

LIFE AND MIND: THE COMMON TETRADIC STRUCTURE OF ORGANISM AND CONSCIOUSNESS – A PHENOMENOLOGICAL APPROACH

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The question of the holistic structure of an organism is a recurring theme in the philosophy of biology and has been increasingly discussed again in recent years.² Organisms have recently been described as complex systems³ that autonomously create, maintain and reproduce themselves⁴ while constantly interacting with their environment. Key focal points include their autopoiesis⁵, autonomy⁶, agency⁷ and teleological structure⁸. This perspective marks a significant advancement from the 20th-century viewpoint, which predominantly saw organisms as genetically programmed, randomly generated and blindly selected survival-machines. However, crucial questions about the shape and development of organisms still lack answers. Shape and development are deeply interconnected and seem to require a holistic approach. Here, I will briefly outline a phenomenological perspective which could provide a framework for seeking answers to these fundamental questions.

I. The Structure of the Organism

The origin of every organism and each of its organs can be traced to an ancestor or a precursor form. An organism's specific structure is enabled and constrained by what has been generated by its predecessors or previous stages of development. At the same time, every stage of an organism's development carries the potential for its future developmental goals. A seed, for example, has the effective potential to develop into a flowering plant. The activities and changes that take place inside the seed happen *for the sake of* its future development, and this principle applies at the morphological, cellular, biochemical, molecular, and genetic levels. All processes are directed towards supporting the life and survival of the organism or species as a whole.

It's also important to keep in mind that an organism always develops as a specific type or species which remains constant throughout its development. A rose is always a "rose", whether it exists as a seed, a shoot, a flowering plant, or a rose hip. Throughout its development, there is an underlying constancy. Biologically, this constancy is the species of the organism; epistemologically, it is its type or concept. Finally, an organism is dependent on its environment. While the species remains unchanged over time, the environment always only influences the organism in its current physical state.

A living organism can therefore be described by four distinct but interacting aspects, as illustrated in Fig. 1. (In fact, it is arguably impossible to think of an organism by leaving any one of these aspects out). When the developmental stages shown in Fig. 1a are merged, a fourfold structure is obtained (Fig. 1b). Its horizontal dimension, encompassing descent and goal-directedness, represents organic life across time. The two horizontal arrows signify an interpenetrating process: both influences are active throughout the organism's development, life, and reproduction. The vertical dimension illustrates the organism's autonomous agency in relation to its environment.⁹ Different organisms exhibit varying degrees of autonomy¹⁰ (compare, e.g. jellyfish and mammals). Consequently, the two vertical arrows don't interpenetrate but oppose each other. This tetradic

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² Mossio (2024).

³ Gilbert und Sarkar (2000); Bizzarri et al. (2013).

⁴ Nicholson (2014).

⁵ Weber und Varela (2002).

⁶ Moreno und Mossio (2015); Fulda (2023).

⁷ Desmond und Huneman ; Virenque und Mossio (2023).

⁸ Steigerwald (2006); Walsh (2006); Walsh (2015); Gambarotto und Nahas (2022); Rosslénbroich (2023).

⁹ Jacques Monod, although being an influential advocate of genetic determinism, nevertheless described this autonomous agency of an organism in very clear words: "[An organisms] structure demonstrates a clear and unrestricted self-determination that includes a quasi-total 'freedom' from external conditions and forces. External conditions can certainly hinder the development of the living object, but not direct it; they cannot impose their organization on it." Monod (1975), S. 28 (transl. CH).

¹⁰ Rosslénbroich (2014).

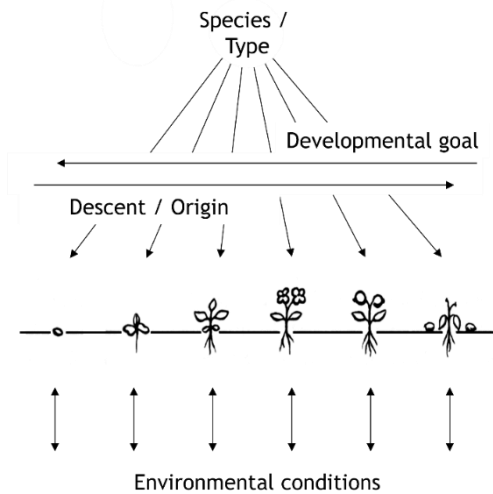


Fig. 1a: Phenomenological depiction of the factors which constitute a developing organism.

