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Life as Self-Maintenance

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Abstract: The article constructs the organism as a living being and – unlike an automaton – as an individual concerned with its own self-maintenance, endowed with intrinsic purposiveness, autoregulation, and with an agency of the self as well. This is done from the perspective of the philosophy of organism developed by Kant, Hegel, and Plessner, and subsequently in the light of Systems Theory. Hegel's Philosophy of Nature proves to be best suited to emancipate the contemporary, comprehensive *concept* of organism and its selfhood. To put it with Hegel's words, it 'is the Concept that comes into reality' here.

Keywords: Organism; self-maintenance; intrinsic purposiveness; self-agency; Systems Theory; Kant; Hegel; Plessner.

I. Introduction

For centuries, the leading science, the paradigm of science, was physics. Today, it is biology[1]. Kant's dictum that there will never be "another Newton may some day arise, to make intelligible to us even the genesis of but a blade of grass from natural laws" (Kant 2007, 228; see also 238) sounds obsolete today. With the decoding of the genetic information by Francis Crick and James Watson half a century ago, biology not only advanced to a rigorous science, but also set out decisively to discover new continents of knowledge. In 1944, Erwin Schrödinger, who, as his research in Quantum Theory shows, certainly cannot be called discouraged about science, still saw a scientific understanding of what *life* is as being a long way off (Schrödinger 1951). This is hardly comprehensible

1 This article is based on the fifth chapter of Dieter Wandschneider's monograph *Naturphilosophie* (Wandschneider 2008), translated from German with the author's permission and made available here courtesy of C. C. Buchner Verlag (Bamberg, Germany).

today. Even if science still has no concise answer to the question of the essence of life, it is nevertheless considered certain that any detail of the organism can be made accessible to empirical scientific research.

This has opened up a new horizon of thought in which, for the first time, questions that have occupied the entire philosophical tradition again and again – more or less without tangible results – appear to be answerable. I am thinking here of three major topics: (1) organismic self-maintenance (problem of 'intrinsic purposiveness') (2) origin and development of life (evolution problem), (3) beginning of psychic activity in nature (mind-body problem). The central problem of the first topic, the principle of *organic self-maintenance*, concerns – to put it in anthropomorphic terms – the constant concern for one's own existence. In contrast to this, inanimate objects, a stone or a star, or a locomotive or a computer, do not care about their own existence. If they are still there, it is either by chance or because they have been maintained by human intervention.

The second topic is devoted to questions regarding the *origin* and *evolution* of life: how can life emerge from non-living? How can we explain that matter organises itself into the form of organismic structures? How is the formation of purposeful structures in the sense of organismic self-maintenance to be comprehended without the need to suppose a purposeful designer? How does the progressive growth of life come about, and might this evolution be steered by a purpose?

The emergence of *mental existence* [*des seelischen Seins*] in nature forms a third topic. Empirically, there can be no doubt that higher animals dispose of sentience, perception, emotion, and that the 'human' animal, beyond that, is spirited [*Geist*]. In this way, a further advance in the evolution of nature is made visible: after living systems have emerged beyond inanimate nature, a new, apparently 'immaterial' form of being arises on this organismic-vitalist basis: the inner, *psychic dimension*. That entirely new questions arise here is evident from the continuing resistance that the mind-body problem poses to its solution. Nevertheless, one dare to claim that no era was as close to a solution as the present one, which has done more research than any previous one into the material conditions of psychic processes.

As the concept of the autonomous system has already demonstrated, maintenance is always already part of material existence. Nonetheless, we are convinced that the self-maintenance of the organic is of an utterly different quality than, for example, the structural stability of a stone. What this ability of the living may consist of is a perennial enigma that recurs throughout the entire philosophical tradition. Without delving into the historical details, here are just a handful of references to this topic:

For Plato, the soul is the proper principle of life, responsible for motion and control over inanimate matter. Aristotle calls this principle of self-motion *entelechy*, the intrinsic teleology of an organism, which – unlike in automata – is not placed in the organism by humans, but originates immanently from within it. Descartes, on the other hand, attempts to eliminate the problem of life by conceiving the organism technically as a sort of *machine* and the soul as a separate, independent substance. In contrast, Leibniz develops a view according to which *everything* is more or less alive. Admittedly, such interpretations do not make life any more comprehensible. On the one hand, referring to the Platonic-Aristotelian principle of self-motion merely raises the question anew. On the other hand, given the manifest differences between living and non-living entities, one cannot be satisfied with Leibniz's view that everything is alive, nor with Descartes' reduction of life to technology.

II. Kant's View of Life as Intrinsic Purposiveness

The problem of the living is recognised and considered in all its sharpness in Kant's *Critique of Judgment* (1790). Kant sees that the concept of nature developed in the *Critique of Pure Reason* (1781) is no longer sufficient in this context. The transcendental interpretation advocated there, according to which the subject itself already possesses forms of perception (space and time) and categories (e.g., substance, causality) prior to all experience (a priori) and imprints them on the yet unformed matter of sensory perception, is expressed in the already quoted formulation from the *Prolegomena* (1783): "*the understanding does not draw its* (a priori) *laws from nature, but prescribes them to it*" (Kant 2004, § 36) – the principle of causality is an example of this. These are the most general, experience-independent (a priori) principles, which we cannot conceive of in any other way – this is where their 'transcendental' character becomes clear. However, specific laws of nature, according to Kant, can only be acquired through experience; let us consider, for example, thermodynamic or optical laws. This applies in particular to the formations of organic nature, where the *purposefulness* is particularly striking. Transcendental interpretations in line with the *Critique of Pure Reason* do not advance us here. In their abstract generality, they cannot grasp and explain concrete, organismic, functional complexity. One is rather reminiscent of technical constructions, such as a clockwork, whose parts fit together purposefully and make up a functioning system. But such constructs are not the product of nature; they are engineered products whose *purposiveness* is therefore *due to* [another] *rational, purposeful activity* [*deren Zweckmäßigkeit sich vernünftiger Zwecktätigkeit verdankt*]. Thus, the organism's specific nature is not captured in this way because the organism is not a technical mechanism, although both are equally purposeful in terms of their functioning.

The *problem of purposiveness* is precisely the central theme of Kant's *Critique of Judgment*: in its first part with reference to art, and in the second part – which is the only one we deal with here – with reference to the organic. The opposition between organism and mechanism is basically what Kant is concerned with there: How can something material, such as an organism, be purposeful, even though it does not originate from technical construction? Is it thinkable that nature itself pursues ends; does it guide the creation of organic, purposeful formations, thus behaving 'teleologically'? Or is a teleological nature just our interpretation, rationalised into nature? The question of organism versus mechanism thus involves the *problem of teleology*. Kant explains to what extent an organism differs from a mere mechanism by comparing it to a clockwork mechanism. In a clock, one part is

> certainly present for the sake of another, but it does not owe its presence to the agency of that other. (...) Hence one wheel in the watch does not produce the other, and, still less, does one watch produce other watches, by utilizing, or organizing, foreign material; hence it does not of itself replace parts of which it has been deprived, nor, if these are absent in the original construction, does it make good the deficiency by the addition of new parts; nor does it, so to speak, repair its own defects. But these are all things which we are justified in expecting from organized nature. – An organized being is, therefore, not a mere machine. For a machine has solely *motive power*, whereas an organized being possesses inherent *formative* power, and such, moreover, as it can impart to material devoid of it – material which it organizes. This, therefore, is a self-propagating *formative* power, which cannot be explained by the capacity of movement alone, that is to say, by mechanism (Kant 2007, § 65).

Tu put it in a nutshell, the difference between an organism and a mechanism lies in the self-organising *self-maintenance* of an organismic system: this is its primary purpose, to which all other functions are subordinate. This does not apply to a mechanism. Its existence is irrelevant to it, and it owes its purposeful construction to its constructor. In this sense, Kant distinguishes between two fundamentally different forms of purposefulness: *Extrinsic purposiveness* is one that has been placed 'from outside' into matter by a constructor, i.e., through purposeful activity planned by rationality. *Intrinsic purposiveness* has been brought about by nature itself, i.e., without rational engineer's purposeful activity.

