The force of dialectics
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Chapter 12. General conclusions and perspectives.

In this chapter the general conclusions concerning the central question of this thesis - viz. what is the logical structure and ontological function of the concepts of force in the Leibnizian, Kantian, and Hegelian systems of nature, and how are these concepts related? - will be considered.

It is the irony of the structure of the concept of force that it does not allow philosophical conclusions apart from its historical and systematical exposition. One could, of course, try to point out a number of remarkable features as concerns this concept and its structure, or one could try to summarize the exposition, but in doing so one would lose the essence, as will be explained below.

The apparently perfect agreement between the Hegelian concept of force on the one hand, and the forms of this concept in the systems of nature of Leibniz, Kant, and Hegel respectively, is indeed a remarkable fact. If one assumes that this agreement is in fact an agreement between on the one hand the structure of the concepts of Hegelian force and reflection, and the general historical development of these concepts on the other hand, then there are, I think, two ways in which one might endeavour to explain it.

The first way is simply to deny it. In this option, the concurrence of the concept and its history could be plain coincidence. Or, which amounts to the same, it could be entirely my own construction. As concerns the former assumption, I can only say that such a coincidence seems a highly unlikely and rather bizar one; the concurrence is simply too perfect to explain it away by chance. With regard to the latter assumption, it is true that I have constructed the concurrence, but only in the sense that I have analyzed and presented which was already there; I merely presented a reconstruction of the three systems of nature and their concepts of force, therefore my constructive activity cannot be blamed for the occurrence of the concurrence, but only for the presentation of the concurrence.

The second way is to accept it. Then there are two possibilities. On the one hand, the history of the concept may be determined by an external factor (e.g. the scientific knowledge of natural processes and relations); on the other hand, it may be determined by an internal factor (i.e. the essence of the concept itself).

Suppose the former is true; then the history of physics would determine the history of metaphysics. This seems plausible enough, but there is at least one problem: sometimes metaphysical concepts seem to anticipate physical theories. In the case of Leibniz it is hard to decide whether his concept of monadic force is anticipating physical theories or repeating (in another form) old ones; in the case of Hegel, there is a strong suggestion of anticipation of Einsteinian ideas (e.g. spacetime, gravitational field), although it would be difficult to prove this. But Kant’s theory of the history of our solar system
and of galaxies clearly precedes exact physical knowledge of this subject; and his concept of force is closely related with this theory. Of course one might point out that Kant’s theory is in part proved wrong, especially if it is taken as the whole history of the universe; contemporary astronomy and astrophysics have concluded that the most likely history of the universe is the Big Bang model (50), and Kant’s model lacks the first period of it in which matter was formed and spread - but the rest of it still bears a remarkable similarity. And even if Kant’s theory would have been falsified completely, the fact would remain that in his time he was the first to see that Newton’s force of gravity could be used to explain the existence of the solar system and galaxies if gravity was understood as not only attraction but as implying also its complement, viz. repulsion; and with this, he anticipated Laplace’s physical theory by half a century. Therefore, even if the history of physics determines the history of metaphysics (which it undoubtedly does), this determination is not complete.

Suppose, then, that the latter is true, viz. that the history of the concept of force is determined by the nature of the concept. It seems a rather obvious assumption that the development of a concept is determined by its essence, that is, by what it actually is and becomes. Thought certainly must have its own particular properties which determine it apart from everything else, for if not, it would not be the particular faculty it is. But the fact is that this concept follows the structure of Hegelian reflection; it is not just a concept, it is a Notion. If one would grant that the (relative) self-determination of metaphysical concepts explains the historical course the concept of force actually has taken, one would have to acknowledge that Hegel’s theory of the self-determination of the Notion is correct (in this case, at least), for this theory presents the very structure of this actual historical course. One could, of course, rightly object that Leibniz’s, Kant’s and Hegel’s concepts of force are not the only ones and that, moreover, Kant’s concept of force is not the only one historically occurring between Leibniz’s and Hegel’s. But to make this objection really convincing, one should prove that the other concepts essentially differ from the ones presented by Leibniz and Kant, and, therefore, falsify Hegel’s theory. Even then one should take good care to rule out the possible influences of physics etc. in order to be sure that one has discovered the concept’s pure self-determination - but this is, in my opinion, impossible.

One must conclude, therefore, that it is practically impossible to offer a completely convincing and satisfying explanation of this remarkable concurrence and to prove this explanation.

There is, however, another way to test the pretensions of Hegel’s theory. If the concept of force actually has followed the structure of Hegelian reflection, as has been demonstrated, then it must, in its ultimate form, be a Notion. This means that it has reached its highest form of development as such; there is no better general concept of
force. On this ground, it should be able to stand up to the test of contemporary physics and astronomy. It should be compatible with the current concepts of force or, if contemporary physics in fact is rather retarded as compared to Hegelian philosophy, its Kantian or Leibnizian form should be. Of course, an extensive test of this kind exceeds the scope of this thesis, but there is yet another reason why I do not intend to carry out such a test.

One should be aware that in general the assumption of agreement between Hegelian concepts and actual historical development of thought is everything but a modest one, and that it has some awkward implications. For one thing, it suggests that all historically occurring concepts and theories which do not fit into Hegelian categories are somehow deviating from the course historical development should take. For another, it implies that Hegel’s philosophy is the ultimate system of thought; there would be no real future in philosophy after him. It is rather careless, I think, to ignore these ‘deviant’ forms of thought; to reduce history to the genesis of Hegel’s system implies making use of a kind of teleology which, in my opinion, frustrates actual insight in historical processes because it leaves too many historical facts out of consideration.

There is, however, another approach to the problem of agreement. One could assume that, although Hegel’s Notions of force and reflection do not describe the historical pattern of thought in general, they do describe and explain a particular form of thought. In this case, I see no reason why anyone should wish to simply deny that the agreement which I presented actually exists. As I pointed out above, I merely reconstructed and presented what was already there to reconstruct and present. The objections against investigating the influence of physics on this particular form of thought remain the same as the ones pointed out above. Testing Hegelian concepts by comparing them with contemporary physics might be interesting, but such a test could only reveal that there are or are not similarities; the test would not entail further conclusions concerning the validity of Hegelian concepts or physical concepts.

Having made this assumption, then, it seems best to remain within the field of philosophy itself and ask the questions (i) how the essence of this particular form of thought can be described, (ii) what induces this particular form of thought, and (iii) why it appears in these three forms successively. I will answer these questions below.