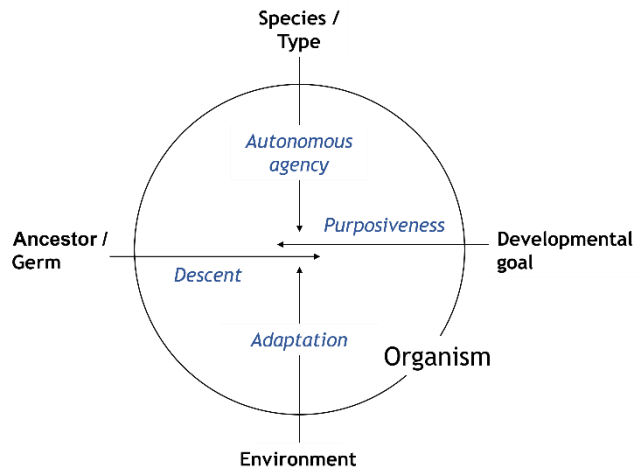


Fig. 1b: The tetradic structure of the organism.

structure symbolizes an organic whole as a dynamic interplay between descent, goal-directedness, autonomous agency, and environmental adaptation.

II. The Molecular Level

The tetradic structure also applies to the molecular level of the organism. The “livestream” from the past is represented by inheritance of DNA, whose structure copies the organism’s past into the present, so to speak. DNA itself (the supposedly “controlling” genes) is an entirely passive structure. Any activity and developmental potential is realized through the catalytic action of proteins. By lowering the activation energy, catalysis enables biochemical conversions that would otherwise take centuries or longer. Just as the achievements of the past remain present in the organism through the structure of its genes, its future potential is “drawn” into the present through the function of catalytic proteins.

And just as the species or type “superordinately” determines the course of development of the organism as a whole, gene and protein activities are regulated by the whole organism according to its requirements in respective developmental and physiological states. And finally, as physical substances, DNA, RNA and proteins etc. correspond to the present physical structure and substance of the organism (whereas in relation to the past and future, DNA and proteins must be thought of functionally rather than substantially).

The tetradic structure therefore describes the organism not only on the macroscopic but also on the molecular level (Fig. 2). The structure can also be applied to metabolism and to all other cellular, organic and organismic processes and thus “permeates” all levels of the organic, as it were. In fact, it can be argued that this structure hovers implicitly in the background of any biological knowledge relating to an organism. It can therefore be seen as the concept of the living organism, the bio-logos.

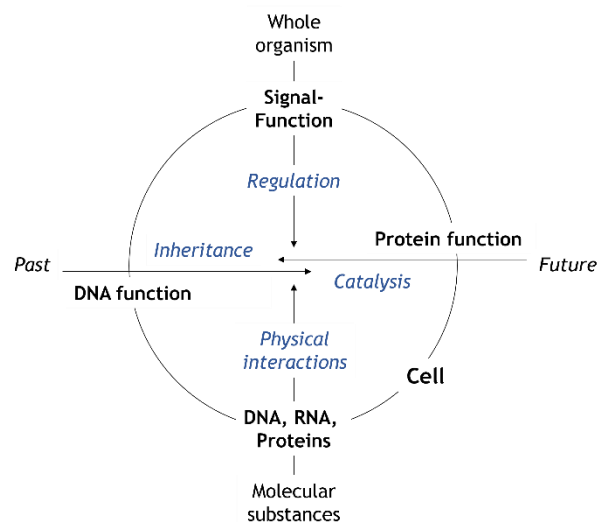


Fig. 2: Tetradic structure of molecular-genetic components and functions of the organism.

III. Structure of Consciousness

Interestingly, the tetradic structure also describes the structure of consciousness, if it is described in a phenomenological first-person perspective (Fig. 3). When I look at the bud of a rose, I add to the present sensory impressions the images of its past stages through memory, and I also anticipate – perhaps not very conscious, but nevertheless recognizable – its future development. I summarize these impressions, memories and anticipations in the concept “rose”. And this does not only apply to the cognition of an organism, but to the structure of (healthy) consciousness in general: In every waking moment I have sensory impressions, memories of the past, subtle anticipations of the future and find myself in a constant state of “apperception” of the “I”¹¹.

