

MEDIUM EMERGENCE – Part Two – A Short Reductionist Argument against Materialism

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Abstract

Medium emergence, which unites the concepts of strong and weak emergences, is the proper personalist ontological position between dualism and materialist monism. Michael Polanyi's ontological conviction of personal reality and his understanding of "existential" and "conceptual" emergence comport with this theory, according to which persons emerged from inanimate fundamental matter through evolutionary achievements. This is the reason that they have tacit and personal knowledge which cannot be represented in the neutral terms of physics and chemistry and thus cannot be reduced synchronically to matter. Theorists of materialism claim that every higher level phenomenon can be reduced synchronically and thus cannot exist ontologically; however, reduction, as a form of human knowledge, is itself a higher level phenomenon thus is the necessary precondition of any kind of reduction. Therefore, the (synchronic) reduction of reduction and human knowledge is self-eliminating and logically impossible—that is, materialism cannot stand.

Keywords: emergence, reduction, materialism, Michael Polanyi.

1. Preface: Medium Emergence

In the first part of this paper, I argued that the concept of medium emergence is the proper personalist ontological theory. In this second part, I will show that Michael Polanyi's understanding of emergence comports with this concept. The point of his personalism is not his fierce, well-known anti-reductionism, but his frequently ignored anti-materialism, because reduction, in accordance with this concept, is not an ontological conviction, but rather an epistemological method which can be used against materialism too.

Emergence was originally a medium ontological position between dualism and materialist monism. According to dualism, there are two different kinds of reality, generally described as mind and matter or soul and body, which are independent, fundamental substances. This is the ontological conviction of the European Christian tradition. According to materialism, there is only one kind of reality: one fundamental substance, matter. This is the ontological conviction of modern European, 20th and 21st century science.

Adherents of emergentism accept the dualist concept that there are two different kinds of reality. However, they hold that only one of them is fundamental, while the other is emergent—that is, emergentists also accept the materialist concept that there is only one fundamental substance, matter. It follows that emergent realities are dependent on fundamental matter and have to evolve from it and so they do: *man is the achievement of emergent evolution.*

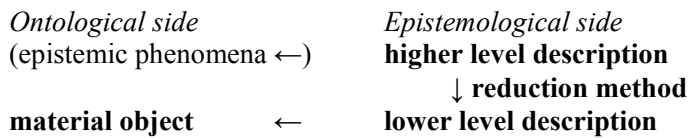
Dualism	Emergentism	Materialism
Mind	Emergent realities	
	↓ dependence	
Matter	Matter	Matter

This is the ontological conviction of Michael Polanyi and the root of his personalism. We are not eternal souls, neither are we just complex systems of matter, but real, emerged persons in our bodies.

Since the emergent kind of reality is real, it cannot be reduced to fundamental matter. Nevertheless, because it is not independent, substantial reality, but a dependent, evolved one, it can and has to be reduced to fundamental matter.

In the first case, we are speaking about reduction in a *synchronic* sense. This method corresponds to the Newtonian concept of the reversibility of time and to the knowledge-ideal of objectivism and exact sciences. Time is not a real, independent factor, but rather a special dimension of space, and therefore every higher level phenomenon can be reduced at the moment, that is, synchronically. This means that there are no higher level phenomena in the ontological sense; every higher level phenomenon is only an *epistemic* phenomenon. Reduction in the synchronic sense means *ontological elimination*. Since epistemic, higher level phenomena are

dependent on fundamental matter, they are *emergent*; and because they are only epistemic phenomena, they are emergent in the epistemological or weak sense. The theory of weak or epistemological emergence is a *materialist theory*.



In the second case, we are speaking about reduction in a *diachronic* sense. According to the views of Henri Bergson, Alexander Samuel, Norbert Wiener, and Michael Polanyi, time is irreversible and a real, independent factor, and therefore we cannot reduce every higher level phenomenon at the moment, that is, without taking account of this independent factor. This means that higher level phenomena exist in the *ontological sense*, and thus cannot be reduced synchronically. However, they can and have to be reduced in a diachronic sense because they are dependent on fundamental matter and evolved from it over time. Reduction in the diachronic sense means *ontological emergence*.

According to the theory of strong emergence, highly influenced by C. D. Broad, every higher level phenomenon is emergent in the ontological sense and therefore cannot be reduced synchronically. Broad's main example of this kind of emergence was the chemical phenomena (Broad 1925). Thus, the chief difference between the theories of strong and weak emergences is their relationship to *synchronic reduction*. The former asserts that *no* higher level phenomena can be reduced in this way, while the latter asserts that *every one* can.