Describing the essence of a form of thought means describing its logical structure. The description of the assumed particular type of thought as concerns its logical structure is confronted with the fact that the three forms in which this type of thought appears are different in this respect. The Leibnizian structure implies a logical contradiction (see the preceding chapter, section 3) which is expressed in the Kantian structure by separating it in its constituting parts, which introduces the new category of particularity, and Hegel unifies these separated three
constituting parts, thus sublating the contradiction.

But it has also been pointed out that these different forms actually are three forms of the same thing, viz. reflection. It is true that the Leibnizian structure does not as such contain particularity, yet it is also true that this structure itself presents particularity, as becomes evident in the Kantian structure. It is true that the Kantian structure presents its constitutive parts separately, yet it is also true that this structure as a whole presents its unification. And this unification is expounded in the Hegelian structure.

As has been pointed out in the previous chapter, it is apparent, therefore, that the logical structure of this particular type of thought contains its own development.

In other words, the logical structure of this type of thought contains also itself, viz. in the expounded way of development; the logical structure is the structure of self-construction. The fact that this structure appears in three different forms is, therefore, consistent with the fact that they are presenting one and the same structure. For the structure of self-construction can only be presented as the forms it assumes successively. Its logical essence, viz. negation of the negation, cannot be presented for itself without losing the very essence it is, because it is not for itself, it is the negation of being for itself. The logical essence cannot be presented in itself either, that is, implicitly, because it is the sublation of being in itself. The logical essence of the structure of this particular type of thought is explication as well as sublation of explication; therefore it can only be presented as the whole of the process of self-construction it is, that is, it can only be presented as the totality of the forms it assumes.

This means that the only satisfactory description of this type of thought is the exposition of the forms it assumes, combined with the explication of the relations between this forms. Which is what has been presented in the previous chapters.

What induces this particular type of thought? In general, one can state that a type of thought is determined by its object. The object of the type of thought which has been expounded in the preceding chapters is force. Not, however, force as a physically appearing phenomenon (in which case a physical description and a mathematical formula would suffice), but the ontological concept of force. In each of the three forms this type of thought assumes, force is the establishing of universal relatedness by a double negation, viz. negation of the being-one of the universe (i.e. by differentiation) and negation of the differentiation (i.e. by motion and interaction) which restores the wholeness. The ontological concept of force entails, therefore, solving the problem how the universe can be both one and many. Logically, this entails the unification of different levels (viz. universality and singularity), which unification can only overcome its implied contradiction by way of mediation (viz. by particularity). Ontologically, mediation means motion and
interaction.
One can, therefore, conclude that what induces this particular type of thought is a particular approach to the problem of the universe’s being one and being many, viz. to think of the universe as a self-mediating totality. This approach assumes three forms which have been expounded in the preceding chapters.

Why does this particular type of thought appear in three successive forms?
One can consider this question purely historically. It has been pointed out above that Leibniz’s system of nature involves a contradiction which is analyzed in Kant’s system, and that Kant’s system presents the mediation with which, in Hegel’s system, the contradiction is solved. One can say, therefore, that Leibniz formulates the problem, Kant analyzes it, and Hegel finally solves it. This is a perfectly reasonable order, but it does not furnish an answer to the question why, for example, Leibniz did not carry out the analysis of his own system, or why Kant did not proceed to solve the Leibnizian contradiction. One could argue that finding solutions takes time, and that expecting Leibniz to solve his own contradiction is somewhat like expecting Aristotle to formulate the general theory of relativity. History proves that the evolution of theories takes more than a single lifetime.

In fact, to explain every turn and twist of the course history actually takes is probably beyond human power. It is, therefore, better to consider the question of the historical appearance of the three successive forms logically. In that case, one should ask whether it can be demonstrated that Leibniz’s system is logically the first step, Kant’s the second, and Hegel’s the third. Actually, this has been demonstrated already throughout the preceding chapters. As I have pointed out above, the essence of self-construction must be presented as the forms it assumes. Hegel’s system is the demonstration that the implicit form must precede the externalized form and the sublation respectively, and I have already demonstrated that Leibniz’s system is the implicit form, Kant’s system the externalized (viz. analytical) form, and Hegel’s system the sublation.

So, again, the answer to this question is the exposition in the preceding chapters.

The fact that the answers to these three questions are actually already given throughout the preceding exposition is not amazing in the case of a structure of which the essence is the exposition of this structure. All questions concerning the positing of this structure are answered by the exposition of this structure, because every question asks what the structure actually is.

To complete the exposition, however, one should also show its perspectives, that is, one should not only ask about the position, but also about the negation of this structure. Is the structure of the Hegelian system the ultimate structure concerning force, or can it be negated or sublated as it negates and sublates its predecessors?
And if it can be negated, in what way?

The structure in question consists of three interrelated elements, viz. universality (U), particularity (P), and singularity (S). Ruling out the possibility of an additional fourth element, the negation or sublation of the Hegelian structure must consist in positing an alternative interrelation. There are two possibilities for this, viz. (i) reversion, and (ii) inversion.

The reversion of the Hegelian structure means beginning with the end and end with the beginning of the reflection-structure.

With Hegel, U is negated, which posits P, and P is negated, which posits S. The reverse would be that S is negated, which posits P, and P is negated, which posits U. The question is: is this different? And the answer is: no, it is not.

Consider the negation of S which posits P. This negation must not result in nothing, for this would frustrate the following negation of P which posits U. If S is only 'being singular', its negation results in nothing, for there is nothing left if its singularity has been negated. Therefore, there must be something in it besides singularity. It cannot be P, for if P would be in S, the negation of S would mean the position of the negation of P instead of the position of P as is required. Therefore, S must contain U. Which means that the negation of S which posits P is mediated by the negation of U.

This is indeed the exact reverse of the final reflection with Hegel, in which the negation of P posits S via U (on account of the fact that the reflection in the other is the reflection in itself). But it is also clear that this reversion as such is only valid if U is presupposed, viz. if it is presupposed that the negation of U posits P—-which is the first reflection-form with Hegel. One has to conclude, therefore, that if one attempts to start with the end of the reflection-structure, actually one has to start with its beginning.

Further. Consider the negation of P which posits U. If P would be only particularity, the result of this negation would be nothing. If it would contain U, its negation would posit the negation of U instead of the position of U which is required. Therefore, it is the negation of S (which P contains) which is negated and posits U; the negation of P posits U as the negation of the negation of S.

