

Ruyer, Raymond. *La genèse des formes vivantes*. Paris: Flammarion, 1958. 5-9. Original translation by Taylor Adkins.

Morphology, the study of forms and their arrangements, does not present any fundamental difficulty. It needs more than precision and meticulousness. It requires, more frequently, indirect methods that demand a lot of ingenuity, like those methods that led to the structural diagrams of organic chemistry or to the genetic cartography of cellular nuclei. The results of these indirect methods are frequently followed by direct verifications. Photographs for crystalline research and negatives for electronic microscopes have made it necessary sometimes to see these structures before cleverly speculating on their nature. This proves that at least in principle, morphology is ‘easy’—in the very particular sense of the word in scientific research—easy, like a vision and a direct description.

In addition, in the science of forms, one escapes the unpleasant obligation to engage in philosophical subtleties on value and the possibility of knowledge. Eddington, in his last work [1], tells us which intellectual event represents for him the refutation of Bertrand Russell’s theory of the structural character of scientific knowledge. We could have avoided many philosophical speculations, Russell says [2], if we had realized the importance of structure and the difficulty of going beyond it.

For example, he says frequently that phenomena are subjective, but they are the effects of things-in-themselves which must have, *between themselves*, differences corresponding to the differences of phenomena. When this kind of assumption is made, it is generally supposed that we therefore know very few things on the objective counterparts of the phenomena. In fact, however, if the assumptions are exact, the objective counterparts would form a world having the same structure as the world of the phenomena. . . In short, any proposition having a communicable significance must be true, either of these two worlds, or none.

To express it grossly, the dog that we observe is not the dog as “animal in itself;” instead the two dogs have four legs, a tail, lacking sweat glands, and all the other anatomical details arrange in the same order. It does not matter that our world is only a world of shadows, if, as in the hell of Charon, the shade of the dog, trotting behind the shadow of its master, has four legs like the real dog. It does not matter that I do not know the real brain and living dog, that in terms of perception of this brain by my own brain, if I am able to describe exactly its anatomy and functional operation. Many philosophers, facing the “problem of the two dogs” have the impression that it is necessary to reject as irremediably naive the scientific point of view, and that it is necessary to think in a more subtle and direct way the notion of ‘the phenomenon,’ while returning to the immediate data and by devaluating as artificial all that science achieved in the deciphering of sensory experience.

But this discouragement—or this pretension—is completely unjustified. The theory and practice of machines as information have familiarized us with the major importance of structural correspondences. It is indifferent to the user for whom the soundtrack of the film is obtained in one way or another, with one material or another, provided that the sound is accurately reproduced. It is indifferent to the user who listens to the concert with the radio that transmits by amplitude modulation or frequency modulation, with two or three stages of amplification, if hearing is good. In the same way, it is indifferent to the anatomical scientist who knows the structure of the dog through his own cerebral relays, or directly, like absolute phenomenon. It is indifferent for him to learn that it is in the cave of

Plato, or in the world of Kant, or that of Brekeley, or in that of Husserl, provided that he can “decode” the final state of a structural group.

Naturally, all that one can say of the knowledge of structure applies to the knowledge of operation. Both apply to it the same domain. A structure is a closed group of possible operations, as well in mathematics as in biology. The rotation of a sphere, like a group of operations on the points of the sphere, precisely defines the structure of a sphere. The mode of locomotion of the dog performs only one action with the structure of its members, or more exactly with the structure of its members *plus* the structure of the nervous apparatuses ordering the muscles. At the least, the postulate of scientific physiology is that which can, in theory, find in the current structure of the nervous apparatus how to completely explain the mode of locomotion of the dog like a cyclic operation. This postulate can be still expressed in the form: “One must always be able to manufacture or imagine, for a considered function, an automaton of structure and equivalent operations.” The automaton will naturally be made of metal or plastic material and not living cells, but its structure, according to the definition, will be exactly the same one, for the considered function, as the structure of the living dog.

If morphology, with the physiology of operation, is the easy part of traditional science, morphogenesis presents on the contrary the maximum of difficulty and of mystery. It is easily conceived. If knowledge rests on structural correspondences—*isomorphism* between the real object and its phenomenon or its theoretical diagram—how will it be able to have *isomorphism* between an unspecified structural diagram and the passage of an *absence* of structure to a *presence* of structure? That the dog, which develops from the state of a unicellular, fertile egg, has formed its four legs and its nervous system cannot be understood in the same way that one understands how the dog, having now four legs and a nervous system, is able to move. *There cannot be isomorphism between a form and a formation, but only between form and form, or between formation and formation.*

In the mystery of morpho-genesis, there are only two possible attitudes: either to try to deny the formation, by reducing it to an operation, or to resort to a nonstructural diagram, with analogies to another, more familiar field, or one also notes formations, such as the field of artistic or technical invention. According to this last type of assumption, the structure and the operation of the automaton correspond to the anatomy and the physiology of the dog, and the formation of the dog corresponds to the invention of the automaton. The *isomorphism* of knowledge is preserved: in the formation as in the invention there is passage of an *absence* to a *presence* of structure; or, if one prefers, there is passage of an *iso-amorphism* to an *isomorphism*. But it is at the price of renunciation in order to know scientifically the invention as well as the formation. The psychologists with a scientific tendency did not lose the hope to explain invention like an operation of the human brain. However, it is clear that it is necessary to dispense with this hope if one places invention and formation in parallel, because there is no brain, human or not, that is at the origin of the formation of the dog, its brain included. Nature does not have a nervous system for creating nervous systems. It does not have hands, said Plotinus, nor to form any hands.

1. *The philosophy of physical science*, p. 151-2.

2. *Introduction a la philosophie mathematique*. (Payot).