monist*, vol. 2 (1892): 533-559.

[21]William Wimsatt, "Reductionism and Its Heuristic: Making Methodological Reductionism Honest," *Synthese, 151* (2006): 445-475. See also my "Rethinking the Machine since Descartes."

[22]Ibid., 457..

[23]Marjorie Grene, "Reducibility: Another Side Issue?" In *Interpretations of Life and Mind,* edited by Marjorie Grene (London: Routledge and Kegan Paul, 1971), 27- 28. Gulick, in criticizing Margitay's conception of the completeness of physics, also points out that this idea is part of a reductionist, objectivist program that Polanyi and others have "successfully questioned" (M2, 14).

[24]Wimsatt, "Reductionism and Its Heuristic," 454-455.

[25]In my "Rethinking the Machine," I show how eliminative reductionists illicitly commandeer mechanistic interlevel reductions—miscasting them as successional reductions—in the service of promoting an unfounded ontological reduction that purportedly eliminates certain "folk" concepts (18).

[26]There are problems even with this poster child of reduction, as Takaki (M2, 37) points out and Margitay acknowledges (M2, 52). See also Steven Horst, *Beyond Reductionism: Philosophy of Mind and Post-Reductionist Philosophy of Science* (Oxford University Press, New York, 2007), 51.

[27]"We can identify tangible manifestations of mental processes only by first recognizing the mind at work in them…without reference to mind, these particulars observed in themselves, would become meaningless…the actual practice of behaviourist experimental psychology is rescued from this fate by tacitly relying on the mental interpretation of its observations, which are then translated into objectivist language" (*KB*, 169).

[28]See Grene, "Reducibility: Another Side Issue?"16.

[29]According to Grene, for Polanyi to say that "physics is complete" means that physics sets necessary conditions. Polanyi's contention that reality is indeterminate also implies that reality cannot be sufficiently determined by physics. Ibid.

[30]Margitay strengthens Kertész's argument and goes on to say, "if we can conceptually comprehend a machine type as part of our ontology, then we can treat it only as an emergent entity in the lack of a complete inter-theoretic reduction of the machine type to its physical-chemical particulars. And since we do not possess such inter-theoretic reduction and still can comprehend machines as part of our ontology, therefore, they are emergent entities" (56).

[31]Horst, *Beyond Reductionism*, 61-63.

[32]Ibid., 103.

[33]See Lowney, "Rethinking the Machine," 187, for a discussion about why this natural conclusion is resisted.

[34]Horst, *Beyond Reductionism*, 38.

[35]See Horst, Ibid., 101-109, on the "Thesis of Causal Closure" and presumptions of determinism. Moreover, one does not even have to challenge the TCC to get distinct ontological levels. The thesis is also satisfied with a "deterministic 'downward causation' that is underdetermined by strictly physical laws" (109).

[36]See her 1976 presidential address at the Metaphysical Society of America, "Merleau-Ponty and the Renewal of Ontology," *Review of Metaphysics*, 29 (1976): 605-625.

[37]Ibid., 607 and 609.