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Conference Report

Constitution of the Hegel Society of Great Britain

Announcement

From the Separateness of Space to the Ideality of Sensation. Thoughts on the Possibilities of Actualizing Hegel's Philosophy of Nature[1]

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Abstract

The Cartesian concept of nature, which has determined modern thinking until the present time, has become obsolete. It shall be shown that Hegel's objective-idealistic conception of nature discloses, in comparison to that of Descartes, new perspectives for the comprehension of nature and that this, in turn, results in possibilities of actualizing Hegel's philosophy of nature.

If the argumentation concerning philosophy of nature is intended to catch up with the concrete Being-of-nature and to meet it in its concretion, then this is impossible for the finite spirit in a strictly a priori sense — this is the thesis supported here which is not at all close to Hegel. As the argumentation rather has to consider the *conditions of realization* concerning the Being-of-nature, too, it is compelled to take up *empirical* elements — concerning the organism, for instance, system-theoretical aspects, physical and chemical features of the nervous system, etc. With that, on the one hand, empirical-scientific premises are assumed (e.g. the lawlikeness of nature), which on the other hand become (now close to Hegel) possibly able to be founded in the frame of a Hegelian-idealistic conception. In this sense, a double strategy of *empirical-scientific concretization* and *objective-idealistic foundation* is followed up, which represents the *methodical basic principle* of the developed considerations.

In the course of the undertaking, the main aspects of the whole Hegelian design concerning the philosophy of nature are considered — space and time, mass and motion, force and law of nature, the organism, the problem of evolution, psychic being — as well as Hegel's basic thesis concerning the philosophy of nature, that therein a *tendency towards coherence and idealization* manifests itself in the sense of a (categorically) gradually rising succession of nature: from the separateness of space to the ideality of sensation. In the sense of the double strategy of concretization and foundation it is shown that on the one hand possibilities of philosophical penetration concerning actual empirical-scientific results are opened, and on the other hand — in turn — a re-interpretation of Hegel's theorem on the basis of physical, evolution-theoretical and system-theoretical argumentation also becomes possible. In this mutual crossing-over and elucidation of empirical and Hegelian argumentation not only do perspectives of a new comprehension of nature become visible, but also, at the same time — as an essential consequence of this methodical principle — thoughts on the possibilities of actualizing Hegel's philosophy of nature.

* * *

1. Introduction

The Cartesian concept of nature, which has determined modern thought up to the present, has become obsolete. For us nature is more than just pure extension,[2] in which, as Leibniz had already pointed out, not even the central physical phenomenon of force could be discovered.[3] Accordingly, natural science in its actual development — if not in its self-awareness — has dissociated itself more and more from Descartes' concept of nature. Even the old mind-body-problem, which for centuries was aporetically bound in the corset of Cartesian mind-body-dualism, could not remain unaffected by the progress of scientific knowledge and has been given new impetus. The need for a new, non-Cartesian concept of nature has thereby resulted. The philosophy of the present has not been able to satisfy this demand so far. By allowing the philosophy of nature to be displaced by the philosophy of science, it has failed to develop a contemporary concept of nature.

In this situation it is surely obvious that we must also look into the past to see to what extent traditional philosophical thought can be utilized. In this sense the following investigation links up with *Hegel's objective-idealistic concept of nature*. The opinion that this is obsolete, useless and eccentric has long been superseded.[4] Doubtless, details are antiquated — in what historical text is this not the case? — but in the following we are concerned more with *basic principles* in Hegel's thought and its consequences for a new, non-Cartesian concept of nature.

It is decisive that such a conception can be argumentatively developed in a consistent manner. Hegel's own argumentation in his Philosophy of Nature, i.e., in the framework of an 'encyclopedic' presentation of his philosophical conception, is actually so short that it must be 're-created' or *reconstructed* by interpretation. For the realization of this project I have first some preliminary remarks: What Hegel himself intends is a *comprehending* cognition of the Being-of-nature, which as such is "not an appeal to experience" (9.15);[5] what is meant is an a priori-dialectical philosophy of nature. In the present context this a priori aspect can only be intimated in many cases because of the principal difficulty, that a theory of the dialectic of the philosophy of nature has not been available so far.[6] On the other hand, the a priori pretension may not have to be maintained strictly at all in so far as the natural-philosophical argumentation in certain points, as it seems, will in principle not manage without *empirical* elements. With

regard to Hegel's a priori demand, this conjecture — its legitimacy has to be examined — is unquestionably quite irritating. Here for the moment some brief comments about that:

In this context, I think, it is essential that the re-constructive interpretation mentioned must at last also consider *conditions of realization* concerning the Being-of-nature and is thereby necessarily dependent on empirical-scientific facts. If an organism, for instance, is to be understood as a real system in a real environment *system-theoretical* aspects must also be considered, or, on the animal level, basic physiological facts about neural organisation and sensual perception, too. Such empirical borrowings are indeed unavoidable if we are to clarify under what concrete empirical conditions something like 'self-preservation' can be *realized* in an empirical world.[7] *Perhaps* it is not at all entirely erroneous to assume that such matter could be *fundamentally* derivable in an a priori sense, too. But it appears to me that, under the conditions of *finite* spirit, the argumentation concerning philosophy of nature requires essentially *empirical concretization*.

To be sure: By accepting empirical elements, the argumentation can no longer claim absolute a priori stringency but in this respect only *probability*. This actually contradicts Hegel's intention of '*comprehending* cognition' (even if he speaks of the fact that "matter ... proves itself to be obstinate against the unity of the idea" (9.539 add.) and, therefore, "contingency ... has its right in the sphere of nature" (9.34)). Yet this loss of a priori stringency is compensated for by a gain of concretion. The object of philosophy of nature is precisely the concrete Being-of-nature. The argumentation of philosophy of nature must catch up with this concrete being and meet it in its concretion. Besides, this agrees with Hegel's demand for 'concrete thinking' (even if Hegel himself certainly did not have the reversion to empirical facts in mind). In this way the inclusion of empirical aspects may be considered as not only acceptable but even unavoidable in natural-philosophical contexts — but, of course, only then when the subject itself demands it. This form of empirical concretization also appears to be an *actualization* of Hegel's argumentation by proving itself to have an affinity with the actual science of nature.