So would be the first approach to the origin of both forms of purposiveness. Kant also makes an important *structural* distinction: the *intrinsic* purposefulness of an organism is characterized by the fact that its parts "combine of themselves into the unity of a whole by being reciprocally cause and effect of their form" out of their own causality. In an organism, "every part is thought as *owing* its presence to the *agency* of all the remaining parts, and also as existing *for the sake of the others* and of the whole, that is as an instrument, or organ. But this is not enough – for it might be an instrument of art [it could also be a mechanism], and thus have no more than its general possibility referred to an end. On the contrary the part must be an organ *producing* the other parts – each, consequently, reciprocally producing the others"; in short, it is not only "an organized", but also essentially a "*self-organized being*" [*sich selbst organisierendes Wesen*] (Kant 2007, § 65). For example, the heart, kidneys and liver are not simply 'organs', i.e. instruments serving the organism, but are themselves maintained by the organism and thus form a mutually self-maintaining whole – which is clearly not the case with a mechanism. The wheelworks in a clock, for instance, are not reciprocally dependent on each other or on the clock as a whole and therefore, unlike the organs of an organism, require external preservation and repair. In an organism, therefore, the organ is not only a means to the end of maintaining the organism, but conversely, the organism as a whole is also a means to the end of every one of its organs.

For Kant, the characteristic feature of life is therefore intrinsic purposiveness, and the organism is accordingly a system "*in which every part is reciprocally both end and means*" (Kant 2007, § 66, [204]). It is no overstatement to say that this description of a living being has remained basically unchallenged to this day. In Paul A. Weiss, a classic author of modern Systems Theory introduced by Ludwig von Bertalanffy (1949, 176 and 185) the following characterisation of an organism can be found: if, for example, A, B, and C are its parts, then "the *coexistence and common functioning of all three* (...) is the precondition for the existence and functioning of each of them" (Weiss 1970, 27). Weiss accurately captures the sense of *reciprocity between cause and effect* in Kant's concept of intrinsic purposiveness, whereas an insightful thinker such as *Helmut Plessner* completely fails to grasp this point when he associates self-maintenance with the "filter function" of *semipermeable membranes*, not only in his early work (1928) but also much later: "Organic materials achieve the character of organisms through this" function (Plessner 1964, 200). Kant's system-functional explanation is therewith reduced to a purely morphological factuality.

With regard to the causal *conditions for the realisation* of intrinsic purposiveness, Kant is confronted with seemingly insoluble difficulties. He considers a *causal explanation* impossible: from the perspective of causality, the *reciprocity* of means and ends required for intrinsic purposiveness is a reciprocity of cause and effect. However, Kant considers this impossible for two reasons: (1) the causal relation is *asymmetrical* and *invariable*, i.e. directed one-sidedly from cause to effect, whereas the *reciprocity* of cause and effect in the structure of intrinsic purposiveness would imply that the cause can also be the effect and the effect can also be the cause (Kant 2007, § 65). Kant further claims that causal processes are *blind* ("the mechanism of blind efficient causes") (Kant 2007, § 67) i.e. they do not run purposefully, since they are determined solely by determinants lying in the past and not by the end to be achieved in the future, as is clearly the case with the self-maintenance of an organism. One could object that a causally determined process is also goal-oriented, insofar as a future process state is unambiguously *determined* by its past course (e.g. Sachsse 1979, 13). Contrary to this, causally determined processes can be *disrupted* by external factors, i.e. diverted from their original purpose, whereas organismic activity seeks to pursue its specific goals *even against external disturbances*. More on this later (Section V). It is also not very helpful when Hans Driesch postulates his *vitalistic holistic causality* (e.g., Driesch 1924, 375; Driesch 1927, 92). Kant already saw that such ad hoc hypotheses cannot be considered real explanations.

From the perspective of the contemporary *Systems Theory*, Kant's two criticisms addressing causal relations, namely *asymmetry* and *blindness*, are to be rejected. As far as we know, *cyclical* causal structures are also possible, e.g., feedback mechanisms in which the outcome of a process ('effect') is traced back to its input and thus regains the status of a 'cause'. Despite the asymmetry of the causal relationship, a *structural symmetry* is realised in such a way that each link in such a cyclical system is both cause *and* effect. The asymmetry objection is no longer valid from a Systems Theory perspective. Also, the reproach of *blindness* of causal processes cannot be upheld in general, because behaviour guided by ends – as a conduct guided by set-point values – is known to be causally reconstructable.

So much for Kant's sceptical assessment of causative relations. However, Kant is even more sceptical about the *notion of purpos*e contained in the concept of intrinsic purposiveness. He argues that, while we can be certain a priori never to encounter an object in experience that is not causally determined, there are indeed things whose intrinsic purposiveness as organisms is undemonstrable. For this reason, the "purposiveness" of the organic can only be regarded as a "merely *subjectively* valid" principle, that is, "a simple maxim of judgement," which as such guarantees nothing about the nature of the *objects* (Kant 2007, § 71 and § 72), and remains "a mere idea", a "*regulative* rather than constitutive principle" (Ibid., § 72 and § 76), serving only to "reflect" on nature, but not to determine its objective properties (Ibid., § 74 and § 79). For him, the presence of the concept of purpose in this context indicates the concept of life to be merely our subjective interpretation, whereby we attribute something like rational and purposeful conduct to nature – for which, of course, there would be no alternative if we wanted to conceptualise the phenomenon of life in some way.

Unless, of course, natural being is in fact based on *reason*: an *objective, purposefully acting* nature would then no longer be absurd; unless, of course, nature was actually based on *reason*: an *objectively purposeful* nature would then no longer be absurd; its rational character would make the organism's intrinsic purposiveness comprehensible. This tempting interpretative perspective motivates Kant to consider the speculative idea of a *extra-sensory substrate* of nature [*ihrem übersinnlichen Substrat*], i.e., a *reason inherent in nature itself* (Kant 2007, Preface to the first edition, 1790; cf. § 67; § 70; § 73 and § 85; cf. Düsing 1968, 108; Bartuschat 1972, 215 and 253). His argument begins with the moral-philosophical reflection that the will determined by practical reason should also be translatable into real action [*in reales Handeln*] and thus ultimately into physical conditions. This can only be possible, Kant suggests, if nature itself is not utterly unreasonable. Consequently, "there must, therefore, be a ground of the *unity* of the extra-sensory that lies at the basis of nature, with what the concept of freedom contains in a practical way" (Kant 2007, Introduction, II). According to this view, reason would no longer be a merely subjective faculty, but rather "an extra-sensory real ground, although for us unknowable, would be procured (...) for the nature of which we ourselves form part" (Kant 2007, § 77). It would then no longer be merely the foundation of thinking, but of everything that exists. Reason would no longer have merely moral relevance, but *ontological* relevance in terms of a *logos* equally fundamental to both subject and object. From this perspective, it would be understandable that, on the one hand, natural objects can be organised in a purposeful manner in terms of 'intrinsic' purposiveness and, on the other hand, the subject's reason is capable of adequately grasping this purposiveness of nature. Given his doubts about the possibility of causal conditions for the realisation of intrinsic purposiveness, Kant certainly found the idea of such a reasonable – i.e., 'extra-sensory' – natural substrate extraordinarily attractive. Transcendental conception of reason in its subjective, cognition- and knowledge-regulating function, developed in the *Critique of Pure Reason*, would then be left behind. Kant ultimately refrains from drawing this conclusion. In accordance with his concept of knowledge restricted to its experiential basis, it is essential for him that we have no experience of a potentially extra-sensory, reasonable natural substrate and therefore an "undetermined concept" of it (cf. Kant 2007, XII, *The Division of the Critique of Judgment*). Accordingly, the ontological idea of a logos underlying nature is withdrawn, and the possibility of grasping the intrinsic purposiveness of the organic as a reasonability inherent in nature itself is ultimately rejected. The only way we can comprehend organic purposiveness is teleological, but this remains oriented towards the technical model – as if organisms were constructed by a "supreme Architect" (Kant 2007, § 78). This clearly leads one back *to extrinsic, technical* purposiveness, which as such presupposes an ideal anticipation of purpose. Kant already put this in the aforementioned, resignation-laden formula of the impossibility of 'Newton's of blade of grass' (Kant 2007, § 75) expressing his regret that for human thinking, the principle of intrinsic purposiveness has the status of a *merely regulative idea* for which no *conditions of realisation* can be provided and which, therefore, does not enable any *scientific knowledge* of the organic. The analysis of the means-end relationship carried out in a previous context (Chap. 3.2 of my book) has shown, that even extrinsic purposiveness inevitably contains the prerequisite that natural logic is underpinned by reason. Thus, in the course of realizing a conceptually anticipated purpose, a *transition* from the conceptual-ideal sphere to reality occurs, effected by the arrangement of suitable means. This configuration of means – as I had formulated – facilitates the *translation* of the ideal content of the purpose into the real shape of this purpose, which, at the same time, implies that both are affined, i.e., that reality also possesses an ideal character in some way. With the possibility of extrinsic purposiveness, an ideal underlying nature or, as Kant put it, an "extra-sensory substrate of nature" is always already presupposed. Since Kant holds extrinsic, technical purposiveness to be possible, he could not have rejected the idea of an extra-sensory substrate of nature, i.e., the possibility of a nature that is *purposive* in itself. To put it in a nutshell: if extrinsic purposiveness is realisable – and technology is a unique, magnificent example of this – then intrinsic purposiveness is in principle also *realisable* and not merely a subjective idea. This consequence, which requires an *idealistic* concept of nature, was only drawn in succession to Kant by Schelling and Hegel. However, as explained at the beginning, the triumphant development of the natural sciences, initially above all physics and chemistry, pushed natural-*philosophical* approaches – especially those of Hegel – completely into the background already in the 19th century.