This is indeed the other end of Hegel's reflection-structure, viz. the reverse of its beginning (i.e. the negation of U posits P). But the presupposition of U in S entails that positing the negation of the negation of S actually means positing the negation of the negation of U—which is the final reflection. One has to conclude, therefore, that if one attempts to end with the beginning of Hegel's structure, actually one ends with its ending.

In other words, the reverse of Hegelian reflection is still Hegelian reflection. This was to be expected, since the structure is circular.

In fact, one can consider beginning with S which pre-
supposes U, etc. as a sophisticated variant of the Leibnizian structure. Since Hegel sublates Leibniz, it is not amazing that such a variant does not offer a further evolution of the reflection-structure.

The other possibility, viz. the inversion of the Hegelian structure, is turning this structure inside out. This breaks the circularity into two halves, viz. the relation of P and S, and the relation of U and P. Of course, it would not do to split up the structure in its constituting parts, viz. the negation of U posits P, and the negation of P posits S, for this would invert nothing but simply reconstitute the structure. And, of course, one must not repeat the reversion. The relations must, therefore, be the negation of P which posits S, and the negation of P which posits U; in this way, the Hegelian structure is split in the middle.

The crucial thing to notice is that, in this case, the negation does not have a necessary successor; the circularity has been broken.

The negation of P which posits S now signifies dividing relatedness in its constituent parts; but this relatedness is not the relatedness of the whole universe, it is just relatedness. U has yet to be posited, viz. by the negation of P. This relation is really a problem, because there is no presupposition of U one can fall back on; it can only be a virtual relation which may result from an infinite number of P-S-relations, that is, an inductive conclusion. But induction for itself is not conclusive. To overcome its inconstelliveness, this variant presupposes, therefore, the Hegelian reflection-structure it is negating.

In fact, one can consider this to be a sophisticated Kantian structure, since P is its central category which is negated in singularity (as is the case with Kant), and because this structure has a typical Kantian inconclusiveness (viz. that P is by its own virtue incapable of positing U). This form of negation of the Hegelian structure is, therefore, not very promising either in terms of a further evolution.

One could, however, also point out that this variant actually resembles the structure of non-philosophical thought in science. Science tends to explain singular events by particular relations; the number of particular relations grows, as does the universality of these particular relations, but they never reach the level of universality which is implied in the Hegelian structure of philosophical thought. It appears that scientific thought, if it wants to be conclusive, needs the assistance of this type of philosophical thought. If, then, the Kantian variant offers a further evolution, this evolution is not the evolution of philosophy for itself. If it implies a sublation of the Hegelian structure of reflection, this must be the sublation of this particular type of philosophical thought in the sciences.
Notes to division 3.


2. This is not to say that there is no development in Hegel’s philosophical ideas; his first attempt to make an exhaustive system of philosophy (exhaustive, because it had to cover both reality and thought), which he worked on while living in Jena, failed but was not without reward with regard to the development of such crucial notions as negativity and sublation as well as of the criteria for and the structure of the system as a whole (see e.g. W. Bonsiepen, *Der Begriff der Negativität in den Jenaer Schriften Hegels*, (Hegel-studien Beiheft 16), Bonn, 1977, especially pp. 178 ff.). And even his Encyclopaedia has its rather intricate history of development. When he lived in Jena (1801–1806) Hegel made his first draft of a philosophical system, which he later substantially changed (see e.g. G.W.F. Hegel, *Naturphilosophie, Band I, Die Vorlesung von 1819/20*, hrsg. von M. Gies, (Bibliopolis) Napoli, 1982, p. xii). In the years 1816/17, Hegel already gave lectures on this newly conceived system (which would become his Encyclopaedia) and in the summer of 1817 a first edition was available (see: G.W.F. Hegel, *Gesammelte Werke, Band 19, Enzyklopädie der philosophischen Wissenschaften im Grundrisse: 1827*, hrsg. von W. Bonsiepen u. H.-C. Lucas, Hamburg, 1989, p. 455). But in a letter dated 30 July 1822, he writes to Dubroc that he is not satisfied with it, which he calls "partly imperfect, partly incomplete" ("teils unvollkommenen, teils unvollständigen Arbeit") (G.W.F. Hegel, *Gesammelte Werke, Band 2, Briefe*, p. 329). He tries to make amendments and additions, but he makes slow progress; on 16 August 1826 he sends a first revised part of the Encyclopaedia to his friend and corrector Daub. Hegel writes that the manuscript is, unfortunately, not very well suited for print, and that he did not bother to make a copy for himself because he would certainly make more amendments in it which would render it utterly unreadible (G.W.F. Hegel, *Gesammelte Werke, Band 19*, p. 457). By the end of May 1827 he has completed the corrective work; but when the result appears in print, he is dissatisfied with it again. He had expected Daub to make stilistic amendments (op. cit., p. 462), but more importantly, he wanted to update the work in view of the latest scientific developments (op. cit., p. 464). A third edition is prepared; a whole lot of new corrections is made. Among other things, the following-order of the sections on the philosophy of nature is changed in view of Hegel’s teaching-experiences (op. cit., p. 465). But on the whole, the system of the second edition remains intact; its parts are elaborated (which resulted in a larger number of sections), but their order remains more or less the same (op. cit., p. 470).
In this thesis, I have used the third edition of Hegel’s *Encyclopaedia*.

3. M.J.Petry (Hegel’s *Philosophy of Nature*, op.cit., vol.1, p.21) writes: "The Hegelian system is truly encyclopaedic. If it is to be fully appreciated therefore, it has to be grasped as a whole [...] The ‘Philosophy of Nature’ [...] constitutes an integral part of the whole."


5. In general I use J.M.Petry’s outstanding translation of Hegel’s *Philosophy of Nature* (see note 1), i.e. of G.W.F. Hegel, *Encyclopaedie der philosophischen Wissenschaften im Grundrisse*, 3. Ausgabe (1830). As regards sublation, a crucial concept in Hegel’s system, Petry writes: "Sublate: aufheben (Latin tollere). The double sense in which Hegel uses this word is explained in s.96 of the ‘Encyclopaedia’, ‘We mean by it (i) to clear away, or annul: thus, we say, a law or a regulation is set aside; (ii) to keep or preserve: in which sense we use it when we say: something is well put by.’ The Latin equivalent has the same double meaning as the German word." (J.M.Petry, op.cit., vol.1, p.172). In this way sublation indicates the transition of one transformation of the Absolute to the next, a transition in which the specific determination of the previous form (as well as the determinations of all previous forms) is negated yet preserved because the Absolute arrives at a higher level (as it does with each transition).