One more thing: With the inclusion of empirical-scientific arguments the *presumptions* contained in them are also adopted, which on their part, however, must first be philosophically clarified and legitimized. This philosophically seemingly critical state turns directly into an advantage, however, when it becomes evident that those presumptions especially can be *founded* on the basis of Hegel's conception. To take an example: Every theory of evolution presumes that nature does not amount to nothing more than its factual being but contains *possibility*. But this is only justifiable within the framework of an objective-idealistic ontology of nature, for which, in turn, this also means the possibility of *actualization*.

In this way possibilities of actualizing Hegel's philosophy of nature in the sense of a *mutual illumination* of empirical-scientific and objective-idealistic arguments are imaginable in principle: on the one hand, in the *empirical-scientific concretization of arguments given by Hegel* and, on the other hand, through the *objective-idealistic founding of empirical-scientific argumentation*. This double strategy of *concretization* and *foundation* will prove itself, as a

methodical basic principle, to be very fruitful in the following. So much for methodological aspects; now it is time to face the content.

Hegel's general determination of nature at this point will be presented only briefly:[8] According to the law of dialectics, to the Logical-ideal, which is demonstrable as unconditional, there also belongs its opposite, the Non-ideal, which for Hegel is nature itself — as an eternal accompaning phenomenon of the Logical.[9] If the Ideal is characterized by conceptual interrelation, then the Non-ideal, that is nature, is determined as *separateness*. However, as the Non-ideal it remains dialectically connected to the Ideal; in other words: Nature *is* not the Logical-ideal but the Logical-ideal *underlies* it. Separateness is the manner in which the Being-of-nature *appears*, but the *essence* that underlies it is the Logical-ideal, through which it remains implicitly determined. This *discrepancy* between appearance and essence is characteristic of the Being-of-nature, according to Hegel.

From this a basic feature of the Being-of-nature becomes clear: While its appearance and essence are not congruent with one another, it is determined by a *tension*, which, according to Hegel, expresses itself in the tendency to overcome this lack of congruence and which means that there is a trend in the appearance to adapt itself to the underlying ideal essence of nature. Thus nature shows, according to Hegel, a tendency towards *coherence*, towards the negation of separateness up to the point of the *ideality* of the Logical underlying it: Accordingly, Ideality is to be understood as the immanent telos of nature, which, however, is only approximately attainable by the latter.

At this point and in the following it must be observed that Hegel certainly does not understand this in the sense of a *natural process* but *categorially*, i.e., as a basic characteristic of the conceptual development not of nature, but of the *categories* of nature and thus of the *argumentation of philosophy of nature* rather than a temporally-real evolutionary process, whose assumption Hegel considered by the way to be false (although statements can sometimes be found that could suggest such an interpretation).[10]

This view, according to which the Being-of-nature (under a *categorial* aspect, as has been stated) shows the tendency toward the negation of separateness in the sense of a return to the Ideal — a doubtless highly speculative interpretation of nature — constitutes, as regards content, the basic thesis of the following investigation, i.e., on the one hand, it is to be shown that and how such a *tendency towards coherence and idealization* is characteristic of the Being-of-nature and, on the other hand, that from this perspective an *internal connection of natural phenomena* results — from the elementary separateness to the ideality of psychic being in nature. Nature would no longer be, as with Descartes, the strict opposite of the psychic but would include its very possibility — a completely non-Cartesian image of nature that without a doubt deserves attention in view of our contemporary problems with nature. The following deals mainly with this *overall perspective of nature* that has to be developed in the light of Hegel's thought and the methodical double strategy already characterized of empirical concretization and

idealistic foundation, which in its double structure, as already expounded, itself brings forth *possibilities of actualizing* Hegel's philosophy of nature.

2. Space and Time

The first determination of nature in Hegel's sense is pure and still completely undetermined *separateness*. Even at this stage its immanent tendency to negate itself and form coherent structures is recognizable, more precisely: The *category* of separateness forces the introduction of further *categories*, which are of richer structure. However, Hegel's argumentation concerning the development of the category of separateness is extremely short and, therefore, needs to be interpreted to a great extent. I have presented an interpretation concerning this matter in another investigation.[11] Here I will confine myself to making Hegel's respective intention visible: According to the law of dialectics, the category of *non*-separateness also belongs to the category of separateness and is understood as the determinate negation (in the specific Hegelian sense) of separateness, and that is the category of the point. The unfolding of its dialectic leads via the determination of the line and surface to that of the ultimate spatial element, i.e., a space confined by surfaces. In this threefold development Hegel sees the result of the 'concept' underlying nature and of its three 'moments' — singularity, particularity, universality — and therein at the same time an argument for the *three dimensionality* of natural space.[12] Hegel's argumentation leads further to the category of *time* and its characteristic structure of past, present, and future.

Above all, it is important that this argumentation — presupposing its stringency — at the same time makes clear how *coherency correlations* in the sense of a space-time-structure of the Being-of-nature are derived from the supposition of a completely amorphous separateness. This concerns, on the one hand, the dimensional relationships of space and time and, on the other hand, the essential unity of space and time. Naturally, spatial juxtaposition, as well as temporal succession, always has the character of separateness, but yet precisely a *structured* and, because of that, already *coherent* separateness. Such structures are, e.g., the object of mathematics when, say, it asks about the conditions that are fulfilled by the points of a surface. In a certain sense the relation between temporally successive states is even closer in so far as the earlier state produces (in a certain sense) the later one. The irrevocable connection between space and time is expressed in the end in the fact that not only the place but also the point of time is important for the determination of an event: For fundamental coherences of this kind, which are characteristic of the spatial-temporal separateness of nature, Hegel's argumentation offers an interesting approach towards an explanation.