III. Systems Theory

Under Ernst Haeckel's impact, the problem of life became a topic in the early 20th century, this time in empirical biology. The biologist Hans Driesch (1867–1941) was an eminent supporter of this idea, called *vitalism*, and tried to solve the problem scientifically. He experimented with the division of sea cucumber eggs, which showed that the parts independently reconstituted themselves into a whole. This, he believed, suggested the assumption of a specific *'holistic causality'* [*Ganzheitskausalität*] for organisms, governed by a quasi-Aristotelian *entelechy* (cf. Driesch 1924; Driesch 2027, 89). However, this form of 'vital force' [respectively, élan vital – *trans. note*] postulated by Driesch remains nebulous. Only the discovery of genetic information (1953) opened up possibilities of explanatory research into the phenomenon of organismic regulation that do not require ad hoc 'vitalistic' hypotheses, or in other words: that can now explain scientifically what vitalism meant.

The broader framework in which these developments can be viewed is *Systems Theory.* As a *general Systems Theory*, initiated by Ludwig von Bertalanffy (Bertalanffy 1949), it examines general properties of systems, e.g. the relationship between the system as a whole and its subsystems, the hierarchy of system structures, the relationship between the system and its environment, closed and open system forms, etc. This approach has subsequently been developed in a variety of ways – from mathematical, physical, technical and even sociological perspectives; this does not need to be explained in detail here.

The essential idea underlying Systems Theory (apart from its sociological variant) is that purely physical and chemical terms are no longer sufficient to characterise systems, because systems are *holistic entities*. Although their constituents are physical and chemical in nature, they form newly organised structures that require new terms to describe them: a system is more than the sum of its parts, as Bertalanffy puts it: "We often believe that if we have studied *one* thing thoroughly, we know everything about *two*, because 'two' is 'one plus one'. But we forget that we still have to examine the 'and'". Systems Theory "is a study of 'and' – that is, of organisation" (Bertalanffy 1970, 90). The organisation – here still without any organismic sense – consists in the fact that elementary laws of nature are 'interconnected' in the system, thereby establishing a new level of specific *system laws* 'above' the elementary laws of nature. Consider, for example, a television set: Maxwell's equations apply to its receiver and electronics, while the laws of solid state technology, thermodynamics, etc. apply to its components and housing. One of the resulting 'system laws' causes the device to be activated by pressing the power button (provided it is connected to the mains). Pressing another button causes a programme change. The fact that an increase in pressure at certain points in the system results in its activation, a programme change or similar is not in the least derivable from the physical and chemical properties of these points. These are new, system-specific laws which, as such, are located beyond the elementary laws of nature – even if the former inevitably presuppose the latter. What Paul A. Weiss observes with regard to living systems also applies to technical systems such as a television set: There is no phenomenon here “that is not molecular, but there is also none that would be *exclusively* molecular. It may happen that one cannot see the forest for the trees, but it is a very serious matter if one then simply denies the existence of the forest” (Weiss 1970, 20). Another beautiful example coined by Weiss is “the self-supporting arch in architecture. It would be impossible to build such a vault by placing loose stones on top of each other, because they would slip off as soon as the curve began. In other words, the arch as a self-supporting structure can only exist as a whole – or not at all” (Weiss 1970, 27).

It is therefore important not to lose sight of the *holistic nature of the system* and the *new laws* that emerge with it. These are possibilities already inherent in the elementary laws, which can only manifest themselves at the system level, i.e., in this particular constellation of elementary laws of nature. Technology as such offers a paradigm for this. It constantly constructs new laws that have never existed in nature before – without, of course, violating the laws of nature, but solely through the appropriate ‘interconnection’ of such laws (cf. Wandschneider 2004, chap. 1.2.4.). The term ‘*emergence*’ describes this manifestation of something new at the system level which is not yet present in the subsystems. And it is not only technological achievements that are based on the emergence of new laws, but – as will be discussed in detail later – basically also the diverse forms of living nature and, apparently, of the psyche.

The fact that emergence allows something *new* to appear means, on the one hand, that the *potential* for this already exists within the system components, but on the other hand, that this potential can only become *a reality* at the level of the system itself. Interpreting this as ‘reductionism’ would be a misunderstanding. For the emergentist interpretation does not say that a phenomenon occurring at the system level is already realised in subsystems and can therefore be reduced to them. The subsystems only contain potentialities which in their entirety – i.e. at the higher system level – result in something *new*. Reductionism notoriously overlooks the ‘and’ emphasised by Bertalanffy, which connects the parts to form a *new whole* that is more than the mere sum of its parts. I will leave it at these general remarks on the concept of emergence; this is not the place for a *theory* of emergence.

The subsequent paragraph will focus on characterizing the *organismic* system in more detail. An initial approach allows a distinction to be made between closed and open systems.

A system is *closed off* when it has no exchange of matter or energy with its environment. By the Second Law of Thermodynamics, its behaviour tends towards the most probable state, which is the state of Entropy Maximum in Equilibrium, i.e. the greatest possible disorder under existing envirnmental conditions. Gas molecules, for example, which are initially located in the corner of a container (or in any other position) will soon occupy the entire available volume of the container due to their self-movements and constant collisions with each other (for a more detailed explanation, see Weizsäcker 2006, chap. 8.5; note from János Boór).

In contrast, an *open system* is in a state of material and energy exchange with its environment. This prevents it from reaching a state of Maximum Entropy. Nevertheless, *dynamic* forms of equilibrium such as '*flowing equilibria'* are possible. Examples include the constant bow wave of a moving ship or the relatively constant shape of a candle flame. In the first case, the water of the wave is constantly lifted and exchanged, and the energy required for this comes from the ship's engine. In the second case, the combustion produces flammable gases whereas convection creates a flow of air that constantly draws in ambient air, thereby maintaining the burning process. Ilya Progogine (1985) calls such dynamic equilibrium forms resulting from the dissipation of energy '*dissipative structures*'. In this way, systems representing elementary forms of self-organisation (similar to bow waves and flame) become possible. Humberto R. Maturana coined the term '*autopoiesis*' for this phenomenon.

The organism is clearly an open system, because it needs nourishment and uses energy, both of which it obtained from its environment. However, it is also clear that an open and even self-organizing system is not yet an organism, as the examples of the bow wave and the flame show. In the euphoria following the discovery of autopoietic systems (1977), this was occasionally overlooked. For the moment, it is only important that the *emergence* of order characterizing organisms does not violate the Second Law of Thermodynamics, which predicts the emergence of disorder, but, as already explained, only for closed systems, not for open systems such as organisms. So much for the energetic-dynamic aspect of organismic systems.