Medium emergence is not just a medium ontological conviction between dualism and materialist monism, but *also* a medium ontological position between strong and weak emergences. Its adherents accept that many higher level phenomena can be reduced synchronically, but reserve that many can not. The former has been clearly demonstrated by the physical sciences in the cases of physical and chemical higher level phenomena such as heat, covalent bonds, etc. The reason for the latter is twofold. First, *no one has ever shown* that biological and cultural higher level phenomena can be reduced synchronically; moreover, the evolutionary explanations of those phenomena are clearly *diachronic* and do not correspond to the knowledge-ideal of objectivism and exact sciences. Second, it simply *cannot* be done because it is logically impossible; doing so would lead to the denial of our own knowledge, or even the denial of our own existence. In Polanyi's words:

“If, then, it is not words that have meaning, but the speaker or listener who means something by them, let me declare accordingly my true position as the author of what I have written so far, as well as of what is still to follow. I must admit now that I did not start the present reconsideration of my beliefs with a clean slate of unbelief. Far from it. I started as a person intellectually fashioned by a particular idiom, acquired through my affiliation to a civilization that prevailed in the places where I had grown up at this particular period of history. This has been the matrix of all my intellectual efforts. Within it I was to find my problem and seek the terms for its solution. All my amendments to these original terms will remain embedded in the system of my previous beliefs. Worse still, I cannot precisely say what these beliefs are. I can say nothing precisely. The words I have spoken and am yet to speak mean nothing: it is only *I* who mean something *by them*. And, as a rule, I do not focally know what I mean, and though I could explore my meaning up to a point, I believe that my words (descriptive words) must mean more than I shall ever know, if they are to mean anything at all. This prospect may sound deplorable, but a programme that accepts it may at least claim to be self-consistent, while any philosophy that sets up strictness of meaning as its ideal is self-contradictory. For if the active participation of the philosopher in meaning what he says is regarded by it as a defect which precludes the achievement of objective validity, it must reject itself by these standards.” (Polanyi 1962: 252-253)

Polanyi says of the (cultural) emergence of persons that only a person can understand anything, even in the case of the most precise assertions, and if, in accordance with an objectivist programme, “the active participation of the philosopher in meaning” is left out, then the existence of the person is denied. Of course, nobody can deny his own existence; to do so is logically self-contradictory and thus the objectivist programme is simply self-destructive. In the third section, I will show that the synchronic reduction of persons corresponds to this train of thought, and since it cannot be achieved, materialism must therefore be invalid. Before doing so, however, I will first demonstrate that Polanyi's concept of personal reality corresponds to the concept of medium emergence.

2. Polanyi's Understanding of Emergence

Polanyi starts "The Rise of Man," the 13th and final chapter of his *Personal Knowledge*, with the following:

„Living beings can be known only in terms of success or failure. They comprise ascending levels of successful existing and behaving. [...]

Accordingly, it is as meaningless to represent life in terms of physics and chemistry as it would be to interpret a grandfather clock or a Shakespeare sonnet in terms of physics and chemistry; [...] Lower levels do not lack a bearing on higher levels; they define the conditions of their success and account for their failures, but they cannot account for their success, for they cannot even define it. [...]

We must face the fact that life has actually arisen from inanimate matter, and that human beings—including the teachers of mankind who first shaped our knowledge of rightness—have evolved from tiny creatures resembling the parental zygote in which each of us had his individual origin. I shall meet this situation by re-establishing within the logic of achievement, the conception of emergence first postulated by Lloyd Morgan and Samuel Alexander." (Polanyi 1962: 381-382)

Firstly, Polanyi states that the neutral terms of physics and chemistry cannot represent life, which, according to the logic of achievement, can be known only in the normative terms of success and failure. That is, we cannot give full and explicit descriptions of the higher level phenomena of life because we have to use our tacit powers to appraise successful achievements and failures and express them in the normative terms of biology. This means that higher level descriptions of life cannot be reduced to lower level physical and chemical descriptions. However, this does not mean that life is entirely beyond matter; on the contrary, life depends on matter because lower levels define the conditions of higher levels and "account for their failures." Life is dependent on lower levels because it has arisen from inanimate matter during the long course of evolution. This means that life is an emergent phenomenon in the ontological sense.