3. Motion and Mass, Relative and Absolute Motion

On the basis of such fundamental coherence relationships of separateness more specific connections then also become possible. Expressed more concretely: According to Hegel, with the categories of space and time the categories of *motion and rest* and — at first perhaps surprisingly — that of *mass* are involved. I shall at this point give only a short summary of

Hegel's argumentation (cf 9.55ff), or rather a reconstructive interpretation of the same:[13] The explication of the connection between space and time, which is at first only implicit, compels the introduction of the category of *motion*. Now motion only makes sense relative to a motionless state, i.e., with the category of motion that of *rest* is also always implied. However, something can only be at rest that is preserved identically in motion and thereby defines a *definite single place* as a point of reference of motion. Such a Singular, which is identically preserved in motion is then, according to Hegel, *mass*. The 'logic' of the concept of motion in this sense demands the category of mass: mass as a Singular identically preserving itself, whereby 'place' is realized as the necessary point of reference for motion, which as such represents non-motion or 'rest'.

Now, a mass itself can naturally be moved relative to another mass. In this case the relation of motion is symmetrical: Each can equally be looked upon as moved or as at rest. But with that, a *principle of the relativity of motion* is formulated which says in this form: *the motion of mass is equivalent to relative motion.*

Now, this connection immediately has the remarkable consequence that the motion of a *non-mass* is *non-relative motion*. Such motion indeed refers to a mass, but being non-relative it is independent of the respective instance of reference and, therefore, refers to *every* mass in the *same* way. In other words: A non-relative motion has the *same* velocity in reference to every mass. Besides, such a non-mass can itself — in accordance with its concept — not be at rest but be *only moved* — a very strange phenomenon, which, however, is empirically realized in the form of the motion of light.

But what is meant by a non-mass? Hegel has given reasons for the fact that something like this must exist in nature and identified it with *light* and, in fact, attributed an *absolute* (thus non-relative) character to its motion. (9.111f add.). As already mentioned, this is empirically correct for light and is the circumstance which led Einstein to develop his (Special) Theory of Relativity. It would naturally be absurd to maintain that Hegel anticipated Einstein's theory, because this is, above all, a complex *mathematical* theory, whose very achievement consists in the fact that it has shown the mathematical compatibility of relative and non-relative motion. Yet, following Hegel, the basic thoughts of relativity theory can be actually gained from the 'logic' of the concept of motion.

At this point impressive possibilities of actualizing the Hegelian type of argumentation (to express myself quite generally) in the philosophy of nature become visible with a remarkable explanatory power in the sense of a *philosophy of modern physics:* The thoughts developed are to be seen as a contribution to a philosophical penetration of the theory of relativity which have not been achieved in the otherwise extraordinarily sophisticated analyses of E. Cassirer[14] and H. Reichenbach.[15] In this manner it has been shown that a non-relative motion does not only not contradict the principle of the relativity of motion but is, indeed, an implication of the same: This is a necessary, non-trivial consequence of the philosophical interpretation of the principle of relativity presented here.

And furthermore: The fact that light possesses the same state of motion relative to every mass also means, vice versa, that the singular and, therefore, different masses are *identical* to each other in this respect. In other words: In the phenomenon of the motion of light the inner *essential identity* of masses now appears *explicitly* and, in fact, independent of their quantity, and their diversity, which is founded in their singularity, thus proves itself to be an aspect of their exteriority.

4. Dynamic Concepts

On the basis of the category of mass, following Hegel, we further attain *dynamic* concepts: According to the principle of the relativity of motion, a mass can be observed as either at rest, namely, in reference to itself, or as moved, namely, in reference to another mass (that is moving relative to it). Thus, in principle, a mass can be both at rest or moved. It is, therefore, so Hegel, "indifferent to both" and in this sense *inert*: "In so far as it is at rest, it rests and does not begin to move by itself; if it is in motion, then it is simply in motion and does not begin to rest by itself" (9.65 add.).

Now, with the *collision* of two masses this leads to the following situation: Together they both constitute thereby "momentarily ... *one* body" (66); "as soon as they touch each other they are set in one". Since, however, both have different states of motion, this is at the same time, metaphorically speaking, "the fight for *one* place" (9.67 add.). Thus, this *'interaction'* of masses is characterized by states of motion which are opposed to each other: one at rest and the other as moved, respectively. Such an opposite state of motion in itself can now no longer be kinematically comprehensible (for that would mean: *either* at rest *or* moved, according to the instance of reference) and thereby possesses a new kind of structure to be characterized as *dynamic* — 'dynamic' in so far as something like resistance, change of motion and thus deviation from the inertial behaviour of the masses is involved with it. Physics has introduced for this the concepts of 'force', 'energy', 'momentum' etc.

As Hegel emphasizes, the dynamic is a potentiality existing in mass or matter[16] "as the very essence of matter, an essence which itself, at the same time, belongs to matter's inwardness; therefore, physics passes over to the Reflection-idea of force" (9.68 add.). Indeed, this transition from purely kinematic to dynamic concepts is also compelled — a fact only suggested here — by the character of *singularity* and thereby the *diversity* of masses, which in this way can also possess different states of motion, so that their 'interaction', as explained, can no longer be comprehended in a purely kinematic manner.