IV. Forms of Autoregulation

Almost simultaneously with Bertalanffy's idea of a general systems theory, Norbert Wiener developed the concept of *cybernetics*. In short, the central intention of cybernetic systems is the technical realisation of *self-regulating processes.* In order to highlight the specific nature of organismic self-maintenance, let us briefly compare different forms of self-regulation.

Already inorganic systems may have certain self-regulating properties. Let is consider the example of a spiral spring: when loaded with a certain weight, it reaches a stable equilibrium position that is energetically optimal (minimum potential energy). Slight disturbances to the equilibrium cause forces to act on the spring, returning it to its equilibrium position – and, due to inertia, even beyond this point, causing it to oscillate around the equilibrium position. The self-regulating nature of this system lies in the fact that the forces acting to return the spring to its equilibrium position seek to restore this equilibrium. This equilibrium position is, so to speak, the 'process goal' that is achieved when the process comes to rest in a stable equilibrium (an unstable equilibrium, on the other hand, would be the state of a pencil standing on its tip, which any small disturbance would cause to tip over). Essentially, the process goal in these cases is determined *purely energetically*. If the energy relations change, for example when the spring is loaded with an additional weight, it also changes; the more heavily loaded spring is longer.

In contrast, the form of self-regulation in a *control loop* [*Regelkreis*] is not energy- but *information-controlled*. The functional principle can be briefly illustrated using the example of a thermostat: A set-point value of temperature is set on the regulator. This is compared with the actual value of the room temperature to be regulated. If the actual value and the set-point value do not agree, the heating (or cooling) system is activated. The thermometer measures the resulting change in the actual value of the room temperature, which is then compared again with the set-point value, and so on.

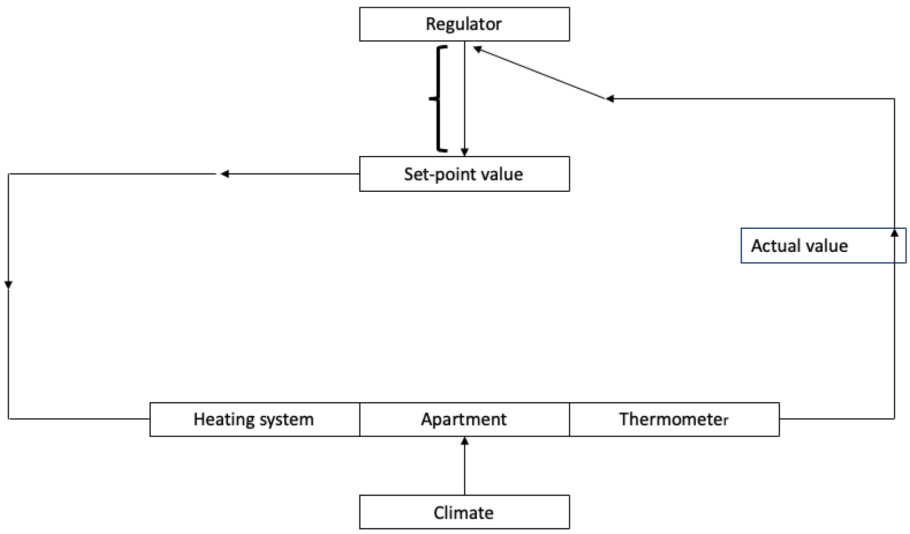

Figure 1: Heating system.

The information about the temperature change achieved by the heater ('actual value') is fed back to the heater control system by comparing it with the set-point value. This feedback enables the temperature to be regulated in accordance with the set-point value. The actual value and set-point value represent the actual temperature and the target temperature, respectively, and therefore provide information. The thermostat is thus already an information-processing system. Self-regulation is no longer mediated by energy relationships, but by information. Although the flow of information requires a certain (minimal) amount of energy, the control process does not depend on this, but solely on the information variables (for the concept of information, see Wandschneider 2004, chap. 1.2.6.). The organism's functions are also controlled by control loops and set-point values; let us consider the complex regulatory mechanisms for body temperature, blood sugar levels, adrenaline release, etc.

Regarding the manifold forms of self-regulating organismic functions, Hans Jonas warned against the misunderstanding that this already captures the specificity of the organism. Self-regulating mechanisms – Jonas' example is the self-steering, target-seeking torpedo – are merely automata whose behaviour is determined by "mechanical necessity" and is therefore performed "blindly" (Jonas 1953, 183). In reality, a target-seeking torpedo is not "engaged in the attainment of the goal," but follows solely causal determination in "terms of entropy", and this should not be interpreted to mean that it *wishes* to follow this course (Ibid.). The missing element here is "the concernedness of all life with itself" (Ibid., 186). "From a strictly semantic point of view, one can say that the entire cybernetic doctrine of teleological behaviour can be reduced to the confusion of 'acting on purpose' with 'having purpose'" (Ibid., 184), so far Jonas.

With regard to Jonas's example, one has to agree with him. There is no doubt that the target of a torpedo is as *irrelevant* to it as the room temperature is to a thermostat. But *what* is missing from the control loop in terms of Jonas's pointed "concern of life for itself"? Clearly, it is the fact that its behaviour is *completely unrelated to the existence of the system itself*. For example, the set-point value for the room temperature on the thermostat is *not* one of the conditions for the thermostat *itself* to function, whereas the normal temperature of a mammal represents a characteristic *value state of itself*. By aiming all its behaviour at maintaining its own, physiological set-point values (within certain limits), it is essentially concerned *with itself*. Organisms therefore differ fundamentally from automata in that their behaviour is not controlled by *any* set-point values, but – essentially – by their *own* set-point values.

The specific difference between automata and organisms is therefore, contrary to Jonas's view, in principle entirely comprehensible in terms of Systems Theory. This also contradicts the view held by Löw (Löw 1980, 298) and Spaemann and Löw (Spaemann & Löw 1981, 249 and 278), according to which the cybernetic interpretation of the organic is to be rejected as inappropriate and superseded by a view that is once again anthropomorphic and oriented towards the human self-understanding. It seems to me that this would merely amount to a *renunciation of knowledge*.

As a model realisation of his idea, Ashby designed a system he called *'homeostat'*, whose set-point values are precisely those parameters that constitute the very existence of the system, similar to body temperature, blood sugar level, etc. in a mammalian organism. The diagram shown is a model of organismic self-regulation based on Ashby's homeostat: The system's relationship to its own constitutive parameters is realised by two hierarchically linked control loops: One interacts with the environment and regulates the actions associated with a behaviour (e.g. nutrition intake) via sensors and effectors. At the same time, a higher-level control loop monitors the system conformity of these actions, i.e., all sensor-determined values are examined for danger in a controlling instance. If this results in an imminent danger (indicated here by a 'negative area') an alarm signal is triggered (in higher animals, e.g., a sensation of pain), which is forwarded to a repertoire of possible behaviours and switches the system to a different behaviour (e.g., a flight reaction) until the alarm signal disappears.

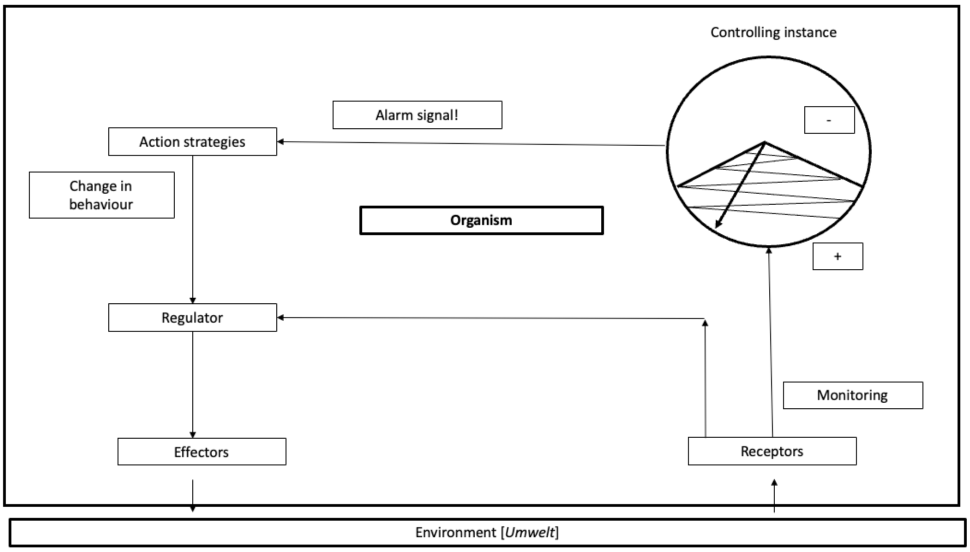

Figure 2: Controlling instance-based control loop.

