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Dialectics of Emergence*

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One of the central paradoxes with which we are confronted in non-linear thinking is that of emergence. It can be formulated as follows: while a whole is generally thought of as a sum of its parts, a spontaneous generation of properties that do not belong to the parts seems to occur in the non-linear passage of the parts to the whole. This compels us to re-examine with greater philosophical care the seemingly simple categorical couple of whole/parts, where the whole – to paraphrase Kant – is any kind of multiplicity taken as a unity.

From the whole to totality

According to the traditional view, whole and part are two opposed determinations, each taken as external to the other, that can be related in two different ways: either through disjunction or through conjunction. In the first way, the whole is a prior unity capable of division into parts, or, depending on the case, into fragments, segments and so on. These parts are homogenous with the whole from which they originate, like the portions of a cake or pieces from a crumbling rock. The very word ‘part’ itself (from the Latin ‘parterre’, to divide) expresses the logically secondary character of what has been separated from an already existing whole. In the second way, parts are prior entities capable of forming a whole – like a construction of some sort combining pieces that, depending on the context, can be called ‘elements’, ‘components’, ‘ingredients’ and so on. Such a whole is not necessarily homogenous with the parts that make it up, but is more like a molecule in respect to its atoms. Here, the whole is presented as logically secondary in relation to its parts.
Although they differ in one significant respect, these two logics share a fundamental feature: they suggest that both whole and part are conceivable without the other. The whole can remain undivided, and thus without parts. Likewise, the elements can remain independent, so that they never form a whole. Whole and part are conceived, therefore, as two aspects of a pair while remaining more or less autonomous, that is ‘without a necessary internal connection’. The same whole can be divided into various kinds of parts, and the same parts can be recomposed into different wholes – so that neither the whole nor the parts can be said to contribute anything essential to the sense of the other. The possible non-homogeneity of the whole and the parts in the second of these logics, therefore, cannot be rationally accounted for. It is impossible to understand the new properties of the whole on the basis of its prior parts or from anything that occurs in the whole itself. Thus, the emergence of these new properties must remain a mystery.

**Mechanical and dialectical relationships**

In some typically difficult pages devoted to these two categories in his *Science of Logic*, Hegel reformulates the problem before us in a dialectical manner. The approach to understanding that pretends to be able to think of the whole prior to its parts and of the parts prior to the whole is simply nonsense. Treated independently of the whole, parts cannot be ‘parts’. Likewise, taken independently of the parts, the whole cannot be a whole. To say of atoms that exist in a free state that they are ‘parts’ would be absurd. They become parts only when they enter into the composition of a whole, that is only in relation to a molecule. And the atoms in turn are only wholes in relation to the nucleuses and electrons (or parts) into which they can be broken down. ‘Whole’ and ‘part’, therefore, are not really concepts that refer to two ‘different’ kinds of things. As Hegel points out regarding other categorical couples (like cause and effect), whole and part form but one and the same concept:¹ that of the *whole/part relationship*.

This dialectical view finds corroboration in every area of contemporary science where – at the deepest level – what we find are not things but relations. In quantum physics, for example, in contrast to what is suggested by the inaccurate expression ‘elementary particles’, it is not the particle that is elementary but the *fundamental interaction* in which it participates. ² One can easily draw examples of this sort from the other sciences. The whole, therefore, is in its essence a totalization of parts, which in their turn are constitutive elements of a whole. What we have