At this point the physical concept of a 'field of force' could, indeed, find its place. Today it is understood as a system of 'field particles', which can transmit energy and momentum through interaction and thereby exert force effects. On the one hand, the aspect of interacting particles is essential here and, on the other hand, that of a spatial-temporal *system* of such interactions in the sense of a 'field' (which will be explained at once). With Hegel himself the concept of a force field occurs in connection with gravity in its content (if not in its

terminology). An important point emphasized by Hegel here is that the body "*qua* body ... is inseparably connected with its gravity" (9.69). In the language of modern physics one would say that the gravitational field is 'coupled' to the mass; this is to be understood, so to speak, as the 'source' of the field. The field is *bound to the source* with which it forms a *system* — thus, a form of coherence of *dynamic* states which, at the same time, represents a new level of negation of the separateness of nature. In this sense Hegel interprets especially gravity appearing as the attraction between masses: This striving for the negation of separateness is the "first true inwardness" in nature (9.72 add., also 63 add.).

From the essential coupling of the field of force to its source a further consequence results: Space- and time-concepts have a superficial-contingent character for the field of force. That means now, too, that this is *invariant,* i. e., independent, e. g., of displacement in space and time. As mathematical physics shows, dynamic quantities, e.g., the total momentum or total energy of a system temporally conserved in such operations, correspond to such invariances. The occurence of such *conservation quantities* can be interpreted in a way that the *identity* of the dynamic system, as it were, appears explicitly therein — as a system with this total energy and this total momentum etc. In the multiplicity and diversity of the field states the system represents in this manner, as already noticed, not only a form of coherence but also essentially an identity comprehending the multiplicity and, in this stronger sense, *unity.*

The independence of a dynamic system from its positioning in space and time (mathematically its invariance according spatial-temporal displacements and rotations) means, furthermore, that the (isolated) system always and everywhere acts *the same way.* In other words: Its behaviour shows a *lawlike* character. Under a dynamic aspect, therefore, the concept of a *universal natural law* is implied, which as such is independent of space and time. According to the objective-idealistic view, nothing other than the *basic logic* underlying the Being-of-nature becomes visible therein, which as such can, of course, be comprehended only by thought. On the side of real natural appearance this corresponds, as said, to a behaviour of dynamic systems, which is invariant in a spatial-temporal respect, or, formulated more generally, to something like *constancy* or *uniformity of nature.*

The universal law of nature as an expression of the logic underlying nature, or the constancy of nature as its real appearing: Both are the expression of a much stronger form of the negation of nature's separateness on the *dynamic* level in comparison with the *dimensional* structure of space-time and the *kinematic* equivalence of masses: While spatial-temporal separateness shows only a certain order of connection, and masses appear equivalent in their singularity only 'under a kinematic aspect', the dynamic states of the field of force are dependent on one another in reality and constitute in this way a real, comprehensive unity of their multiplicity and diversity — precisely, indeed, a *dynamic system.*

5. System Formation and Organism

The concept of field of force also implies that something like *attraction* and *repulsion* exist[17] — Hegel himself attributes "repulsion" and "attraction" to mass in a basic sense, namely, in the sense connecting up with Kant's *Metaphysische Anfangsgründe der Naturwissenschaft* in which matter possesses singular existence by repulsion, i.e., is exclusive toward other matter, and its internal connection is guaranteed by attraction (9.60f, 62f add.). Hegel's argumentation has its foundation in the logic of quantity (5.190ff). At this point I would like to let this rest and directly observe the *empirical-physical* side of the subject in order to pursue the question of how the principal tendency towards coherence and idealization in nature made valid by Hegel represents itself in this perspective:

Quite generally, the conditions for the phenomena of attraction and repulsion are always given on the basis of fields of force. Together both make the formation of *complex material systems* fundamentally possible,[18] whereby these are understood as a — also temporally variable — real unity of structure of material elements. This is no longer merely an abstract order of connection, as stated in reference to time and space, or an equivalence relation as in the case of singular masses, and also not merely a system of dynamic states as in the case of the field of force: It is characteristic of all these forms of coherence that they are only *implicitly* realized, i.e, they must first be made visible through thought, as it were, e.g., in the form of a mathematical expression describing the field of force. It is characteristic of the realized coherence in material systems, on the other hand, that it now appears *explicitly*, i.e, in material form on its part.

Without going into further detail I would like to turn to a class of material systems of special interest, namely, *organisms*. If we consult first Hegel's philosophy of nature on this, organisms are characterized by possessing the *character of subject* (9.337, 339ff add.), and for Hegel that means more precisely the structure of the *concept* (339 add.). The earthworm is, as it were, a concept which is winding its way through the soil. It is decisive for this viewpoint that the organism shows *self-preservation* in the sense that it attempts to preserve itself actively as this kind of system, i.e., in its *universality of species*. The life process of the fly is also the continual striving for the preservation of the 'flyness' realized in it, exactly because the organism, Hegel argues, is in its essence something universal, which attempts to preserve itself as identical in its particularities: and so, in fact, is precisely *subject* — something like a concept having become active. The concept, which, according to the objective-idealistic view, underlies the Being-of-nature in total, appears itself in the organism in real form, as it were; "what was merely perception up to now, has now come into existence" (340 add.). "Here nature has thus reached the existence of the concept" (336 add.); "life is the concept that has attained its manifestation" (37 add.)

It is important to see that thereby a new, higher status of the coherence of nature's separateness is reached: This coherence has just conceptual and thus already *ideal* character,

though still in the form of a material system. In Hegel's interpretation the organism is, as it were, an existing Ideal in material form.

At this point we must ask to what extent *empirical conditions of realization* can, in fact, be given for this 'speculative' point of view. A basic answer is possible within the framework of *system theory*: An organism can only be a self-preserving system in this way if it contains an *instance of control* which controls and regulates the function of the system in the sense of self-preservation[19] — and thus, as it were, is a representative of itself, a *self-instance*. As we know today, these processes are ultimately determined by the *gene information* underlying the system. It represents the structural and functional plan of the system, thereby its 'norm' or *universal* and, in fact, in this manner has an *ideal character*. At the same time a *determined identity* is thereby actually defined, which becomes immediately clear in comparison with non-organic systems: The division of a pebble results in two pebbles; the division of a fly, by contrast, destroys it, precisely because the specific identity of its species, the universality of its species, is thereby destroyed. In a literal sense it is, therefore, an 'in-dividual', 'indivisible';[20] this is the case because it is at the same time a *universal*. Hegel's interpretation of an organism as an existing concept is in this way, indeed, reconstructable in system theory and can thereby also be *actualized* in this sense.