Admittedly, this is a rather simplistic blueprint of the organism. In Ashby's design, switching to a different behaviour is achieved, for example, by means of a random generator, which corresponds to trial and error behaviour where different possibilities are selected randomly. Previous 'experiences' cannot be taken into account, i.e., the system does not become 'smarter' but always starts 'from scratch'. However, the value of the model lies in the fact that the *principle of* existential self-reference can be technically illustrated in this way and, once reconstructed, becomes understandable.

In the sense outlined above, efficiency improvements can be achieved by implementing *capacity for learning*: this makes action patterns available that have been successful in previous similar situations. From a technical point of view, this is not a problem: decades ago, Karl Steinbuch (1971, chap. 11) presented a learning system based on a '*learning matrix*' model, which has since been further perfected into the elaborate form of '*neural networks*'. Another serious shortcoming of Ashby's model is provision only for external perception and not for *internal perception*. Needs (e.g., hunger) and sensations (e.g., pain) are thus not included. In order to take this *internal dimension* into account, the model should be supplemented by an 'inner world' agency representing the entire system itself. As a result, not only external actions, referred to as 'animalistic' regulation with regard to animal's self-motion but also internal functions – analogous to the 'vegetative' processes in the organism – can be regulated.

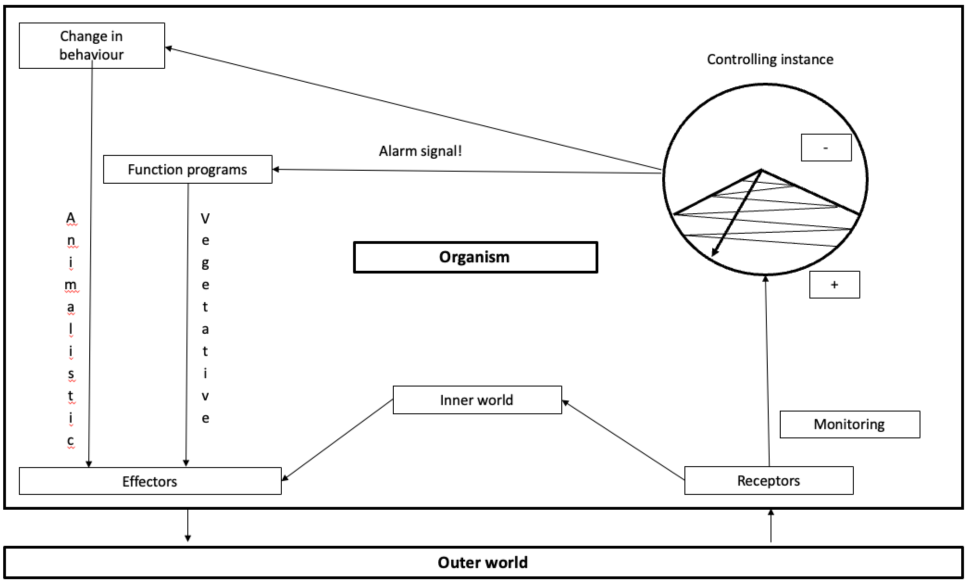

Figure 3: Animalistic vs. vegetative autoregulation.

One more word on Ashby's term 'ultrastability': this is not a particularly fortunate choice of words, since the pure stability aspect is certainly not crucial for characterizing organismic systems – a locomotive is undoubtedly 'more stable' than a fly. Much more essential in terms of active self-maintenance is the previously explained character of existential self-reference, which cannot be predicted by a locomotive. Not 'superstability' but self-maintenance through self-regulation, or autoregulatory self-maintenance, would be characteristic feature of the organism. In this respect, a term such as '*autoregulation*' would seem more adequate and will therefore be used here.

Since the self-regulating *system* is controlled by *inherent* set-point values, i.e. by the physiological parameters constitutive for the system's existence, it therefore contains a '*program of itself*'. Within the system, the system itself is virtually present once again in the form of such a programme of itself. Only in this way can the controlling instance perform the control function assigned to it. Generally speaking, auto-regulatory systems are therefore characterised by the existence of a *self agency* or, in more common parlance, a '*self*'. The somewhat mystical-sounding term 'self' refers here to nothing other than the internal organisational and functional programme of self-regulating systems that controls all system activities, thus acquiring a meaning comprehensible in terms of Systems Theory. This interpretation of the self agency can also be viewed as a Systems Theory reinterpretation of the *entelechy principle* postulated by *vitalism*, which was intended to justify the vitalistic claim of *holistic causality* in organisms (see Section 2).

At the same time, a criterion is available for distinguishing organismic processes from (1) causal-deterministic processes, which as such run towards a specific end state but lead to other end states when disturbed – processes whose 'telos' is therefore *contingent*, are also referred to as *telematic* processes (cf. Spaemann & Löw 1981, 233 and 235) – and (2) from forms of goal-oriented but not yet organismic behaviour, such as processes with active goal pursuit, which are referred to as *telenomic* (Ibid., 218). In the latter case, the process goal is no longer contingent, but is constantly present as a *set-point value* and effective as a process regulator, as in the case of a thermostat or a target-seeking torpedo, but this goal is not yet identical with the *system's existence itself.*

V. Characteristic Properties of Autoregulative Systems

After presenting the more technical side of self-regulating systems, it is now time to consider the *principle-theoretical perspective*. Fundamental characteristics of self-regulation – such as *those* of existential self-reference and situation assessment – have already been mentioned. The core points of this interpretative approach will be explained in more detail below.

(1) *Active self-maintenance:* Autoregulation is understood here as a system's ability to maintain itself against all external or internal disturbances of its functions, and is thus defined from the outset as self-maintenance. A thermostat which protects itself against overheating is not yet an autoregulatory system. The temperature set-point value is *only one of the parameters* of the system's existence, but control of all these parameters is required. It would not be equipped to deal with an acid attack, for example, and flight behaviour is also foreign to it. Of course, self-maintenance is not immortality. The emphasis is rather on the 'self'. This should be maintained by the system's inherent means, which is of course only possible within certain limits. No amount of self-maintenance can prevent a shot to the brain.

(2) *Intrinsic purposiveness:* If self-maintenance is to be possible at all, self-regulation can only be conceived as the realisation of Kant's concept of intrinsic purposiveness. For in order to ensure its own existence, the system must also ensure the existence of its components, which are thus simultaneously means and ends for one another. Self-regulation can be understood as a systems-theoretical reinterpretation of Kant's philosophical concept of life.

(3) *Situation assessment:* All impressions received by the self-regulating system are assessed by the controlling instance in terms of whether they are 'beneficial to the system' or 'detrimental to the system'. Implementing this is undoubtedly the greatest technical challenge, but it is absolutely essential to the 'autoregulation' project. In organic systems, situation assessment is encountered at every step, most notably in higher animals as pleasure and pain feeling, but even plants show preferences for nutrients, warmth, light, etc. The criterion for this is always the 'system conformity' of the data received by the system. But how does the system 'know' what is beneficial to it and what is not? Undoubtedly through the 'programming' of life forms in the course of evolution.