6. Petry writes: "The main principle behind the organization of the subject matter of the ‘Encyclopaedia’ is [...] that of a progression from what is more *simple* to what is more *complex.*" (op.cit., vol.1, p.25).

   In fact, this is oversimplifying the matter; I think it would be more accurate to say that the principle of organization is a progression from what is least determinate to what is most determinate.

7. This is, of course, one of the oldest problems in philosophy which is reconstituted in the opposition between dialectics and formal logic. Dialectical philosophy sees reality as a process; everything moves and changes constantly, so to picture this one seems to need "liquid" concepts. Formal logic, on the other hand, is only applicable to non-changing objects – in fact, it is only applicable to concepts;
in this view, concepts must be "non-liquid". The basic axiom of formal logic is "A is A, and A is not not-A", the definition of formal identity. The basic axiom of dialectics is "A is both A and not-A". As one can see, the latter is the negation of the former. This is essentially what is the case: dialectics is the negation of formal logic, and vice versa, that is, in order to exist each one of them needs to negate the other, therefore it needs the existence of the other. Formal logic would be nothing if it did not negate contradiction; dialectics cannot exist without negating formal identity.

Now, it is clear that language would lose its meaning if words could be used indiscriminately; this would be the case if words were "liquified", for then any word would ultimately refer to anything at all. Therefore, formal logic rightly demands a non-contradictory use of words and meanings. But formal logic has, of course, no right to demand a rigid and unchanging reality. The problem is, then: formal logic should be applied to concepts, dialectics should be applied to reality. Either we are to give up a firm relation between concepts and reality, or we are to reconcile dialectics and formal logic.

As concerns this problem, dialectics has a distinct advantage over formal logic, since there is clearly a contradiction involved. Formal logic cannot conceptualize any contradiction at all, but dialectics can. One would expect that, therefore, a solution would have come from dialectical philosophy. Sadly, this is not so.

8. Self-determination and self-understanding, because it is always the Absolute which is both the acting subject and the object which is acted upon in Hegel’s system.


10. "Being-implicit" is Petry’s translation of Hegel’s term "an sich sein" (Being-in-itself), which would be in Latin "in se esse" (see J.M.Petry, op.cit., vol.1, p.159). Hegel uses it to denominate the initial level of each transformation, which is followed by being-for-itself and being-in-and-for-itself. At the initial level all determinations remain within one unity, at the second level they are considered outside this unity, that is, as such, and at the third level they are re-united again, with the result that at this level both the unity and the complexity of that unity have become clear and are expressed by one concept. (See also note 6.)

11. Petry writes: "For itself: Für sich. This term has its origin in everyday German usage, in which it occurs in such phrases as 'to live by oneself' (für sich leben), ‘to remain single’ (für sich bleiben),
to speak to oneself’ (für sich sprechen), i.e. with the meaning of alone, without relationships, withdrawn from company [...]" (J.M.Petry, op.cit., vol.1, p.156).

12. Petry (op.cit., vol.1, pp.31-32) thinks that the origin of Hegel’s "triad" must be found in religion; the structure of the Encyclopaedia, that is, the fact that it is divided in three spheres (Logic, Nature, and Spirit), originated in the Trinity (Father, Son, Holy Spirit).

Maybe this is true (Hegel may well have been fascinated by patterns found in christian dogmata; Bonsiepen remarks for instance that, in Jena, Hegel used the christian dogma of divine incarnation as one of the patterns for his thoughts; Bonsiepen, Der Begriff der Negativität in den Jenaer Schriften Hegels, op.cit., p.29), but in any case I am inclined to think that one should not take this as something which provides essential information about Hegel’s system. The theological problems involved in the idea of the Trinity are rather complex (to say the least) and the concept itself appears in many different forms in various brands of christian religion and their respective systems of theology. It is, therefore, not very likely that this concept would shed light on Hegel’s "triad".

13. With Hegel ‘actual’ actually means ideal, because his Actor is the ideal Absolute, viz. the Spirit; actual transformations, therefore, can only occur in the realm of the Spirit, that is, in the third and final part of his system. This does not mean that the other transformations are no transformations — they are no actual transformations, that is, they are no actions of the Spirit and lack, therefore, ideality.

14. The concepts of the Philosophy of Nature seem, therefore, to be derived both from the Logic and from the Philosophy of the Spirit; therefore, they are logically necessary, that is, necessary according to the logic of Hegel’s system. But, in the light of the development of the empirical knowledge, one can question their absolute necessity. D.Wandschneider (Die Stellung der Natur im Gesamtentwurf der Hegelschen Philosophie, in: M.J.Petry (ed.), Hegel und die Naturwissenschaften, Stuttgart-Bad Canstatt, 1987, p.37) remarks: "Sicher hat Hegel nicht immer der Versuchung widerstanden, noch unzureichend erforschtes empirisches Material systematisch zu vereinnahmen und vorschnell als aus "dem Begriff" deduzierbar zu deklarieren. Doch ist dies für Hegel keineswegs die Regel."

Petry thinks that the Hegelian categories are essentially independent of the empirical knowledge they fit together; he says about this: "It is essential that its subject matter should be regarded as being open to constant revision in the light of the
changing state of knowledge. It is no less essential however that this subject matter should be structuralized with reference to the principles through which it becomes most fully intelligible, and that these principles should be recognized as absolute and changeless." (M.J.Petry, Hegel's Philosophy of Nature, op.cit., vol.1, p.33). And furthermore he is of the opinion that with regard to the scientific content of Hegel's philosophy nobody should lightly judge this to be out of date: "His actual mistakes [concerning scientific concepts] are few and far between." (id., pp.49, ff.), and: "Hegel put an immense amount of effort into elaborating his philosophy of mathematics and the natural sciences. He opened his career with a thesis on Newtonian mechanics, lectured regularly on a whole range of related subjects over a period of thirty years, presented a detailed and constantly revised exposition of the Philosophy of Nature as the central feature of all three editions of his Encyclopaedia." (M.J.Petry, "Hegel's Philosophy of Nature; Recent Developments" in: Hegel-Studien, Bd. 23, Bonn, 1988, p.305). This opinion is shared by G.Buchdahl, who remarks "Hegel moved within this edifice [viz. the system of the natural sciences and mathematics] with astonishing dexterity and a formidable breadth of knowledge." (Buchdahl, G., "Hegel's Philosophy of Nature and the Structure of Science", in Ratio, XV, 1973, p.1).