6. Evolution

From the point of view of the tendency toward coherence and idealization of nature put forward by Hegel the organism has obviously progressed the furthest. Now, can this progression be understood as a result of an *evolution of nature*? Generally, nature is, so Hegel argues, "to be seen as a *system of levels*, out of which one necessarily emerges from the other". However, this is not to say "that one is *naturally* born of the other" (9.31); in other words: Hegel himself rejects the idea of a *real evolution* of the forms of nature, which for us at present is in no way to be doubted. This verdict is founded on the 'categorial' view of development already mentioned, according to which *development* concerns only the 'concept', namely as making explicit that "which in itself is already there" (8.308 f add.), while in the sphere of being there exists only a *transition* into another. The only exception is the individual organism, precisely because, as already presented, it is to be understood as a real existing concept. According to Hegel, to assume a real development of species is, by contrast, ruled out. Thus, for him 'development' in reference to nature can always only have the character of a conceptual development of the *categories* of nature.

In spite of this, I have shown in another analysis[21] that right within the framework of Hegel's ontology of nature one can argue for a temporally-real *process of upward gradation* of nature, as I would like to express it, without needing Hegel's concept of development (in the sense of a *conceptual* development). In content we can designate this as 'evolution' as we understand it today. To outline this briefly (whereby I shall not consider cosmogonical processes):

Under the supposition of a so-called 'abiotic' evolution (i.e., the origin of life from anorganic matter[22]) a *biotic* evolution can take place, i.e., the formation of life out of life and, furthermore, the successive further development of life in nature. From an *empirical-scientific* point of view one can in principle argue in a 'Darwinistic' manner for such an evolution: 'Mutations' in the genome can lead to advantages in the struggle for survival. These mutations can be inherited and, in the competition of individuals, can lead to the 'selection' of new varieties. This connection between mutation, selection and inheritance in principle offers a theoretically satisfying explanation for the empirically observed 'Origin of the Species' — so the title of Darwin's epoch-making book published in 1859 — which is at the same time a *higher development* in the sense of higher complexity and organization.

Darwinian arguments for the process of upgrading can also be found[23] by following this line of argumentation: Because land exists, land animals must arise out of aquatic animals (more exactly: on the basis of a population living first in water a selection pressure arises, which — in the long run — works in the direction of the development of land animals); because air exists, birds must also arise. In the long run, there arises a successive occupation of the potential environments *already existing*. Now, in analogy to that one can also argue for the idea of the *generation of new* environments: If there are single-cell organisms then mutiple-cell organisms can also arise; if there are plants, then herbivores can also arise; if there are herbivores, then carnivores can arise. In this way evolution itself *brings forth* environments: The condition just realized at the same time forms the basis of new possibilities of life and in this sense we can in fact speak of an evolutionary *process of upgrading*.

At the same time it is clear that these new possibilities of life mean a *More of complexity* and, therefore, in principle demand more complex living beings. Let us look at the transition from plants to herbivores as an example: Plants are *autotrophic*, i.e., they can *themselves* produce organic substances from the dissolved material in the ground in which they are located. Animals, on the other hand, are *heterotrophic*, i.e., they need organic substances produced from *other* living beings — here plants. At first sight this seemingly unimportant condition has decisive consequences for the organization of animals (which, by the way, Hegel has already pointed out, cf. 9.§ 350ff): Not only does it have to be equipped with a suitable set of teeth to take in food, and — to process it further — with a complex digestive system; above all, it must first be able to find food. To do this it must be able to move and to orient itself in its environment. This demands an *organization of senses*, a *nervous system* and, basically, a central regulation- and control-instance, a *brain*, to process the sensory data as well as for the coordination and supervision of the vitally necessary activities, while plants are simply concerned with the biochemical regulation of their internal functions. In other words: Animal organization is necessarily more complex than that of plants, i.e., the evolutionary process of upgrading is simultaneously a step toward *higher complexity*. In this way, *something new* continually arises in the course of biological evolution — how is that to be understood ontologically concerning nature?

Let us look into the question of the new in an *empirical-scientific way* first of all: System theory has coined the concept of *emergence* for this phenomenon. Emergence explains the appearance of qualitatively new properties and, indeed, by system formation. This is to be understood as a *holistic phenomenon*: Emergent properties are system properties, which are part of the system as a whole and, therefore, can be completely new in comparison with the properties of the partial systems.[24] On the other hand, through emergence there obviously only appears something that was already contained in the Being-of-nature as a *possibility*: This is still hidden in elemental matter, but through system formation the possibilities lying in it come to light. That is no mystical phenomenon but a direct consequence of the fact that matter is subject to *laws of nature*: Of course, system formation is nothing other than a working together of elemental laws of nature to form more complex laws, namely, laws of system, which thus can lead to the emergence of qualitative new phenomena. Cosmogony, biological evolution, but also, for example, technology in this respect offer rich material for illustration: Supernovae, ants and lasers are examples of the fact that the Being-of-nature is not limited to primitive forms of appearance, but contains essentially *possibility*, which has its origin in laws of nature and comes to light in the phenomenon of emergence.

This dimension of possibility connected with the Being-of-nature is thereby of decisive importance for the understanding of system formation, evolution, emergence and naturally technology, too. Its origin is to be found in laws of nature. The fertility of Hegel's concept of nature thus is demonstrated once again: Of course, according to objective-idealistic interpretation, laws of nature are in this way the expression of the logic underlying nature. The central presupposition of every theory of evolution will rest, from this point of view, only on the fact that nature does not amount to nothing more than its factual being but contains possibility which comes into appearance in the process of evolution, i.e., 'emerges'.