The structure of consciousness appears to correspond to the structure of the living organism. Consciousness can therefore be seen as an inner experience of organic life. *To be conscious means to experience life from within.*¹²

IV. Gestalt-Perception

An organism cannot be seen as a present phenomenon only, because it integrates its past and future, and consciousness cannot be limited to the present moment, but must be seen as a “time field” in which past and future are integrated through memory and anticipation.¹³ Interestingly, time-integration is also relevant for shape perception. Traditionally, shape-perception is considered to require the merging of percepts and concepts. However, Viktor von Weizsäcker demonstrated that the perception of shapes also involves a subtle temporal process.¹⁴ In an experiment, he showed test subjects individual points that lit up one after the other at different positions on a screen. If these points together formed a circle (or another simple and concise figure) this “circle” could be “seen” by the test subjects, although it was “not at all founded in the stimulus”¹⁵. This is only possible because the test subjects remembered the positions of the previously shown points and expected the following ones. von Weizsäcker called these phenomena the “anamnesis” and “prolepsis” of gestalt perception, respectively (corresponding to retention and protention in Husserl’s analysis of musical perceptions).

The tetradic structure therefore also describes the *perception of a gestalt*. In Fig. 4 one can observe the interaction of the four components in a self-experiment. The holistic concept of an “elephant” does not entirely fit with the detailed individual perceptions which are linked by memory and anticipation: I do not see what I expect to see according to what I think I should see and what I actually saw. Due to the lack of fit, the four components are pulled apart here, so to speak, which would otherwise coincide in a flash and thus go unnoticed.

These observations show that in biological cognition we are not only dealing with living organisms “out there” and (similarly structured) cognition “in here”, but that the organic gestalt itself (and thus also its changes during development) can only be understood as such if the (time-integrating) interplay of “outside” and “inside”, of nature and mind is taken into account.

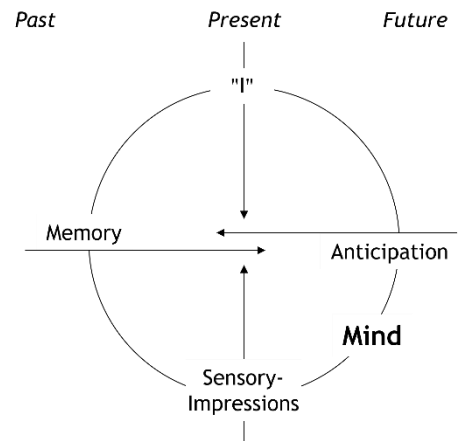


Fig. 3: Tetradic structure of the conscious mind.

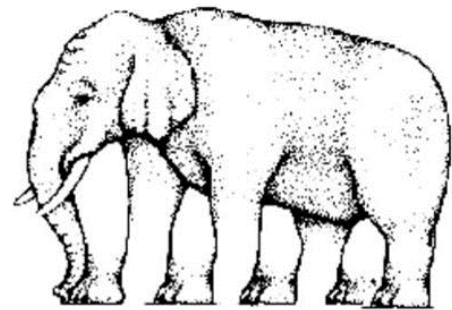


Fig. 4: Self-experimental demonstration of the interaction of concept, perceptions, memory and anticipation in gestalt-perception.

¹¹ Kant (1926).

¹² Recently, some scholars have argued that both the cognizing subject and the organismal object could be treated as organized living systems. The investigation of the properties of living organization would therefore simultaneously be an investigation of the subject of biological knowledge and vice versa. Cf. Mensch ; van de Vijver und Haeck . This corresponds to the notion of “continuity without identity between life and mind” as recently advocated by Gambarotto und Nahas (2023). These authors explicitly claim that “the structure of natural life is the same as the structure of mind” (p. 769).

¹³ Cf. Husserl (1928).

¹⁴ Weizsäcker (1942).

¹⁵ Ebd., S. 50.

V. The Reality of the Organic

In summary, one can say that the structure of the organism corresponds with the structure of consciousness and also with the structure of perception of its gestalt. These correspondences facilitate the argument that the question of organic form and its development can (only) be answered if the cognizing consciousness is taken into account. This could be a resolution of the teleological dilemma, as expressed so clearly in Kant's "Critique of Judgment". Kant had to describe the organism in teleological terms as a "natural purpose", but he could not naturalize purpose because he projected his empiricist and mechanical concept of the inorganic to the whole of nature.¹⁶ A phenomenological analysis, however, indicates that organic nature must be treated differently in the first place. A living organism cannot be understood under the premise of the dead. Its development in the counter-current of descent and goal-directedness and its constant, autonomous species with its changing and environmentally adapted appearance belong to organic nature like particularity and mechanical causality to dead matter. For the organic, only nature and mind *together* result in what we experience as the reality of a living organism.