I think that Petry is right in judging that Hegelian categories are essentially independent of empirical knowledge. That is, Hegel's philosophy of nature provides a system in which empirical knowledge of all kinds can be structuralized. Yet one has to be aware of the fact that there is no such thing as purely empirical knowledge; all knowledge has a theoretical component, and it is a very distinct possibility that some theoretical components of well-established empirical knowledge are in conflict with the theoretical presuppositions of Hegel's system. I do not think, therefore, that all empirical knowledge can be structuralized in Hegel's system without any problem.

15. I will present Petry's translation of Hegel's philosophy of nature (see note 1) throughout this part; only when I deviate from this translation, I will make a note of it.

16. In this part I will use, as does Petry (see J.M.Petry, Hegel's Philosophy of Nature, op.cit, vol.1, p.154) "difference" for the Hegelian concept of "Unterschied".

17. Hegel's deduction of the dimensions of space and time is rather problematical. D.Wandschneider (Raum, Zeit, Relativität, Frankfurt 1982, pp.49-64) tries to clear it up as follows. Space, he argues, is the general form of "being-apart" ("Auseinandersein"),
therefore it must be the being-apart of something which is not apart itself and which is not many (otherwise the argument would become an infinite regression or a circle, and in both cases it would lead to nothing). This "something" is the point. The negative relation between space and point (negative, since they are opposites) is establish in the next form, viz. the line. Follows the negation of the negation, viz. the plane.

V. Hösle (Raum, Zeit, Bewegung, in: M.J. Petry, Hegel und die Naturwissenschaften, pp.262 ff.) remarks that this explanation does not explain why Hegel fails to establish the general concept in three stages (as is his usual method); for with point, line, and plane space is not yet complete. Neither Hegel nor Wandschneider give a solution for this. Hösle suggests the following. The point is not really the first determination, for it is related to space; therefore the plane is the third determination of point, but not of space. Plane is "erst Prinzip und Grenze des Abschlusses" (op.cit, p.263).

As concerns time, Wandschneider stresses that the negative relation of time with space is necessary to go to the concepts of multitude and motion, but he cannot explain why time must have three dimensions (Wandschneider, op.cit., pp.77 ff.). Hösle claims that the irreversibility of time derives from its negativity, and that irreversibility implies anisotropy, and one temporal dimension only (Hösle, op.cit., pp.274-275). Wandschneider attempts to deduce the anisotropy of time from the fact that it is one-dimensional (Wandschneider, op.cit., p.78); Hösle does the reverse (Hösle, op.cit., pp.275 ff.).

This is in itself already an interesting fact, since it shows that Hegel’s system can be stretched to fit opposite views. But how far one may actually go in one’s interpretation is revealed when Hösle says: "Als Übergang vom Nichtsein ins Sein und vom Sein ins Nichtsein konstituiert sie [viz. time] die drei Dimensionen, wie Hegel sagt, bzw. die drei Modi, wie wir heute sagen würden, von Vergangenheit, Gegenwart und Zukunft." (Hösle, op.cit., p.276). This is, I think, not acceptable. There is rather a great difference between "dimensions" and "modi". The latter is a more or less neutral metaphysical concept which refers to forms of existence of one substance; the former is a very specific geometrical concept which refers to a distinction of direction in extension. Of course, if Hegel only wanted to say that anything always stand at a certain location, and is able to "look" in three directions ("back", "here", and "forward"), Hösle is right; in that case modi and dimensions mean the same. But as a matter of fact this would be a rather sloppy use of language to cover up the fact that time does not have three dimensions in the same way as space does. Now sloppy use of language or opaque phrases to cover things up are not entirely absent in Hegel’s works, but that
does not mean that it is unclear what he wants to establish in such instances. He always wants to uphold his system, which means that he wants to uphold his logic. I think it is obvious that in this case, Hegel wants to repeat the triadic form of space in a similar triad as concerns time. The question to ask here is not: how can we find three dimensions of time where there is obviously only one? The question to ask is: what does the triadic form mean?

Does it come from the three familiar dimensions of space? I think not. It comes from Hegel’s logic: the three stages (that is, forms) of being-in-self, being-for-self, and being-in-and-for-self. Hegel tries to find physical concepts which he can use to make these stages concrete in this part of his philosophy; he tries to fit physical knowledge into his philosophy, not the other way round.

Hegel made use of spatial dimensions, because they were the only triad known in those days. I am convinced that if he had known of modern theories about dimensions (which vary from four, to ten, or more), he would not have used dimensions in the way he actually did. Maybe he would have concluded that physics and cosmology are not yet up to the level of knowledge on which his natural philosophy stands. That would account for the absence of a convincing triad as concerns space and time.

One should not, I think, try and demonstrate that Hegel was right in everything he said. That is a certain way to kill his system off, and his way of thinking too, because of course he was wrong several times. Science has made considerable progress, one should not deny that, and one should also not deny that Hegel was unable to foresee most of it. If Hegel was right, he was right in his logic, in the way he fitted the categories of his system together; the way in which he filled his categories up with scientific knowledge may be accurate (or not) for his own time, it certainly is not for ours — to think that is to deny progress. The problem of dimensions of space and time is typical. One should, in my opinion, make clear how Hegel wanted his logic to work in this case; and if one wants to go beyond that, then one should make clear how he actually struggled with the geometrical and physical concepts involved, and point out that he failed to offer a satisfactory solution.

18. There is difference of opinion on this matter.

D. Wandschneider (Die Stellung der Natur im Gesamtentwurf der Hegelschen Philosophie, in: M. J. Petry, Hegel und die Naturwissenschaften, op. cit., pp. 44-53) seems to reject the idea that Hegel thought of nature as having a real history; nature does have a tendency to develop categories according to his (viz. Hegel’s) logic, but this is a matter of logic, not a matter of history: "Hegel spricht also der Natur zwar eine logische Tendenz zur "Selbstverinnerlichung" zu, lehnt die Auffassung einer realen Naturevolution aber
ab." (op.cit., p.47).

But M.Gies (op.cit., pp. 81 ff) claims it is wrong to reject real evolution in Hegel’s system. The fact that his natural philosophy begins with the logic of space and time and not with the way in which space and time came into existence etc. proves nothing, he says. He argues that time is constituted by actual development (that is, the real sequence of events and stages), therefore logical development as such is independent of time. In other words, it is entirely possible to offer the logic of development without including its actual historic realization; and Hegel may well have done so.