A convincing ontological founding of, e.g., the theory of evolution is only possible in this way within the framework of an objective-idealistic ontology of nature, even if Hegel himself, as already stated, rejects the supposition of a real evolutionary process. In spite of this antiquated rejection of evolutionary thought his conception is of an eminent explanatory value in an *ontological* respect.

7. The Emergence of the Psychic in Nature

The emergence of the *psychic* finally shows us what rich possibilities are available in the Being-of-nature. For purposes of clarification I shall first take up the line of argumentation developed in the system-theoretical interpretation and then show that Hegel's interpretation of sensation can be reconstructed from the same perspective, too. First of all, I shall connect up with what has previously been said as well as with my own analyses and briefly summarize their argumentation: Organisms have, as already mentioned, the character of a subject in the sense of a self-preserving Universal in the process of life. From the point of view of system theory this means, as already indicated, that there exists something like a control instance which controls

and regulates the self-preservation of the organism or expressed with a traditional concept, a self-instance or *Self.* Now, this is the case with both plants and animals, but with a different structure: For the autotrophic plant it is only a matter of the self-regulation of biochemical functions; in this sense I would like to speak of a *functional self.* In addition to that, the heterotrophic animal must — on the basis of neural and sensual organization — also perform the control and coordination of actions and accordingly possesses not only a functional self but also an *actional self,* as I call it. Consequently, in the perspective of system theory such a *double structure* of a functional self and an actional self is characteristic of the animal subject.

Such a 'doubled self' is also held to be true by Hegel as well, remarkably enough. In contrast to plants, Hegel says, a "doubling of subjectivity" in its "unity" is characteristic of the animal (9.430 add.), a "self-self" (432 add.), that means a "self that exists for the self" (430 add., also 432 add., 465 add.); in other words: The self has "itself as its object" (432 add.). This "*Finding-of-the-self-in-itself*" of the subject is, according to Hegel, "*sensation*" (342 add., italics by D. W., also 432 add.).

However, the subjective double structure itself thus underlying the sensation is not proved more closely by Hegel. In the *system-theoretical reconstruction,* on the other hand, it is directly evident; in this way the structure of sensation is also comprehensible through system-theoretical considerations: It is obviously essential for the characterized duality of the functional and actional self that both *cooperate* for the self-preservation of the organism. The functional self thereby stands for the state of needs of the organism, which the norm also prescribes to the activity of regulation of the actional self. This is especially true for *perception* by the actional self, which is thereby always oriented toward 'two sides': On the one hand, it is perception of the outward but, on the other hand, it must always contain perception of the self, as well, i.e., perception of the organism's own condition. For instance, the perception of temperature at the same time contains information concerning to what extent the sensed temperature is comfortable for the organism itself; or by feeling an object I feel myself at the same time (cf. 9.466 add.). Animal perception thus basically includes a subjective element — indeed, increasingly with the higher stages of development; it is a *subjectivized perception* and thereby a finding of itself in itself of the subject or *sensation,* the elementary form of the psychic in nature.

Characteristic qualities of the psychic, such as its *placelessness* (9.431 add.), *inwardness* (9.377 add., also 10.20 add.), *self-identity* ('Being-for-self') (9.430 add., 10.97 add.) and *ideality* (9.465 add.), to which Hegel also calls our attention, are also explained within the framework of the *system-theoretical model*: When the psychic, as presented, constitutes itself in the fusion of external perception and internal perception of self, it cannot be localized at a specific place of the body, but is equally present in *all* sensations; the *placelessness* of the psychic is really its omnipresence as the same simple subjectivity in the multiplicity and diversity of sensations. That means, furthermore, that in the performance of external perception, at the same time, a subjective *internal horizon* of perception is spread out, a private sphere of *'inwardness'* only accessible to the subject itself. And finally: In this inwardness the subject is, in the diversity of

sensations, continually in itself; it not only doesn't lose itself in the changing sensations and preserves its identity therein, but also has the *sensation* of this identity, thus identity for itself, *self-identity.*

Placelessness, inwardness and self-identity are, however, only different sides of one and the same fact, which, according to Hegel, can be characterized totally with the concept of *ideality.* In the changing sensations the same subjectivity is always contained: a feature they have in common, a *universal.* Thus, sensations have, as it were, *conceptual* status, and so indeed the character of *ideality* (16.87f, 9.432 add.).

In this way, I think, a system-theoretical reconstruction of Hegel's interpretation of sensation is possible and thereby an empirical-scientific concretization of Hegel's conception. The psychic is thus explicable as a phenomenon of emergence, and, at the same time, the tendency towards idealization in nature appears, at this point, with maximum clarity: In the placelessness, inwardness, self-identity and thereby the ideality of psychic being, as well, it is obvious that the Being-of-nature does not amount to nothing more than dull materiality but in fact always contains the possibility of *ideality.*

If the psychic in this sense is reconstructed as an emergent phenomenon of matter, this is in no way to be seen as an argument for a materialistic interpretation. Let us once again visualize the connection of arguments: For emergence-theoretical argumentation it is essential that matter is determined by *laws of nature*; only in this way can system formation exist and so organic systems and especially animal structures of organization with perception, self-perception, and sensation. However, laws of nature that determine the behaviour of matter are for their part — as logical-conceptual structures — of immaterial nature. In this respect matter itself has transcended materialism, as it were, which cannot itself explain the existence of laws of nature. This can only be expected of an objective-idealistic concept of nature. The fact that nature brings forth the psychic besides, i.e., a form of ideal being, is not surprising in this perspective and confirms the relevance of an objective-idealistic ontology of nature.