I would like to emphasize that this is not just my conclusion; in his next sentence, Polanyi himself defines his ontological standpoint as a kind of conception of emergence. It is astonishing how many of Polanyi's interpreters have missed or overlooked this important fact and its consequences. Polanyi refers to Lloyd Morgan and Samuel Alexander, two of the three great British emergentists. However, it might actually say more that he left out the third, C. D. Broad, who is clearly the most important of the three for the analytical tradition. In contrast, I consider Samuel Alexander to be the most important of the three. The main difference between them, briefly stated, is that Broad's main example of emergence, as we have seen, was the *chemical phenomena* (Broad 1925), while Alexander illustrated his paradigm with *life*; he did not judge the chemical phenomena to be emergent in the ontological sense at all (Alexander 1920).

Polanyi says that he is re-establishing Alexander's and Morgan's concept of emergence within the *logic of achievement*. His point is that he regards living beings as active knowers who evolve as they try to solve the problems that face them as they act towards their goals. These achievements by living beings are the driving force of evolution, not some kind of vital principle or merely the mechanical and neutral notion of natural selection.

This understanding of evolution is once again positioned between two well-known conceptions: vitalism and neo-Darwinism. The former is a kind of dualist theory of evolution, while the latter is a materialist one; between them is the emergentist theory of evolution. This is the reason Polanyi attacks neo-Darwinism so fiercely; as a materialist theory, it reduces life to inanimate matter. A detailed analysis of these differences and of Polanyi's understanding of evolution is beyond the scope of this paper; however, it could serve as the foundation of a Third Part.

Living beings can act and solve problems because they have the knowledge to do so, and this knowledge is tacit because—other than man—living beings cannot articulate their knowledge into explicit assertions. This means that for Polanyi, *every living being has a kind of personhood* because personhood is the precondition of having any (tacit or explicit) knowledge at all. In his next subchapter, Polanyi writes about emergent evolution in the following way (the italics are mine):

"The next stage on the way towards *personhood* was reached by the protozoa. The appearance of a nucleus within a bed of protoplasm indicates an increased complexity of internal organization, underlying an external behaviour of immensely augmented self-control. Protozoa move about of their own accord and engage in a variety of deliberate purposive activities. A floating amoeba emits exploratory pseudopodia in all directions, which will catch food or else attach themselves to solid ground and then drag the whole mass of protoplasm with the nucleus in it towards this

foothold. All these manoeuvres are coordinated: the amoeba hunts for food. Thus it grows fatter until it reaches the size at which its *personal life* ends by fission.

A further great step was achieved by the aggregation of protozoan-like creatures to multicellular organisms. This enabled animals to evolve a more complex physiology based on sexual reproduction, a manner of propagation which greatly strengthened their **personhood**.” (Polanyi 1962: 387)

Let us recall that the title of his book is *Personal Knowledge*. Polanyi makes efforts at many places in his text to make clear that he means to use the term “person” very broadly, denoting with it even the simplest life forms. Thus for him, Alexander’s concept of emergence “re-established within the logic of achievement” means the *emergence of persons* during the long course of evolution. There are no eternal souls, nor is mind just a complex pile of physical processes; there are instead emerging persons.

„The inarticulate mental capacities developed in our body by the process of evolution become then the tacit coefficients of articulate thought. By the forming and assimilation of an articulate framework these tacit powers kindle a multitude of new intellectual passions.” (Polanyi 1962: 389)

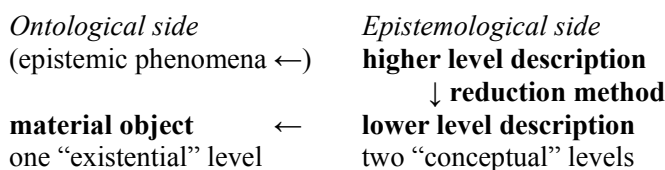
Our knowledge is tacit and personal because of our evolutionary emergence as persons and this is actually the reason we cannot represent the tacit achievements of living beings by the neutral and explicit terms of physics and chemistry; this is the reason we cannot reduce life.

In a subchapter entitled “The Logic of Emergence,” Polanyi makes clear that he has taken Samuel Alexander’s side and not C. D. Broad’s.

„The first thing to observe here is that, strictly speaking, it 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. And we realize then that conceptual progression may not always be existential, but that it becomes so by degrees.