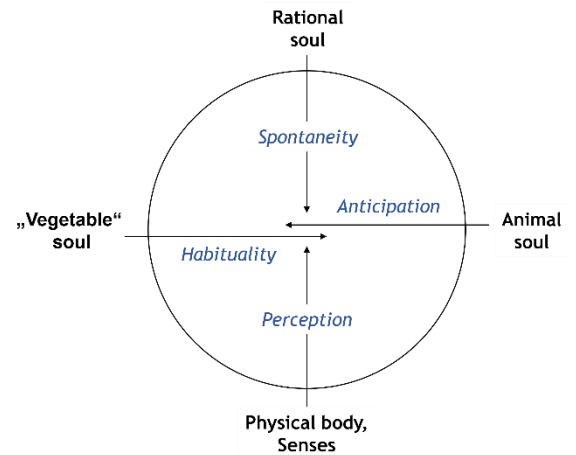


Fig. 5: The Aristotelian "souls" in the tetradic structure of the organism.

VI. Outlook: Aristotelian Causes and "Souls" as Potentially Heuristic Tools

The phenomenologically derived tetradic structure of the organism also reflects Aristotle's four "causes": Descent corresponds to the so-called *causa efficiens* ("how did it come into existence?"), purposefulness to the *c. finalis* ("what is its purpose?").¹⁷ The species or type corresponds to the *c. formalis* ("what gives it its form or identity?") and the physical appearance to the *c. materialis* ("what is it made of?"). Some authors have argued that the connection or even the identity between the *causae efficiens, formalis* and *finalis* is the Aristotelian principle of life, the "soul".¹⁸ However, Aristotle distinguishes between a nutritive ("vegetable"), an animal, and a rational soul. This distinction, in fact, could help to bridge the explanatory gap between life and mind¹⁹ by characterizing the different "souls" (e.g. ways in which the three causes interact) by different degrees of consciousness (Fig. 5). This can only be sketched out here: Physical substance has no consciousness. Descent (*c. efficiens*) can also not be described as conscious, but as a kind of remembered "habit" of the organism in adaptation to changing environmental conditions.²⁰ Goal-directedness (*c. finalis*) is to be regarded as a fundamental characteristic of all organisms, but it becomes an increasingly conscious striving for anticipated satisfaction as the level of organization in animals increases. Actual, free agency is only achieved in humans as the spontaneity of rational consciousness. This in turn means that the analysis of the four faculties described for human consciousness: rational spontaneity, conscious anticipation, habitual memory and sensual perception, would enable the description and exploration of the essence of the organism "from within" and bridge the gap between life and mind.

¹⁶ McLaughlin (1990).

¹⁷ As Fernando Moya wrote: "The introduction of the final cause in the study of living entities is not a response to a vitalist conception, but rather to the need to study the logos in the development of each living organism: a logos that, operating through efficient causes, should explain the regularity of the outcome in embryological development. This logos is what distinguishes living from non-living entities." Moya (2000), S. 331.

¹⁸ Christopher Frey: "An organism's soul is the principle, cause, and end of a single, articulate activity of living and each of an organism's vital bodily movements are aspects or partial manifestations of this unitary, natural activity." Frey (2022). And Lucas John Mix wrote: "Biological explanations are special, though, because they integrate the four causes in a unique way. In living things, the formal, efficient, and final causes are the same. The essence of an organism is its purpose, and both are inseparable from how it came about. In other words, a living thing can be defined through understanding its source (similar parents) and end (similar children). Aristotle used souls as a kind of explanation unique to living things, where formal, efficient, and final causes coincide." Mix (2018), S. 49. And Dalia Nassar wrote: "Like Aristotle's conception of final cause, [Kant's conception of natural purpose] approximates the notion of formal cause. A formal cause concerns the design or structure of an object. ... The structure of a living being ... is realized through the purpose (self-construction; self-maintenance), and the purpose is realized in and through the structure. ... In the case of internally purposive beings, the purpose is nothing other than the maintenance of the structure. The final cause ... is the ongoing realization of the formal cause." Nassar (2022), S. 41.

¹⁹ Gambarotto ; Gambarotto und Nahas (2023).

²⁰ Ebd., p. 775.

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