My own opinion in this matter is presented in section 3 of this chapter.

19. I do not intend to suggest here that Hegel actually anticipated Einsteinian concepts; spacetime is, however, the only term that expresses the unity of space and time in Hegel’s system correctly.

20. In general, for the logic of this, see the next chapter on the Logic.

Wandschneider (in: M.J. Petry, Hegel und die Naturwissenschaften, op.cit., pp.54 ff.) states that Hegel’s Naturphilosophie (in the Encyclopaedia) is ordered according to his Logic, but also according to its own logic which does not bring something new or alien into the Naturphilosophie; thus "wird die Mechanik, deren Gegenstand die Materie überhaupt in ihrer Vereinzelung ist, mit der Seinslogik paralleliert; das, was Hegel Physik nennt und die spezifischen Erscheinungsformen der Materie zum Thema hat, mit der Wesenslogik; und die Organische Physik schliesslich mit der Begriffslogik." (op.cit., p.54).

He concludes that there is a general but not complete correspondence between logical categories and categories belonging to natural philosophy in Hegel’s system (e.g. Sein - Raum, Nichts - Zeit, etc.) (op.cit., pp.54-55).

I am inclined to doubt this. Wandschneider agrees with Hegel that, in the Naturphilosophie, the Notion determines itself by clarifying and incorporating scientific empirical concepts. He gives the example of Space, which must have three dimensions according to the three determinations of the Notion (viz. being general, particular, and singular). Now these determinations do not occur in the Seinslogik, but in the Begriffslogik; but Wandschneider claimed that the Seinslogik corresponds with the Mechanik in which part Space occurs as a category; therefore his idea of correspondence is inconsistent. A second example; according to Wandschneider, the first part of the Naturphilosophie should begin as the Seinslogik begins, viz. with a qualitative category; but in fact Hegel states that Space, the category the Naturphilosophie begins with, is a quantitative category; again, Wandschneiders idea of correspondence is in-
consistent.

Hösle (V.Hösle, "Raum, Zeit, Bewegung", in: M.J.Petry (ed.), Hegel und die Naturwissenschaften, op.cit., pp. 247 ff.) concludes, differently and in my opinion rightly, that the first part of the Naturphilosophie (Mechanik) is of a quantitative nature, and the second part (Physik) of a qualitative nature. However, he suggests that as a consequence Hegelian Logic should actually also begin with the category of quantity, which is, I think, a non sequitur.

Falkenburg confuses the reader by first stating that the first categories of the Naturphilosophie can be viewed as "Spezifikationen von Denkbestimmungen des ersten Teils der Logik", and then that whereas the Logic begins with qualitative categories (Sein, Werden, etc.) the Naturphilosophie begins with quantitative ones (Falkenburg, B., Die Form der Materie. Zur Metaphysik der Natur bei Kant und Hegel., Frankfurt a/M, 1987, pp.185-6.).

To me, it seems necessary that the Logic as a whole is incorporated in every part of its successive part in the system, i.e. the Naturphilosophie. Furthermore, I do not think that "general but incomplete correspondence" is a realistic idea: correspondence is either complete, or non-existent. In fact, in my opinion, there is no correspondence between the various parts of Hegel’s system, except if one wants correspondence to mean "developing according to similar laws" (viz. the law of negation of the negation) which is a rather far-fetched meaning of the term. The unity of Hegel’s system derives not from correspondence but from the fact that it is (or at least is meant to be) one developing whole; in development certain stages may seem to repeat preceding stages but in fact they do not.

21. In the philosophy of nature, Hegel treats "many" and "one" as more or less identical with "discreteness" and "continuity" (which are the parts of a purely quantitative relation). In the Logic he treats these four concepts successively which means that this way of treating them is, so to speak, contracted in his mechanics.

22. Petry translates: "[...] divides itself essentially into particular bodies, and links itself together in the moment of individuality [...]" (Petry, Hegel’s Philosophy of Nature, op.cit., vol.1, p.260). I can see why he does so; the German "urteilt sich ..., schliesst sich ..." is not easily and certainly not idiomatically open to translation into English. Yet it is crucial to remain as close as possible to the Hegelian text, even at the cost of non-idiomatic phrases, because "urteilen" and "schliessen" have a very specific logical meaning in Hegel’s system, and he refers with these terms to his "Lehre vom Begriff" (which is the third part of the Logic). The
translation "divides itself" lacks the very clear mark of the activity of the Notion, which "urteilt sich" obviously possesses. The same applies to translating "links together" for "schliesst sich". The mark of activity of the Notion is all-important, because it indicates that nature (on its most general level) has arrived at its ultimate and true form, here.

23. D. Wandschneider ("Die Kategorien 'Materie' und 'Licht' in der Naturphilosophie Hegels", in: M.J.Petry (ed.), Hegel und die Naturwissenschaften, op.cit., pp.293 ff.) explains that corpuscles "als für sich seiende Einheit" constitute a substantial location ("substantieller Ort"), and that they are only relatively in motion, that is, only with respect to other corpuscles; which means that, in Hegel's system, motion and rest are external properties (op.cit., p.294). With this in mind, Wandschneider claims he can solve Zeno's paradox of the flying arrow: "Dass der Pfeil stets auch ruht, folgt nach dem Vorigen aus seiner Eigenschaft als materieller Körper, der als solcher eben auch einen ruhenden Ort konstituiert. Als Körper freilich ist er, wie dargelegt, gegen Ruhe und Bewegung gleichgültig. Beide sind ihm äusserlich, so dass mit der Möglichkeit von Ruhe zugleich immer schon die Möglichkeit von Bewegung eingeräumt ist." (op.cit., p.296).

If Wandschneider is right, the paradox disappears because the contradiction in it disappears. But I am not convinced that his subtle distinctions are made in the Spirit of Hegel. Hegel, I think, strives to sublate the contradiction, not to annihiliate it. It would be more like him to "solve" Zeno's paradox by pointing out that rest (i.e. being at a certain place at a certain time) is something which belongs to another level than motion; just as point and line belong to different levels; but also that they belong to one and the same object, and that they are certainly not just external properties of it. How can motion be an external property of matter, if it is sublated by and therefore incorporated in matter, as Hegel expressly and systematically states? And how can rest, if it is understood to mean being at a place and, therefore, constituting substantial location, be something which is external to matter, if matter also sublates and incorporates this, as Hegel states? Yes, they can be conceived of as external properties, but only when conceived of as properties for themselves, not when conceived of as related properties, as they must be in the case of any part of matter in motion.