8. Possibilities of Actualizing Hegel's Philosophy of nature

In its reconstructive interpretation Hegel's philosophy of nature conveys an impressive total picture of nature: a *continuous connection* of natural phenomena in the form of a gradual succession which shows a tendency toward increasing coherence and ideality — from elementary separateness to the ideality of the psychic. Hegel's concept of nature is thus worlds apart from Decartes', who conceived nature as pure extension and thereby as the strict contrary of the psychic. According to Hegel's conception, the Being-of-nature, as emphasized, does not amount to nothing more than the factualness of material matter, but fundamentally contains *possibility,* especially the possibility of the *psychic,* which in this way no longer appears as a secluded beyond of the physical. This character of an essential *unity of nature* makes this picture of nature so fascinating — a picture which thereby presents itself as an attractive, up-to-date alternative to the Cartesian conception.

Materialism, or in scientific vocabulary, *physicalism*, also has such a unified picture of nature in mind. Yet one grave difference becomes clear here: These positions are, as already mentioned, of a limited range concerning the philosophy of nature, because they do not have an adequate ontology of nature at their disposal; for they are not in the position to explain laws of nature which, on their part, they must necessarily assume. This only becomes possible within the framework of an objective-idealistic ontology of nature, which offers good reasons on its part.

First of all, the possibility of an a priori development of the categories of nature is essential for this, which, according to an objective-idealistic understanding, makes the logic underlying the Being-of-nature comprehensible. Hegel himself assumes that such a development of categories is feasible in principle.[25] It cannot be maintained, however, that this pretension is generally fulfilled by Hegel's text, even if Hegel's accomplishments earn admiration.

In addition, as was pointed out in the introduction, such argumentation — even if it had really been carried out — obviously always has to be complemented by arguments in reference to *the conditions of realization* of natural phenomena: In so far as they belong to the real world, the aspect of the possibility of realization cannot be shaded out absolutely, and in this sense the inclusion of *empirical-scientific* arguments becomes unavoidable. This point of view already formulated at the beginning has been illustrated, for instance, by the system-theoretical considerations presented. Hegel himself offers an example for this: He explains sensation, as has been shown, by the self-self-structure of animal subjectivity without, however, proving the double structure peculiar to it. At the same time, even he already points out the *empirical* conditions for animal existence (auto-motion, continual food intake, nervous system, etc., cf 9.§350ff). The system-theoretical considerations developed here take up this line of argumentation and continue it consistently.

In fact, it is also of *philosophical* interest to clarify, if at all, to what extent and in what manner this 'self-self-structure' is *possible in reality* and what *consequences* result from it. One of these consequences is the system-theoretical possibility of reconstruction of sensation, or, expressed more generally: the evidence of the emergence of the psychic out of the physical. In fact, only this confirmation can really serve as an answer to the philosophical question posed by the mind-body-problem; everything else would remain — as it is — merely assurance. To this extent, it appears to me that Hegel's argumentation concerning the philosophy of nature not only *allows* an actualization in the sense of the empirical conditions of realization, but also *needs* such an actualization. The argumentation of philosophy of nature not only *can* integrate empirical-scientific views but, indeed, *must* integrate them.

On the other hand, and I thereby return to the starting-point of these methological considerations: If the transition from the physical to the psychic level of being is explained as a phenomenon of emergence, then certain questions become pressing: How can the psychic emerge or 'arise' on the basis of the physical? Where does it come from? Is it already 'contained' in the physical and, if so, in what form? Questions of this type, as already emphasized, can only be answered within the framework of a Hegelian type of ontology of

nature, according to which the being underlying physical being is of *ideal nature* and thus in essential affinity to psychical being. Only under this condition is empirical system-theoretical argumentation *adaptable to philosophy of nature.* In this sense the empirical arguments require an *idealistic-ontological foundation* by themselves. A form of actualization of the Hegelian philosophy of nature is thereby given, which complements the one previously stated: Within the framework of an objective-idealistic ontology of nature empirical arguments can be ontologically founded, and in this manner, and only in this manner, can they be integrated into a total picture of nature.

Seen in total, the considerations developed, as already anticipated in the introduction, result in *possibilities of actualizing* Hegel's philosophy of nature in a twofold respect: first of all, as an *empirical-scientific concretization* of Hegelian arguments, i.e., with respect to the conditions of realization of the same; secondly, in the sense of an *ontological founding* of empirical-scientific argumentation on the basis of an objective-idealistic ontology of nature. In this mutual crossing-over and elucidation of scientific and idealistic-ontological trains of thought concerning nature, in total, an astonishing actuality of Hegel's philosophy of nature becomes recognizable, not only in single points but, above all, in principle, too, i.e., in the sense of a *contemporary concept of nature.*

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1 Translated from the German by Edward Kummert, edited in association with Timo Klein.

2 About this Wandschneider, D. (1998) "Was stimmt nicht mit unserem Verhältnis zur Natur?", in: Fornet-Betancourt, R. (ed. 1998) *Armut im Spannungsfeld zwischen Globalisierung und dem Recht auf eigene Kultur: Dokumentation des VI. Internationalen Seminars des philosophischen Dialogprogramms.* Frankfurt/M. 1998.

3 Leibniz, G. W., *Metaphysiche Abhandlung*, in: Krüger, G. (ed. 1949), *Leibniz. Die Hauptwerke.* Stuttgart ^{3}1949, S. 49.

4 "Until 1970 there was hardly anyone among the Hegelians, let alone among the philosophers dealing with natural sciences, who was willing to accept Hegel's philosophy of nature as a serious field of research"; in Petry, M. J. (1981) "Hegels Naturphilosophie — Die Notwendigkeit einer Neubewertung," in: *Zeitschrift für philosophische Forschung* 35 (1981), 618. From 1970 the number of relevant publications increased rapidly; cf. Neuser, W. (1987) "Sekundärliteratur zu Hegels Naturphilosophie (1802–1985)," in: Petry, M. J. (ed. 1987) *Hegel und die Naturwissenschaften.* Stuttgart 1987. Important articles on this change have subsequently been written by D. v. Engelhardt and M. J. Petry.