For example: pour a handful of shot into a flat-bottomed saucepan, and you will find the grains forming a regular pattern. Crystals owe their symmetrical shapes to a similar principle: molecules of identical sizes and shapes tend to form regular aggregates in the same way as grains of shot in a saucepan. Is this the emergence of a new comprehensive feature? It is arguable that we could know the complete topography of the atoms in a crystal, without seeing that they form a regular pattern. There is, indeed, always a noticeable logical gap between a topography and a pattern derived from it, and to this extent no pattern is specifiable in terms of its topography. Yet since in the case of a crystal we can easily pass from the pattern to the topography and back again, the conception of such a pattern is in fact not destroyed by a knowledge of its topographic particulars. I would acknowledge, therefore, in this case two distinguishable conceptual levels but not two separate levels of existence.” (Polanyi 1962: 393-394)

I believe Polanyi clearly differentiates between the ontological and epistemological sides of reduction, which, as I argued in the First Part of this study, is highly neglected by mainstream approaches. According to this differentiation, he asserts that there are two kinds of emergence. One of them is when there are two “conceptual” levels but only one “existential,” which corresponds to my understanding of epistemological emergence.



The other kind of emergence is, of course, the ontological one—about which we have been speaking throughout this section—when there are two “conceptual” and two “existential” levels.

We have seen that for Polanyi, emergence is not defined by synchronic reduction, as it would be for theorists of strong and weak emergence, but by the logic of evolutionary achievement. He does not assert that every higher level phenomenon can be reduced, as is suggested by the theory of weak emergence, nor does he assert that no higher level phenomena can be reduced, as the theory of strong emergence suggests. And thus Polanyi’s concept of emergence *corresponds entirely to* my theory of medium emergence.

3. A Short Reductionist Argument against Materialism

If Polanyi's emergentist ontology—which I believe is the foundation of his whole theory of tacit and personal knowledge—is true, then materialism has to be false. But is materialism really wrong?

In the first part of this study, I demonstrated in detail that reduction and emergence are not rival concepts; this is only a materialist interpretation. In the ontological sense emergent levels can be reduced (diachronically) to primordial matter, leaving nothing “mysterious” or “magical” in them; diachronical/ontological reduction is only natural science. But now the question is how can we know that an object—a rock, a machine, a frog, or a person—is material? The answer, of course, is that it has to be *synchronically*/epistemologically and *successfully* reduced to fundamental material conditions. More exactly, if a higher level description of an object cannot be reduced in this way, this means that it has original reference and meaning, and the object is multileveled and not material. (In this paper I will not argue against dualism by simply denying it, so in this case I have supposed that non-material objects are multileveled, emergent ones.) But if a higher level description of an object can be successfully reduced in this synchronic way, then there is no higher-level object, there are no higher levels at all, but only the fundamental material substance.

<i>Dualism</i>	<i>Emergentism</i>	<i>Materialism</i>
No reduction	Diachronic reduction	Synchronic reduction

Let us put aside our prior convictions for a minute and investigate the objects surrounding us. What does materialism assert? It asserts that there is one kind of reality, one fundamental substance: matter. That is, every higher level description of objects can be and *has* to be reduced synchronically. There cannot be any exception, otherwise materialism cannot stand.

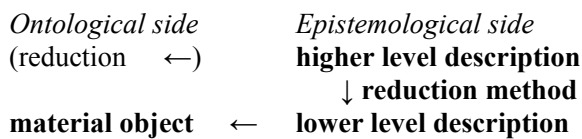
So, then, why do we have to believe in materialism? It is a very *strong* ontological claim, and so far very few higher level descriptions have been reduced synchronically (e.g. heat, covalent bonds, etc.); furthermore, these examples are from the *same* field, exact sciences. There are innumerable descriptions of higher level objects, and there are many fields besides exact sciences. Even so, materialism may be true, but if we believe in it we do *not* believe because we have accomplished this empirical examination, precisely describing higher level objects and synchronically reducing all higher level descriptions. We can be sure merely in one claim about materialism that it is a terribly bold metaphysical program.

What does (medium) emergentism assert? It asserts that there are two different kinds of reality: one is the fundamental substance, matter, and the other is the emergent levels depend on it which are the achievements of emergent evolution. That is, there are higher level descriptions of objects that can be reduced synchronically and those that cannot be. The former implies epistemological emergence and the latter ontological emergence.

