

THE SELF-ORGANIZING UNIVERSE AND THE IDEA OF SYMMETRY: COGNITION AND EXPRESSION

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Abstract: *For a human-being looking onto the world as the field of his (successfull) life, the world appears as a well ordered universe. This impression seems to be contradicted by the 2nd thermodynamical law, which in the common interpretation is sayed to state a continuous growth of disorder. The problem is solved by causal laws that introduce symmetries apt to explain the interactions of particles in matter.*

These laws are given in mathematical form, hence stimulate the question for their ontological status: qualities of the world or of the mind? The historical answers differ. That of Romantic Natural Philosophy gives special re(f/v)erence to symmetry.

1 THE PROBLEM: „ORDER“ OR „DISORDER“ IN NATURE?

Let the universe be created by an almighty God, or let it exist on its own cause and account - its development since, thus also its contemporary shape and structure, would be the result of the inherent natural laws, that have worked up to now for some billions of years.

Existence and actions of Man depend from the experience of a reliable well ordered world, and scientific efforts in fact succeeded in revealing a system of natural laws, that is hierarchically ordered and in a certain respect identical with the universe itself.

Thus, the human fundamental claim for reliability and order would be settled, if not one of the most basic laws, the second thermodynamic, would stir up this comfortable mental indolence by postulating a continuous growth of disorder in the world, a paradoxical contradiction to the empirical evidence of increasing order: Not only the natural laws figure as a wellordered system, but the empirical world itself shows us a multitude of highly ordered phenomena, in a most impressive manner e.g. as crystals and organisms, which obviously have evolved, starting from a presumed chaos of single particles, to highly ordered systems by means of nothing else than natural laws (or alternatively - but not really a constituent of scientific thought - by an „occasionally“ active „deus ex machina“): in contradiction to the second law, the world appears as a universe that *organizes itself as a well ordered system*.

1.1 Solution - The Principle: Symmetry

At that point, the idea of symmetry helps us to solve the dilemma: The second law is but a special case of a general („integrative“) balance of natural processes under certain perspectives. Instead, the analysis of processes „in concreto“, of what really occurs to the involved material substances, shows us that they are regulated by directed forces and interactions of the particles which constitute matter, so that these particles are forced to arrange themselves in symmetrical order: Symmetries are not just formal descriptions, but „dynamical“ explanations of the internal laws of nature. The symmetries of the atomistic particles to their side are caused by the general quantum-mechanical laws of matter.

1.2 Solution - in concreto: Order + Disorder = Selforganization

The consequences can be derived and will be demonstrated by the representative pair of polar opposites: the arrangements of purely spherical particles in metals, and the tetrahedral symmetries of „atomic-bonded“ compounds (plus a variety of intermediate states). Thus, complex systems of matter arise from simple origins just as effects of natural laws, provided that certain additional environmental impacts, like suitable excitation energies, are rendered by chance.

Summing up: General tendency in nature is the *creation of order*, only disturbed - but also promoted - by *thermic disorder*: The history of the universe basically, and correctly, appears as a process of selforganization.

2 SYMMETRY AS COGNITION: MATHEMATICS

Symmetries can be formulated in mathematical terms, and mathematics from its very beginning counted as a field of cognition that is expected to render a special kind of truth of exceptional certainty. Not only does this truth by far exceed the only „dependent“ truth of empirical knowledge, it even exceeds the limits of the - otherwise believed as unlimited - will power of God himself: Mathematic is believed to constitute a field of ideas independent from nature, mankind and God, a reigndom of pure and autonomous rationality that governs them all. The problem with this free and independent reason of course is its ontological status: is it an ordinary entity, or a transcendent idea, or identical with God, or a „free creation of the human mind“? - the diversity of possible answers, puristic, „fundamentalistic“, or synchretistic, constitute the history of philosophy and human selfunderstanding. We must confine ourselves to some aspects of the role symmetry plays in that global performance of mankind.

Symmetry, when defined as „invariance under transformation“ (J.Rosen), holds an exceptional place as an intersection point of general laws of both, formal and empirical character:

- Rosen demonstrated the identity of symmetry with „reproducibility“ and „predictability“, thus with the basic, even defining cornerstones of scientific methodology at all;
- Noether proved the equivalence of symmetries and conservational laws in physics;
- Klein relates symmetry (as a formal equivalent of conservation) to the Kantian category of substance/accidence, the latter in relation to causality and interaction, thus to the general constituents of cognitive object formation;
- von Weizsäcker postulates the identity of these forms of object formation with the basic formal laws of symmetries in contemporary (particle-) physics.

3 SYMMETRY IN EXPRESSION: BEAUTY

Now, because Kant defined categories as cognitive strategies previous to („a priori“) any experience, they were frequently (mis-)interpreted as (innate) qualities of the human mind itself, instead as laws of nature (i.e. as empirical cognitions). This (mis-) understanding was further improved by the feeling of the evident beauty and mental satisfaction which symmetrical objects usually provide, with beauty being widely understood as both, a mental *reactive* (emotional) answer on environmental impacts, as also an *active* spontaneous (internally motivated and freely disposed) expression of intimate (quasi-mental) self-identity (Portmann).

4 UNIFICATION BY SCIENCE: ROMANTIC NATURAL PHILOSOPHY

The complicated balanced system of understanding the world by receptive cognition, and of the constitution of the self by active expression is not yet elaborated satisfyingly.

Yet, the problem by itself generated its own philosophical elaboration in what is called „Romantische Naturphilosophie“ (Romantic natural philosophy, RNP), and its philosophical counterpart, idealistic „Identitätsphilosophie“ - both ill-famed by scientists and critical philosophers soon and up to now, a condemnation in fact well founded, but superficial and too hasty, for RNP immediately had a deep and stimulating, yet long overlooked influence on modern scientific thought!

Schellings Identitätsphilosophie, and its theological surplus, „Pan(en-)theismus“, comprizes God, Nature and Man in a complex unity of interdependent relations: not only is God the creator of the universe and (en-suite or independently, resp.) of Man, but His spirit is continuously present in both of them. The universe is not at all finished by the single act of divine creation, but it is still an active entity, that sets itself into being by a continuous stream of creative acts guided by the natural laws, i.e. by selforganisation.

These indeed are esoteric ideas, often expressed in a strange style; yet those scientists working under the auspices of RNP succeeded in deriving or postulating a wealth of basic general guiding principles which, however, needed 100 years to prove their effectivity and fruitfulness for contemporary science: principles of conservation, of interaction, of symmetry, all these now common framework e.g in quantum mechanics, particle physics, crystallography, theoretical chemistry and biology.

SUMMARY: SYMMETRY - SYMBOL OF COMPREHENSION

In a „Conversation on Symmetry“, the Danish scientist Christian Oersted, according to Romantic „Naturphilosophie“, retransfers both, science and the human mind, into divine spirit by the idea of an all-embracing unification. He conceives a never ending self-evolvement of nature, in which symmetry plays the role of a guide, because it participates in all of its levels in an elementary as well as in a comprehensive sense: symmetry becomes the main stimulus of intellectual insight by affection of our sense of beauty, which in the developing mind must be promoted by education.

References

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