26. This reminds one of Einstein’s theories, as do Hegel’s concepts of spacetime and matter. One should not, however, make too much of such similarities; for one thing, Hegel’s concepts do not include Einsteinian mathematics, and for another, it might well be that one encounters such concepts in every consistent dynamic theory of the universe. Furthermore, anticipation is a rather awkward concept; it implies a kind of fore-sight which is a bit hard to believe in. Moreover, how can one be certain that Hegel anticipated Einstein’s theories, instead of that Einstein coined Hegelian concepts?

27. Again, one is reminded of Einstein’s theories. But if one would endeavour to establish whatever relationship may exist between them, it is clear that this calls for an analysis of the theoretical similarities and relations between Hegel’s concepts and Einstein’s, which is much more than this thesis intends to do.

28. In this chapter, with Logic I or II, I will refer to G.W.F. Hegel, Wissenschaft der Logik, Hamburg, 1975, vol. I or II.

29. Hegel distinguishes between three forms of universality. First: "schlechte Allgemeinheit", which is the abstract universality; second: "Wesenheit", which is the universality of the structure of reflection; third: "Begriff", which is the unity of what is differentiated ("unterschieden").

30. H.H. Holz ("Inleiding in de problematiek", in: H.H. Holz e.a., Dialectiek als open systeem, Groningen, 1985, pp.16-17) remarks that philosophy can only construct necessary concepts (as opposed to contingent concepts based on empirical research) by reflection, that is, by reconstructing the immanent determinations of concepts, quoting Hegel on this topic: "[..] das Reich des Gedankens philosophisch, d.i. in seiner eigenen immanenten Tätigkeit, oder was dasselbe ist, in seiner notwendigen Entwicklung darzustellen. [..] Auf diesem sich selbst konstruierenden Wege allein, behaupte ich, ist die Philosophie fähig, objektive demostrierte Wissenschaft zu sein [..] Ihre Selbstbewegung ist ihr geistiges Leben und ist das, wodurch sich die Wissenschaft konstituiert, und desselben Darstellung sie ist." As a consequence, Holz concludes, dialectics can only be expounded as the process it is.

31. This identity of method and subject-matter is crucial in Hegel’s system, because he wants his philosophy to be absolute philosophy, that is, philosophy which has as its object the Absolute. This kind of philosophy must, ultimately, remain absolutely within itself, and must, therefore, bring forth its own method and subject-matter. In other words: this phi-
losophy is both its method and its subject-matter, it is, therefore, its own exposition.

Of course, this is exactly why Hegel’s system is so hard to swallow: it can only be swallowed as a whole.

32. A thing which flows is a substance which has the flowing as an attribute, but the flowing itself does not have this attribute; the flowing is its very substance.


It is clear, then, that this concept of logic is not the same as the concept of the Logic; but it is also clear that the negative character of Logic is something which Hegel thought essential even in Jena.

Furthermore it is interesting that, in this period, Hegel had not yet rejected the Kantian concept of metaphysics completely, for this indicates a certain extent of continuity in the development of metaphysics.

34. B. Falkenburg (Die Form der Materie. Zur Metaphysik der Natur bei Kant und Hegel, Frankfurt a/M, 1987, p.109) points out that, firstly, Hegel’s Logic is metaphysics (which is a different view as compared to the view Hegel took in Jena), and secondly, that although with Kant metaphysical thought has itself as its object too, there is a difference between Kantian and Hegelian metaphysics in this respect: "Die Basis
des gesamten Systems, die Logik, ist nun für Hegel selbst schon Metaphysik. In ihr hat sich das Denken nur selbst zum Gegenstand, aber in einem völlig anderen Sinne, als Kant dies von der formalen Logik und der Mathematik, die sich beide nicht auf Gegenstände außerhalb des menschlichen Erkenntnisvermögens richteten, sagen konnte. Hegels Logik richtet sich, indem sie sich auf das Denken selbst richtet, sehr wohl zugleich auf dem menschlichen Denken äussere Objekte wie z.B. das "Sein" oder die "Wirklichkeit", die sogar grosstels dem Gegenstandsbereich außerhalb der Kantischen Grenzen möglicher Erkenntnis angehören, und 'begreift' diese in Form von Denkbestimmungen in sich ein. Nach dem Kantischen Gebrauch dieser Begriffe ist sie also Logik und Metaphysik in einem, denn die ist Vernunftverkennnis ihrer Gegenstände aus reinen Begriffen, in der das Denken doch 'bei sich selbst' bleibt."

It is clear that Hegel's development as a philosopher is determined by his criticism of Kant. But, noticing this, one has to bear in mind Hegel's concept of negativity which is not simple opposition or annihilation; Hegel's negation of Kant must, therefore, contain Kantian concepts and structures as well as negate them.

35. Repulsion and attraction are here, in the Logic, ontological categories instead of physical concepts. It is clear that in physics attraction, for instance, means the tendency of certain parts of matter to move towards each other. These certain parts of matter are determinate parts; but that stage of determination has not yet been reached in the Logic.

36. The fact that Hegel's Logic is not an introduction to metaphysics, but is itself metaphysics (see notes 33, 34), is again made apparent by M.Wolff, who points out (M.Wolff, "Hegel und Cauchy", in: R.P.Horstmann & M.J.Petry (eds.), Hegels Philosophie der Natur, Stuttgart, 1986, pp.197 ff.) that Hegel, in his exposition on quantity and quality, offers a (foundation of a) philosophy of mathematics — not, however, as a separate metaphysical system: "Hegel betrachtete es aber als die Aufgabe seiner Philosophie der Mathematik, einen neuen Begriff des mathematischen Unendlichen zu entwerfen, in dem die Widersprüche der metaphysischen [i.e. non-dialectical] Unendlichkeitsvorstellungen aufgehoben sein sollten. Nach seiner Meinung konnte dieser neue Begriff aus eben den Ideen gewonnen werden, die dem mathematischen Limesbegriff selbst zugrundeliegen.