So, then, what is the reason for disbelieving in emergence? For emergentism, unlike materialism, it is sufficient that only one higher level description of an object—or, more precisely, only one kind of higher level description of objects—proves to be epistemologically irreducible, e.g. knowledge or the mind. In comparison to materialism, emergentism is a *far more moderate* ontological claim and *actually corresponds to our experience*, insofar as it seems that there are both reducible and irreducible higher-level descriptions of objects.

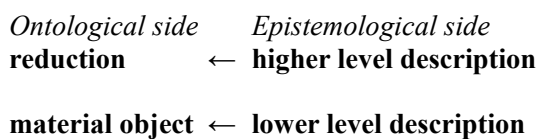
If materialism seems far more believable than emergentism, and this is the case for most scientists and philosophers, the reason for its seeming so is certainly not the bright success of its empirical investigations and synchronic reductions of higher-level descriptions of objects. It is rather the false dualism-materialism dichotomy used by both materialists and dualists which undermine the concept of emergentism. We have seen several examples of such argumentation in the First Part of this study, primarily in the case of reduction, where these theorists skilfully and cleverly discredit the achievements of diachronical reductions, for example.

One final question is of the possibility of the synchronic reduction of one specific object of this section—that is, the possibility of the synchronic reduction of reduction itself as an object. As we have seen in the First Part, reduction has three conditions, at least two different objects (though one of them can perhaps be eliminated), two descriptions of them, and the reduction method itself. On the ontological side are the objects, while on the epistemological side we have the two descriptions and the reduction method that refers to them. However, the latter are not only meaningful epistemic references to the objects; they are also ontological objects in themselves. *Reduction is a human epistemic tool—that is, knowledge—which has to exist and to be wielded skillfully and successfully; otherwise, no reduction will ever be possible.* Thus, if someone believes in materialism, similarly to every other object he has to synchronically reduce reduction itself too.



As we have seen, a successful synchronic reduction is an ontological statement, namely that *only one object exists, the lower level one*. In this case, it is the material substance (in bold on the ontological side of the chart above). But the other, higher level object does *not* exist. In this case, it is the reduction itself which, in fact, is not there. Therefore, in this case, a successful synchronic reduction asserts that *there has been no reduction at all*.

However, the existence of reduction as an object is the *precondition* of a successful synchronic reduction—*otherwise it cannot be realized*. Reduction as an object is there on the epistemological side, too. It was always there; it has to be there. But now, after a successful reduction, it is no longer there. The consequences, then, are the following:



The synchronic reduction of reduction is therefore *unenforceable* and *self-eliminating*. It cannot be turned against itself.

“For if the active participation of the philosopher in meaning what he says is regarded by it as a defect which precludes the achievement of objective validity, it must reject itself by these standards.” (Polanyi 1962: 252-253)

It follows that there is *at least one* higher-level description of an object that *cannot be reduced synchronically*. However, materialism asserts that *every* higher-level description of an object can be and has to be reduced synchronically. Therefore materialism is not and *cannot be valid*.

More precisely, according to this argument, there is more than one higher level description of an object that cannot be reduced synchronically, because if we believe in emergentism, then reduction—as a form of human knowledge—is the achievement of emergent evolution, which is a single, comprehensive process. Thus, all of the antecedents of human knowledge have to exist and have to be emergent too. I will not argue this point in detail; I would merely like to note that, according to this view, one kind of higher level description of objects is irreducible synchronically, namely higher-level descriptions of knowledge, from the knowledge of the first primitive prokaryote to the highest levels of human knowledge. A living being like a frog, for example, is ontologically emergent in comparison to heat, for instance, because the frog has the knowledge to be successful in achieving its goals—that is, in preserving itself, moving, eating, learning, and storing knowledge about the world. And it cannot be reduced synchronically because its knowledge is tacit and personal, and thus cannot be formulated in the neutral and explicit terms of synchronic reduction or the exact sciences.

So, then, reduction itself is an ontologically emergent object that cannot be reduced synchronically. In point of fact, *this is the reason* that its essence and *real meaning* are the consequence of its success or failure and not its “material” conditions—that is, the concrete reduction method. And now it should be clear why materialists are inclined to think that this is not so and focus on only its conditions.