(4) *Species universality:* An autoregulatory system maintains itself as a specific system with specific functions. As such, it is *indivisible,* an *in-dividuum.* If one divides a stone, one has two stones. If one divides a fly, one has two dead halves. The specificity of

the fly system, i.e. its species specificity, is thereby destroyed. The self-regulating system is characterised in this respect by a 'this way and no other', i.e. by its specific way of maintaining itself in existence. In this sense, it is essentially determined by its species specificity and is thus essentially an individual of a specific species (obviously, a hydrogen atom is also characterised by specific properties, and in this respect it is also an individual of a specific kind, but it lacks the aforementioned properties of self-maintenance, etc.). An individual living creature always participates in the universality of its kind – just as the individual fly is a fly because it always participates in 'flyness'. This concomitance of the individual and the universal is ontologically interesting and demonstrates that the universal can also exist in reality. But does *cell division* not contradict the alleged indivisibility of the system? No, because in this particular case, the new units created by division each contain the entire, species-specific genetic information. The fact that the organism reproduces and *inherits* its species specificity in this way should be understood in terms of the economy of nature, so that the development of such complex systems does not always have to begin from scratch. And the fact that the division of an earthworm produces two complete individuals (a frequently heard objection) can be understood as a survival strategy, which, incidentally, only works if the earthworm is splitted 'crosswise'; a 'lengthwise' split would certainly result in its death.

(5) *Anticipation of the future*: The stone is what it is. The autoregulating system, on the other hand, is specified to maintain itself not only now, but also in the future. It does not exist solely in its factual existence: "the living being is ahead of itself," as Helmut Plessner properly puts it in his great work *Levels of the Organic Life and the Human* with regard to organisms (Plessner 2019, 236). "Anticipation is the mode of living being, anticipation not of something determined that is still to come, to become, to enter into being, but rather the anticipation of itself as something determined" (Ibid., 167). To exist as this specific system, i.e., to maintain itself in its generality and universality, is the leading premise of its entire existence. The character of the species-universal cannot be lost, it must be preserved as a type (see point 4), and the autoregulatory system is therefore committed to its future existence in every moment.

(6) *Decoupling system existence and environment*: The self-maintenance of the autoregulating system is self-maintenance *as a principle.* Its goal is not merely *random* maintenance, as is the case with equilibrium systems. A stone is stable against ant trampling, but it cracks in fire. In an autoregulating system, however, such contingencies are – in principle – eliminated: receptors continuously evaluate and examine the environment and for potential hazards to the system. So the system itself does not have to constantly put its own existence at risk. Instead, measuring instruments are inserted between the system and its environment to interact and communicate with the latter: it provides a kind of quasi-*symbolic* contact with the environment that spares the system from an existential collision with it, thus *decoupling* existence from the environment.

(7) *Autonomy:* This decoupling of the system's existence and the environment, as

mentioned, is a detachment [*Abkopplung*] from the contingencies of each given factual situation. The self-regulating system thereby becomes free to exist according to its own species-specific determination, and in this sense, it is *auto-nomous*. This does not mean that it is without any relation to the external world – such a relation is indispensable for the organism as an open system. However, since external influences do not directly affect the system's existence itself, but only its receptors (see point 6), the system is merely 'stimulated' by them and thus prompted to transform external conditions into *system-specific* conditions. Plessner described this relative autonomy of the organism as *'positionality'*, meaning that the organism, while situated in its environment, nonetheless exists in distinction from it (Plessner 2019, 195).

(8) *Subjectivity:* As already mentioned, the self-maintenance of an autoregulating system means the individual, as such a system, seeks to maintain itself in its species universal nature. The life process of the fly is, in essence, the continuous preservation of the 'fly-ness' realised in it. This persistence of the universal amid the manifold changes of the system resembles the character of the *concept*, for which it is essential that its universality is maintained in its various particularities: just as apples, pears, plums, etc. are all equally *fruits*. According to Hegel, however, this is also characteristic of the *subject*, which retains its *identity* in the manifold changes it undergoes. In this fundamental sense, Hegel argues, the organism – including plants – possesses *subject character*, that is, the structure of the concept [*Das Subject besondert sich zwar, erhält sich als Subjectivität in seinem Beziehen auf Anderes, macht sich Glieder und durchdringt sie – TN*] (GW 24.3, § 337 and § 339 Add.). The fly is, in a sense, a concept buzzing through the air! According to Hegel's objective-idealistic view, the 'concept' that underlies nature as a whole now appears in the organism in *real shape*; "what was previously only our recognition has now come into existence" (Ibid., § 337 Add.); "life is the concept that has come to its manifestation" [*das Leben ist der zu seiner Manifestation gekommene Begriff – TN*] (Ibid., § 251). According to this, the authoregulating system is a subject, i.e. an autonomous universal entity, a being that behaves independently in accordance with the universal characteristics of its species, for example in the form of instinct-driven behaviour.

(9) *Self-agency:* The autoregulating system is existentially self-referential, in the model outlined above, i.e., to the controlling instance that evaluates all impressions for their conformity with the system (point 3), which means (to put it somewhat casually) that it *represents* the *system itself*, for example in the form of the constitutive parameters of the system's existence. In this sense, the autoregulating system contains a representative of the system itself within the system; it contains a *self* to which all external and internal matters relate and through which all functions and actions are governed. The autoregulating system is not simply a system, but a system *and its self.* Only in this *doubling* does it attain its organismic *unity.* This distinguishes it from other natural systems. A hydrogen atom, for example, can certainly be said to have a specific 'generic universality' – in contrast to the helium atom – however, it is not an autoregulating system: it lacks the self-agency;

it shows no striving for self-maintenance; its existence is neither concerned with this existence itself nor moved by 'concern' for its existence.

At this point, the question may arise: is the self-agency of an organism morphologically identical to its genetic structure? Most likely not. Although genetic information contains the general blueprint and functional programme of an organism, self-agency is responsible for the control of concrete behaviour, which in plant organisms is largely hormonal and in animal organisms also nervous. In animals, the brain and nervous system thus form the instance that endows the organism or autoregulating system with 'self-character'. The fundamental characteristics of the autoregulating system outlined here reveal various – often only slightly different – aspects that are essentially related. Taken individually, they are either not feasible or insufficient for autoregulation. Point 9 has shown, that natural systems can have generic properties (e.g. a hydrogen atom) without being autoregulating systems because they lack self-instance. It needs no special emphasis that the concept of 'autoregulation' is to be understood as an *ideal-typical project* without technical realisation. This is another reason why we have repeatedly referred to the organism as a natural exemplification of the autoregulating system. This is not meant to be a subterfuge. The real meaning of the 'autoregulation' concept is that Kant's principle of 'intrinsic purposiveness', which undoubtedly captures the phenomenon of life correctly and can be reconstructed as autoregulation in terms of Systems Theory. With the idea of intrinsic purposiveness is thus a possibility of technical reconstruction of organismic systems – or, respectively, of a 'Newton of the blade of grass' – upheld *with* Kant and, at the same time, *against* Kant.

VI. Plants and Animals – Hegel's Interpretation Based on the Self Structure

The difference between plants and animals encountered in nature has not been taken into account so far. As is commonly known, the fundamental difference is that plants are *autotrophic* and animals are *heterotrophic*, i.e. plants are able to produce the substances they need from inorganic matter, while animals are unable to do so and are therefore dependent on organically structured substances as nutrients (instructive on this point: Hösle 1987). From the viewpoint of Systems Theory, the plant is an autoregulating system characterised by predominantly functional, internal regulations. Due to its autotrophy, it finds its nutrients in situ in the soil, which it transforms into plant compounds with the help of sunlight through photosynthesis. The plant does not need to search for nourishment and therefore does not need to change its location. It resembles a complex biochemical factory, but it has virtually no possibilities for action. One could argue that plants also perform certain actions, e.g., opening and closing stomates on their leaves, tropisms (growth movements) and nastia (movements independent of the direction of the external stimulus). However, these are reactions to external stimuli, whereas the animal's actions are also largely motivated by internal states (hunger, mating instinct, etc.). As a autoregulating system, the plant must also have *self-character* and *subjectivity*, even if the corresponding self-agency cannot be clearly located in space, but rather must be imagined as a decentralised system of interconnected regulation circuits. This type of controlling instance is referred to as *functional self* [*ein Funktionsselbst*].