Hegel schwebte damit keineswegs ein neues metaphysisches System der Grundlegung der Infinitesimalrechnung vor. Im Gegenteil, er lehnte jeden Versuch ab, die 'bisherige Auffassungsweise des Verfahrens' der Analysis durch 'Prinzipien' und durch eine 'nachher erschaffene Theorie' zu rechtfertigen; auch die Wissenschaft der Logik sollte offenbar nicht als ein
37. Hegel’s concept of syllogism is different from the classical aristotelian syllogism (for instance, Hegel distinguishes between four forms instead of the three Aristotelian syllogisms (see W.&M. Kneale, The Development of Logic, Oxford, 1962, p.68)), although like Aristotle he uses the terms universal, particular, and singular and stresses the importance of the so-called "middle-term"; an essential difference is that Hegel develops the ‘dynamics’ of the syllogism by which the singular becomes part of the universal, etc.

38. As I have pointed out above, in his philosophy of nature Hegel explains his Mechanics in a way which is consistent with the way he treats Mechanism in his Logic. It might seem a plausible assumption, therefore, that his Mechanics should be analyzed with help of this part of the Logic (viz."Die Objektivität", the second part of the third book) and not, as I do, with the part of the Logic which deals with essence. It is, I think, indeed correct to assume that Hegel’s philosophy of nature deals with forms of the Notion. However, in my opinion the dynamical essence of the Notion is presented in the logic of essence, therefore the analysis of Hegel’s Mechanics should be carried out with the help of the terms which are developed in this part of the Logic.

As I have also pointed out above (see note 20), I do not think that any part of Hegel’s system is, or indeed could consistently be, a mere mirror-image or repetition of his Logic. As the Notion determines itself throughout the entire philosophical system, the proper logic of each successive part must be different from the proper logic of the preceding parts — not, of course, essentially different (for the Notion is its own motion, is, therefore, its own essence throughout its development), but different in appearance. As a consequence, one should not expect the order of appearances to be fixed by any other principle than that of negation of the negation, which is the principle of the essence itself. As B.Falkenburg remarks: "Die Philosophie insgesamt ist für Hegel ein "Kreis von Kreisen" [...] des Denkens, und es ist jedesmal dieselbe Idee, die in der Logik, der Naturphilosophie und der Philosophie des Geistes..."

Assuming that the logic of essence is indeed the dynamical core of the Logic, and therefore of the system as a whole, how can one explain the fact that Hegel wrote a whole book of his Logic following the last determination of the essence, viz. Reality (culminating in Interaction)? Do the determinations of the Notion in this third book, which book is about the very logic of the Notion, play no role in the next part of the system, which is the philosophy of nature? My answer to this is: yes, they do play a role, but they do not explain the essence of the dynamics. If one wants to understand the dynamical essence of Hegel’s Mechanics, one should look for the essence as such of his logic, for there is only one essence in his system, as there is only one motion. One should not look for the proper logic of the Notion itself ("Logik des Begriffs"), for in it the essence has already taken on a new form after the pure and, so to speak, naked form of essence, as I intend to explain in the following sections.

39. "Reflexion" (reflection) has a specific meaning in Hegel’s system. In ordinary language it generally refers to reflection of lightbeams or to (philosophical) reflection. Not so with Hegel. He does not use it as a general term for philosophical thought, as can be inferred from the fact that, in the doctrine of the Notion, the "Schluss der Reflexion" (the conclusion of reflection, which is a particular form of syllogism) refers, not to a general, but to a specific form of philosophical reasoning. It is true, however, that the term often occurs in an apparently systematical connection with terms as "scheinen" or "Schein" (i.e. illuminate or illumination, but the latter also means appearance); the association with light seems to be wanted by Hegel. Now light is a natural phenomena which has drawn Hegel’s special attention; already in his years in Jena, light, motion, and force are used together to gain understanding of the unity of nature (referred to as "Geist"; see G.W.F. Hegel, Jenaer Systementwürfe, vol. II: Logik, Metaphysik, Naturphilosophie, Hamburg, 1982, pp.232 ff.). Light has an important place in his Encyclopaedia too, where it is referred to as "the existing general Self of Matter" (Encyclopaedia, s.275). I think Hegel’s idea of reflection is best understood by referring to the term "Aufklärung", that is, by understanding it as the course of enlightenment which the light of reason takes; not, however, the reason of the philosopher, but the reason of Philosophy, that is, of the ideal reality - the reason which is
commonly called Logos. Reflection refers, then, to the logical structure of "sich setzen", positioning in general.


41. In German, "Schein" and "Erscheinung" are closely related; with Hegel, "Schein" is that which appears, and "Erscheinung" refers not only to what appears but also to the whole process of appearing. I will translate this with Appearance and Appearing respectively.

42. In German, ground or ultimate reason is "Grund" and Hegel uses the connected expression "zu Grunde gehen" which means being destroyed but also, literally, going to the ground. Evidently, he wants to stress that the Essence, which is motion and the nature of change, in whatever form it may assume always is negating, therefore especially so in its ‘basic’ form of Ground; and at the same time he wants to emphasize that this negative activity is not simply destructive, but creative — everything goes to the ground which is what it arises from.

43. In this light, it is clear that Hegel proceeds from this determination not only to Actuality, but, with and after it, to the doctrine of the Notion. It is obvious that the Essence of Being is the object of the Notion as well as, in a general sense, its subject (viz. as logical structure in general, therefore determining activity of forming Notions). And this is how the logic leads on to the Idea in which Notion and Being are sublated.

44. Existence can also be the starting-point, when the entire process has been set into motion, because it leads to its Ground which is Essence. But not before, for the Essence is all-encompassing as such, it is the being-in-itself of Actuality.

45. As before, where I have underlined this word "is", it should be taken literally, that is, in its ontological meaning of general existence. Force, then, does not exist "as such", that is, for itself, but it does exist, viz. as the actual process of real interaction.

46. One may challenge this conclusion by pointing out that not all transitions in Hegel’s system are completely convincing, but even so, one cannot reasonably doubt Hegel’s intention, nor the obviously monistic overall-structure of his system.


49. The metaphors of bud and flower, or of seed and plant, which seem to be applicable, actually are not. Firstly, because Hegel’s logic is always on the level of totality where development in time as such does not exist; totality encompasses time. Secondly, because the seed is not the principle of growth and existence of the plant (nor is the bud that kind of principle of the flower), but only a preceding stage of it. Force, however, is not just a preceding stage of Actuality (although it logically precedes it), but it is its becoming (which also implies that it is not determined by time, but that it, rather, determines time because it actualizes its existence).

50. It is, of course, an open question how long this model will keep its dominant place in astrophysics; lately, several discoveries have been made (e.g. the existence of a constellation named "the great wall" which defies the current theories about the development of the universe) which seem to indicate that it will have to be at least amended soon.