4. The Main Contra-Arguments of Materialism

In the eyes of materialists, of course, the above argument does not work. The main reason for this, as I discussed in detail in the First Part of this study, is that materialists do not distinguish the two (epistemological and ontological) sides of reduction, and thus it has no real ontological consequences. But how could it have? For materialists, it is clear that everything is material. The only question is the particular synchronic method of reduction—that is, the condition for its success or failure. Thus, if a description of reduction and human knowledge has not been—and, in fact, cannot be—reduced successfully, then nothing happens and materialism remains valid.

For example, the great Jaegwon Kim himself concedes that human knowledge (in his words, “consciousness”

and “qualia”) cannot be reduced, and yet he still wants to defend a kind of materialism (Kim 2005). The reason he neglects elementary logic is the materialists’ false assumption of a dichotomy between monism and dualism. Kim sees dualism as the only other real possibility besides materialist monism, but he finds dualism even less acceptable. Of course, he knows about emergentism, but epistemological emergentism is actually materialism, and Kim finds ontological emergentism impossible. The main reasons for this skepticism are the case of physicalism, the notorious notion of downward causation, and the breaking of the causal closure of the physical world (see Kim 1998; 2000; 2002).

In the First Part of this study, I argued that the now-popular term “physicalism” is a *deceptive substitution* for materialism; it suggests that materialism is similar to and inseparable from physics. However, physics is actually an epistemological tool, not an ontological conviction; they are not in the same category. Thus, arguing with physicalism is simply an argument from authority; materialists do not consider it to be a genuinely different ontology from materialism.

Nevertheless, the rationale for using the term “physicalism” is that beginning in the 20th century, physics has followed an ontology different from that of the earlier Newtonian paradigm. This argument is highly problematic for several reasons. First of all, Newton was not a materialist at all. Second, it is not obvious that theories as varied as Einstein’s General Theory of Relativity, quantum mechanics, or string theory follow the same ontology. Third, if emergentism is true, then physics operates unproblematically with higher-level emergent objects. Thus, materialism follows neither from Newtonian nor from 20th-century physics, but is actually the consequence of the objectivist ideal of knowledge (Polanyi 1962: 140-141). Moreover, I believe that the facts and theories of 20th-century physics confirm the principles of emergentism rather than those of materialism, though there is no room here in which to formulate such a long and complicated argument. It is worth mentioning, however, that even before 1920, Samuel Alexander understood Einstein’s theory of relativity as a kind of support for emergentism (Alexander 1920).

The concepts of downward causation and the breaking of the causal closure of the physical world are strongly connected. Higher level emergent realities act in order to achieve their goals and do so by moving their bodies, which are fundamentally composed of matter. Thus, for example, when a frog catches a fly or a working piston moves a car, they create top-bottom effects (downward causation) which interfere with the normal causal chain in the fundamental material level (breaking of the causal closure of the physical world). This is the materialist understanding of what happens when a frog catches a fly or a piston moves a car.

In his famous *Science* paper “*Life’s Irreducible Structure*,” Polanyi clarifies the logic of achievement—that is, how higher level emergent realities act in order to accomplish their goals—by differentiating between epistemologically and ontologically emergent higher level realities which he calls boundary conditions. One of them is the *test-tube type*, which *has no influence* on the fundamental material processes taking place within it; the other is the *machine-type* boundary condition, which has the function of *controlling* and *harnessing* fundamental physical and chemical processes for the sake of some kind of *purpose* (Polanyi 1969). The function of a test tube is to make chemical processes observable by isolating them from their natural environment, but without influencing these processes in any significant measure; it is purposeful only in this sense. In contrast, machines are structured not with the intention of making fundamental material processes observable—these processes are interesting only if a machine fails—but in order to utilize these elementary processes for the *purpose* of some kind of work. Consider, for example, a piston that transforms the energy of exploding petrol into rotary motion, or a mill that does the same with the energy of flowing water. In these cases, lower level processes do not go on freely, according to their lower level principles; the specific structures and higher level engineering principles of the piston and the mill govern (control) and harness these lower level physical processes in several distinct steps in order to move a car or to grind wheat.

“Engineering and physics are two different sciences. Engineering includes the operational principles of machines and some knowledge of physics bearing on these principles. Physics and chemistry, on the other hand, 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.” (Polanyi 1967: 39)

That is, the fundamental difference between the two types of boundary conditions is that test-tube-type boundary conditions are simply consequences of *lower level physical processes and principles*, while machine-type boundary conditions are consequences of *higher level processes and principles*. Consider, for example, an

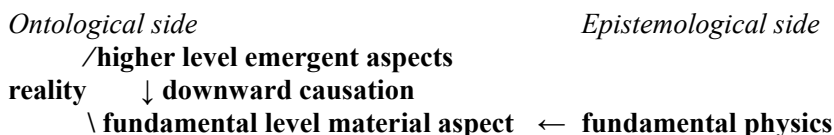
evolving solar system in contrast to an evolving species, or a crystal in contrast to a machine.