Unlike the plant, an *animal*, as a heterotrophic organism, cannot feed on inorganic substances, but needs other living beings, which it hunts and consumes. This means it must first search for and find its food. Unlike the plant, it must therefore move within its environment, carry out actions and thus be better equipped than the plant: it must at least have sensory organs to orient itself in its environment and a nervous system to process sensory data, control and regulate its own actions accordingly. Similar to the plant organism, the animal organism cannot exist without internal functional regulations (e.g., the hormone system) that require a functional self. It also needs a central instance [*eine zentrale Instanz*] – typically a brain – to control the outward actions necessary for self-maintenance: an *actional self* [*ein Aktionsselbst*], as I would name it.

This unveils a striking difference in the subjectivity structure of plants and animals: plants only have functional regulation and therefore possess a functional self. Animals, on the other hand, are assumed to have a combination of functional and actional regulation and, correspondingly, a duality of functional self and actional self. The fact that the form of actional regulation also has a *self*-character, arises from its existential importance in the autoregulatory system: environmental data originating from perception with no physiological-existential importance per se, but rather for the organism – for example, flower shapes and colours for bees – must be evaluated. This data must first be interpreted in existential terms; otherwise, a meaningful actional regulation, which in fact fulfils the function of a *self-agency*, would not be possible. The *dual self*, consisting of functional self and actional self, is thus distinctive for the animal organism – as a structure of subjectivity resulting from the self-movement of the animal and, ultimately, from its heterotrophic modus existendi.

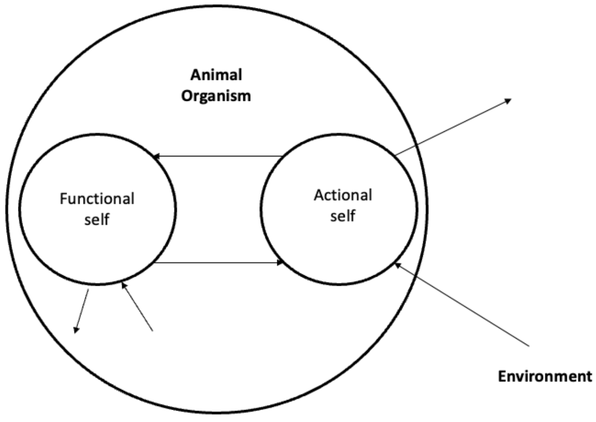

Figure 4: Animal double-self structure.

It is instructive to take another look at Hegel's *Philosophy of Nature*. The self-preservation of the *general/universal aspect of a species* (for instance, 'the fly-ness') realised in the individual is understood as central to organismic nature as such. With this *form-becoming relevance* (in the broadest sense), the transition "from the prose to the poetry of nature" is accomplished (GW 24.3, § 336 Add.); or, less metaphorically: the organic is an "elevation of existence to universality" [*zur Allgemeinheit*] (Ibid.). It is the "Concept" itself "that comes into reality" (Ibid.), whereby "the universal in itself (...) is also brought into existence" (Ibid.). As the *self-maintenance* of the universal nature and thus of its self-identity (e.g., the fly-ness of the fly), the organism is a "*self-centered*" entity (Ibid., § 344 Add.). Starting from the concept of the self, Hegel provides the following classification of the forms of life:

(1) 'Geological organism': self-maintenance with no self (Ibid., § 338 Add.);

(2) Plant: self-maintenance with a non-reflexive self (Ibid., § 343 Add.);

(3) Animal: self-maintenance with a reflexive self = self-self (Ibid., § 350 Add.).

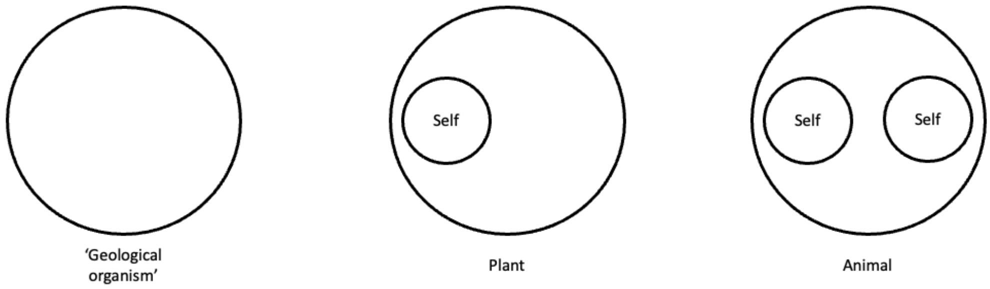

Figure 5: Geological, plant and animal organism with the focus on the self.

The distinguishing criterion, considered from an outside perspective, is therefore the 'number' of self-agencies. However, the 'zero-self system' described by Hegel as a 'geological organism' can hardly be referred to as an organism, because it *lacks* the self-character constitutive of all life, so that, according to Hegel himself, it is "not a living being" [*kein Lebendiges*] (Ibid., § 339 Add.); [*das geologische Leben ... ist das Leben als nicht leben*] (GW 24.1, 133). What Hegel actually means is apparently something like the *ecological system*, as we would say today, which does exhibit a certain 'self-preservation' but can also 'overturn' when the balance is altered. A self-agency that safeguards the species specificity – as is constitutive for organisms – is therefore missing here, along with the "form of subjectivity" (Ibid., § 261). Understood in this way, Hegel's classification of the 'geological organism' makes a lot of sense. Deviating from Hegel, Christian Spahn has argued that the ecological system – entirely in line with Hegel's own reasoning – can be conceived not as the first, but as a later, richer shape of organic nature: namely, as that of "a universality and multiplicity of individuals representing their species and multiplicity of species as well, which all transcends the individual." With this reinterpretation of the 'geological organism', "the idea of ecological *equilibrium*, which is central to contemporary biology, could easily be integrated into Hegel's logic as (...) the hidden higher truth of the competitive relationship between plural individuals" (Spahn 2007, 198).

According to Hegel, the *plant* forms "the first stage of being for itself"; but is this still "immediate being for itself'"? (GW 24.3, § 342 Add.). It has general nature of its kind, and therefore self, subjectivity, but – if I may use this salop phrasing – it "knows nothing of this" because "the plant's selfhood does not yet relate to itself" (Ibid., § 344 Add.), so the plant is "*not yet objective for itself*" and, accordingly, has "no *feeling of its self*" [*kein Selbstgefühl*] (Ibid.). As an empirical reason for this, Hegel states that it does not move from its location and has no nervous system (Ibid.); according to the system-theoretical considerations outlined above, the former depends on the latter.

These are predominantly negative statements about what the plant *lacks*, with the *animal* providing the basis for comparison. Only the animal is – to quote some relevant passages from Hegel – "the self that is for itself," which thus "relates itself to its self as existing for itself" [*Selbst zu sich selbst verhält*], "has its self as its object, the subject as self-self, as a feeling of its self" and is – in contrast to the plant – "a true self being for itself, which attains individuality" (Ibid., § 352 Add.). So: unlike plants, animals have a self-feeling, and their structure of subjectivity takes the structure of a '*self-self*'. These are no longer just negative statements about plants. But what Hegel posits here in favour of animals is merely stated, not justified, and is difficult to interpret in this form. Of course, we know what is meant by 'feeling of the self' because we possess it ourselves. But what is meant by a 'self-self'?

In this context, the previously developed theoretical consideration proves helpful: due to its self-movement, not only is internal functional regulation essential for the animal, but actional regulation is also necessary. *This* is why the animal subject is structured as a '*double self*' – a compound of a functional self and an actional self. In this way, what is rather intuitively grasped in Hegel can be readdressed in terms of Systems Theory. This provides some initial structural clarification. Hegel already hints that the animalistic structure of subjectivity in the form of a double self has serious consequences for understanding the inner, psychic dimension: "Only the self as self is able to refrain from all outward activity and relates this activity to itself as a soul; and since the self is both sides of the relation within itself, this inner circle of the soul turns away from inorganic nature. The plant is not yet this [inner circle and self-relational selfhood – *TN*] and lacks inwardness free from outward activity" [*Innerlichkeit, die von dem Verhalten nach Außen frei wäre*] (Ibid., § 344 Add.).