5 References of this kind refer here and in the following to: Hegel, G.W.F., *Werke*, eds. E. Moldenhauer/ K.M. Michel, Frankfurt/M. 1969 ff, here especially vol. 9, p. 15; 'add.' refers to the inserted 'additions'.

6 In my book, Wandschneider, D. (1995) *Grundzüge einer Theorie der Dialektik. Rekonstruktion und Revision dialektischer Kategorienentwicklung in Hegels 'Wissenschaft der Logik'* (Stuttgart 1995), I have worked out elements of a dialectical *logic*. Attempts according to dialectics concerning the categories of nature can be found in my paper Wandschneider, D. (1993) "Natur und Naturdialektik im objektiven Idealismus Hegels," in: Gloy, K./ Burger, P. (ed. 1993) *Die Naturphilosophie im Deutschen Idealismus*, Stuttgart 1993.

7 An example for this is also, for instance, Kant's thesis on the impossibility of a 'Newton of the blade of grass': Kant gives reasons for this by demonstrating that life itself is characterized by self-preservation and therefore by 'inner teleology' ['*innere Zweckmäßigkeit*'], that is, the total interchangeability ['*Wechselseitigkeit*'] of means and end (Kant, *Kritik der Urteilskraft* (KU), quoted from the third original edition, Berlin 1799, § 63 ff, § 82). However, according to Kant, something like this cannot be realized causally, because it would require (a) the *reversibility* of cause and effect and (b) an *aim-directed* causality. But in fact, from Kant's point of view, causal processes are *irreversal* (directed from cause to effect) (KU 289), and furthermore *'blind'* (KU 270, 326) and therefore not aim-directed. Nowadays we know that both conditions indeed can be realized technically, namely in the form of a 'feedback' of the effect to the cause, mediated and controlled by a 'norm value'. If the 'technical inspiration' in Kant's lifetime had been able to imagine *conditions of realization* of 'inner teleology', Kant's 'Kritik der Urteilskraft' would have had another result: Not just a subjective 'as-if-teleology', but the view of an objective teleology of nature. (For details see Wandschneider, D. (1988) "Kants Problem der Realisierungsbedingungen organischer Zweckmäßigkeit und seine systemtheoretische Auflösung," in: *Zeitschrift für allgemeine Wissenschaftstheorie*, XIX (1988)).

8 Cf. Wandschneider (1993).

9 About this Wandschneider, D. (1989) "Der überzeitliche Grund der Natur. Kants Zeit-Antinomie in Hegelscher Perspektive", in: *prima philosophia*, Bd. 2 (1989).

10 Cf. Wandschneider, D. (in print) *Hegel und die Evolution.*

11 Wandschneider, D. (1982) *Raum, Zeit, Relativität. Grundbestimmungen der Physik in der Perspektive der Hegelschen Naturphilosophie*. Frankfurt/M. 1982.

12 The additional seven (or eight) dimensions postulated by the 'superstring-theory' of physics, which, however, are to be 'wrapped up', have hypothetical status within the framework of a theoretical model, for which furthermore there is much need of explanation.

13 Cf. Wandschneider (1982), Kap. 6; Wandschneider, D. (1987) "Die Kategorien 'Materie' und 'Licht' in der Naturphilosophie Hegels", in: Petry (ed. 1987).

14 Cassirer, E. (1972) *Zur modernen Physik*. Darmstadt ^{3}1972.

15 Reichenbach, H. (1924) *Axiomatik der relativistischen Raum-Zeit-Lehre*. Braunschweig 1924; Reichenbach, H. (1928) *Philosophie der Raum-Zeit-Lehre*. Berlin, Leipzig 1928.

16 'Mass' and 'matter' are used here quite generally and therefore synonymously; by 'mass' Hegel understands more precisely a *quantum* of matter (cf. 9.64).

17 Physically: due to various energy states in space.

18 Physically: due to the possibility of dynamic states of stability, e. g., in the form of relative minima of the potential energy in a field of force.

19 Cf. Ashby, W. R. (1966) *Design for a Brain*. London 1966, esp. ch. 7 and 9. In this respect, Ashby speaks — a little misleadingly — of 'ultra-stability'. Accordingly, the self-preservation of the organism is to be understood basically in this way that self-regulation of the system is controlled by the *norm values of the system-existence itself*, thus by the constitutive physiological parameters of the system.

20 The fact that dividing a worm in half results in two worms is based in this specific case on a specific characteristic of the species (in the sense of a specific survival-strategy); a division of the worm in its length would, on the contrary, be lethal. — Basically, in this sense the very far-reaching possibilities of division with regard to the *plant* can be obviously understood, too.

21 Wandschneider (in print), *Hegel und die Evolution.*

22 M. Eigen has presented a detailed bio-mathematical theory on this matter, cf. Eigen, M. (1977) "Wie entsteht Information? Prinzipien der Selbstorganisation in der Biologie", in: *Berichte der Bunsen-Gesellschaft für Physikalische Chemie* 80 (1977); also instructive is the presentation of the theory of Eigen in Stegmüller, W. (1975) *Hauptströmungen der Gegenwartsphilosophie*, Bd. 2. Stuttgart 1975.

23 Though Darwin himself was sceptical concerning the possibility of an explanation of an evolutionary process of upgrading; comp. Hösle, V./Illies, C. (1999) *Darwin*. Freiburg/ Basel/ Wien 1999, p. 90.

24 A simple example: Two cylinders of a different radius show, when they are given a push, a uniform rolling movement on a smooth plane. But when they are put inside one another, the emerged *new* system rolls in the form of a trembling motion.

25 Cf., e. g., 9.15.