Nevertheless, a machine can control and harness lower level processes *only via* its material *parts*, in full accordance with the fundamental laws and principles of physics. The fixed walls of a piston, while controlling and harnessing the flow and explosions of petrol, *do nothing* to contradict the fundamental laws and principles of physics. Higher level emergent boundary conditions are not independent vital forces or Cartesian substances. Higher level emergent boundary conditions do not work on their own—that is, against their material conditions—but on the contrary, they rely on their material conditions and work in accordance with them. A piston is a boundary condition shaped into its material fundaments by man according to higher level emergent principles. The interaction between the piston as a higher level boundary condition and the controlled and harnessed lower-level, physical-chemical processes inside the piston can be understood only at the lower level. This is necessary since the fundamental physical processes, in accordance with their nature, exist only at the fundamental, lower level and thus can interact only at that level. It follows that a higher level emergent boundary condition can control and harness the lower-level physical-chemical processes in its body only via its own material conditions. Accordingly, the engineer who devises and creates the piston also shapes the piston via his material conditions, his fundamentally physical body, *just* as the piston *acts on* the petrol, not some mysterious mental force or something magical.

So, contrary to materialist impressions, neither the engineer nor the higher level emergent structures violate the fundamental physical laws and principles of nature. The materialist understanding of downward causation and the breaking of the causal closure of the physical world stems from their worldview, according to which *both* the higher and the lower levels are working mechanically, and thus the higher levels would necessarily break the lower causal chains. However, higher emergent levels are emergent precisely because their nature is different in kind from that of the fundamental material level—that is, they are emergent because *they act essentially differently*. In Polanyi's view, they act according to the logic of achievement; they use their bodies to control and harness lower level processes for the sake of a goal. According to the logic of achievement, the lower levels also do not have effect on the higher levels mechanically, but merely determine the fundamental material conditions in which higher emergent levels can act. No one can create a piston from air or from water. Iron makes it possible; however, it is not the physical and chemical properties of iron that determine the shape and function of the piston, but rather the higher level emergent principles of engineering which determine the material conditions in which an engineer can create a piston.

Thus, materialists are correct in positing the existence of downward causation; it must exist, otherwise higher emergent levels could not act and could not be real. However, the breaking of the causal closure of the physical world does not follow from the fact of downward causation; this is merely a materialist (mis)understanding of downward causation. In truth, the concept of the causal closure of the physical world is also only a materialist understanding of the world. In an emergentist worldview, the causal closure of the physical—or more precisely, the material—world simply does not exist because the world, of course, *is not merely material!* Matter is only one (fundamental) aspect of reality.

In the concept of the causal closure of the physical world, materialists mix up two essentially different concepts, one epistemological, the other ontological. This is camouflaged by the fact that they speak about the causal closure of the physical—not about the causal closure of the material—world as the causal closure of a human epistemological tool called physics and the causal closure of the ontological reality which we call the world would be exactly the same. However, to think that the world is causally closed (I, as an emergentist, would rather say that it is a coherent whole) and to use a causally closed physics are two essentially different things: only materialists regard them as identical.



If someone, according to a materialist conviction, identifies the causally closed system of physics with a coherent system of reality, then he will necessarily find that higher level emergent—that is, non-physical—aspects of reality break the causal closure of the lower, physical level. Since higher levels have to act through their fundamentally physical bodies to be real, they then break (by downward causation) the causally closed

system of (physical) reality. This is the reason, according to the materialist argument, that such levels do not and cannot exist.

Thus, their argument is actually the following: Materialism is true. Physics is a causally closed system. And therefore reality is physical and a causally closed system (the causal closure of the physical world). To be real, emergent levels have to be causally effective. Emergent levels are dependent on the physical level, and thus to be real and causally effective, an emergent level has to have an effect on the physical level (downward causation). However, such causation would create new effects from beyond the physical world, thereby disrupting the causal closure of the physical world. Therefore emergent levels do not and cannot exist, and materialism is true. In short: materialism is true because materialism is true. And facts about the synchronic reduction of objects, of course, do not matter.

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