VII. Helmut Plessner's Characteristic of the Organic

Plessner's aforementioned work *Die Stufen der Organischen und der Mensch* of 1928

(English: *Levels of Organic Life and the Human*) is certainly the most significant contribution to the philosophy of organic nature after Kant's *Critique of Judgment* and Hegel's *Philosophy of Nature*. If it was said in the past that the present day lacked an independent philosophy of nature, Plessner's study must be explicitly mentioned as one of the few – quasi 'selective', though – exceptions. Admittedly, as Plessner himself acknowledges in his detailed preface to the second edition, published over 30 years later, certain shortcomings of the work must be pointed out. For example, Hegel's outline, 'which I should have referred to if I had been aware of the relevant passages at the time', unfortunately played no role whatsoever in Plessner's deliberations (Plessner 1928, xxiii). In addition to the parallel positions of philosophical anthropology (Max Scheler, Arnold Gehlen), Plessner mentions enormous developments in the natural sciences of the organic, molecular biology, Systems Theory and cybernetics, Theory of Evolution, etc., which – since the publication of his work – have also significantly shifted the philosophical perspective. Nevertheless, Plessner's arguments are interesting, illuminating in terms of theoretical principles, and still present in philosophical discussion. They are also designed for "an *a priori* theory of the essential characteristics of the organic" (Plessner 1928, 107; Plessner 2019, xxxi; emphasis added), i.e. essentially independent of scientific developments but, as will also become apparent, exemplified by them in a certain sense and occasionally also clarified. For this reason, they deserve at least a brief introduction and explanation.

The aforementioned concept of *positionality,* which refers to an organism's relatively autonomous existence in relation to its environment, would be central to the general characteristic of the organism. It is certainly true that semipermeable membranes – in the sense of permeable boundaries – are of "special significance" (Plessner 2019, 331) from a technical point of view. "This state of affairs gives the body positionality – that is, sets it off against the outside" (Ibid., 333). But making "organic materials" to "become living beings in the strict sense of the word" (Ibid.) through this only must be rejected as a blatant understatement from a Systems Theory perspective. Positionality is rather attributed to the organism through the already described properties of autoregulatory systems, e.g., active self-maintenance, decoupling of system existence and environment, autonomy, etc., which are guaranteed by a self-agency controlling the entire system behaviour. Only then does Plessner's suggestive concept of positionality acquire a content verifiable in terms of Systems Theory.

Plessner characterises the *plant* organism as an '*open form*'. This does not refer to an open system in the physical sense, which the organism naturally always is, but rather to 'a form' in which "the organism in all of its expressions of life is immediately incorporated into its surroundings and constitutes a non-self-sufficient segment of the life circle corresponding to it" (Plessner 2019, 203). Plessner explains this further by referring to a phrase coined by Hedwig Conrad: "all of the plant's movements happen *to* it but never originate *from* it, just as the open form does not have a center from which it would be possible for movement impulses whether instinctive, drive-driven, or volitional – to originate" (Ibid., 207). This addresses the lack of self-motion and the absence of a central self-agency in plants.

In contrast to plants, animals are defined as '*closed forms*', which in turn should not be confused with the physical concept of a closed system. Plessner explains: "The closed form mediately integrates the organism in all of its expressions of life into its surroundings and makes it into a self-sufficient segment of the life circle corresponding to it" and "has the character of frontality, of a contraposition, of an existence directed against the surrounding field of alien givenness" (Ibid., 209 and 226). In contrast to the immediate dependence of the plant on its environment, Plessner considers managing to insert "intermediate links between itself and the medium" to be essential for the animal (Ibid., 210). However, 'encapsulation' [*Abkammerung*] is undoubtedly a false spatialisation of the relative *autonomy of* the animal in relation to its environment.

According to Plessner, the closed form is possible due to the characteristic '*centrality*' of the animal organism, i.e. the control and coordination of the animal's actions by a central agency, a nervous system, which then also constitutes a kind of '*self*'. "The emergence of a center leads to a doubling of the body: now it is also (that is, represented) in the central organ" (Ibid., 213). Note that this is not the doubling of the *self* claimed by Hegel. The doubling Plessner refers to here is rather the duality of body and self. The concept of centrality takes into account the central organisation of the animal.

> This means that the living organism as a whole is no longer immediately the unity of the organs (...), but is this unity only by way of the center. It is thus no longer in direct contact with the medium and the things surrounding it, but is so merely by means of its body. The body, then, has become the intermediary layer between the living being and the medium (Ibid., 213).

What is stated here about the body should probably be clarified by pointing to receptors, i.e., the monitoring and measuring instruments inserted between the organism and its environment, as had previously been argued with regard to the autoregulating [homeostatic – *trans. note*] system.

Plessner finally juxtaposes the '*excentricity*' [*Exzentrizität*] of humans with the centric organisation of animals: "The animal lives out from its center and into its center but not *as* center" (Ibid., 267), but it does not know about this center. The human, in contract, "as the living thing placed in the center of its existence, knows this center, experiences it, and therefore is beyond it" (Ibid., 270). "If the life of the animal is centric, the life of the human, although unable to break out of this centrality, is at the same time out of it and thus excentric. *Excentricity* is the form of frontal positioning against the surrounding field that is characteristic of the human" (Ibid., 271). The ground for this "excentricity" is thus the *possibility of knowledge*, which elevates the animal "human" *beyond* animality.

Although Plessner's terminology is suggestive, he is aware that his findings, resulting from phenomenological analysis, can be reinterpreted from the perspective of contemporary Systems Theory, as he himself notes in the preface to the second edition of 1966: "Phenomena of regulation, control, and memory, once regarded as arcana of living matter, lost their special status in the light of cybernetics" (Ibid., xxi).

VIII. Conclusion

Kant's concept of *intrinsic* purposiveness, which undoubtedly captures the specifically organismic nature, can – as outlined above – be basically reconstructed in terms of systems theory as *autoregulation*. 'Basically' means here that the 'principle of autoregulation' is, on the one hand, rationally comprehensible and, on the other hand, its technical realisation does not face any insurmountable difficulties in principle. Kant's requirement to strive for causal-mechanical explanations as far as possible (because only this allows objective knowledge of nature) is thus – again basically – satisfied to the maximum extent. Today, there are good reasons to assert the compatibility of 'mechanism' (in the broadest sense) and organism, of causation and finality. Kant assessed this differently. Due to its *blindness* and *narrow focus*, he denied the causal relationship the possibility of realizing intrinsic purposiveness. However, as already discussed, this is inaccurate for the *control loop*: processes guided by set-point values enable goal-oriented behaviour, whereby the causal focus is effectively eliminated by the feedback structure. The reciprocity of means and ends asserted by Kant for the life process is thus in principle realisable. Let us keep in mind that the moment when the mystery of humanity will be solved is approaching.

Essential for this is that the *set-point value* (e.g., of the temperature), independent of the actual value and guiding the control loop, does exist. It thus represents something constantly and permanently *universal* [*Allgemeines*]. As such, it already transcends into the realm of the 'extra-sensory'; it has a *normative* character and can therefore define a goal 'beyond the factual' (cf. Wandschneider 2004, chap. 1.2.5.) – without, and this is crucial, violating the laws of nature. The control loop, like the self-regulating system of an organism, represents *system laws* which, as explained above, are to be understood as a suitable 'interconnection' [*Zusammenschaltung*] of elementary laws of nature; they do not negate the laws of nature, but rather presuppose them. *In this respect,* technical and biotic systems are alike (although they differ fundamentally from technical systems due to their 'self-character'). Indeed, it may be said that the potential contained in the laws of nature only comes to fruition in the form of system laws and, in a particular way, in those of the self-regulating system. The 'logic' inherent in an objective-idealistic view of nature is thus becoming increasingly explicit. Hegel's interpretation of the organism as a *concept* that has become active (see above) merely extends this trajectory of thinking.

The phenomenon of organismic autoregulation has so far been completely disconnected from the question of its *origin* in nature. Initially, the focus was solely on clarifying whether and how intrinsic purposiveness can in principle be reinterpreted in terms of Systems Theory.

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