EDITORIAL INTRODUCTION
THE EPISTEMOLOGICAL DISCUSSION ON TELEOLOGY: CURRENT POSITIONS

One could easily come to the conclusion that since the quite animated discussion on functionality and teleology of the seventies - taking place around Woodfield, Wright, Wimsatt a.o., and which tried to chart both the dimension of the description and the one of explanation - a new period of silence, or at least of weakened attention for these subjects, has set in. The developments in micro-biology, in molecular and cellular biology, in biochemistry, the developments in brain research, in the domain of computer-simulation, ... indeed convey the impression once again that the teleological description, and certainly the teleological explanation, have become superfluous and can only be tolerated on economical grounds.

Nevertheless it would be quite wrong to believe that the attention for the teleological problem has in the least diminished. When one looks beyond the different conceptual shifts, one discovers a wealth of investigations - of a theoretical-epistemological, practical or formal nature - which essentially have to do with this problem.

It is precisely the epistemological approach, which we have brought to the fore in the present issue of *Philosophica*, which permits to discern a unifying element in this great diversity of investigations. It is therefore unavoidable that we should make explicit what we understand by teleology.

We further indicate in which way this problem comes up for discussion in biology and in the domains where meaning plays a prominent part. Finally we give a short summary of each of the articles included in this issue.

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One could think at first sight that teleology has to do with a representation or an idea which is connected with a goal that has to be achieved. Teleological behaviour would develop on the basis of a distance between what is and what has to be. Not

without reason did the cybernetics of the first order, for instance, in its characterization of purposive behaviour, take the controlling function of the purpose as its starting point.

Still, behind that epistemological denominator there is a lot more to be found. The purposiveness which is understood and explained on the basis of a goal conception, remains, because of the complexity of certain natural phenomena and systems, a kind of teleology that is too reductive and in fact almost negligible.

Not only the development of a behaviour on the basis of a specific purpose, but also the development of so-called complex phenomena originating in less organized situations, where the purpose is not known in advance, has to be examined under the heading of teleology. In addition there is the resistance and the adaptation of complex systems to disorganizing factors, together with the anticipation of this sort of factors. And there are also the crucial problems of the development of meaning, of the development of higher levels of cognition out of lower perceptual levels, ... All these themes are at the center of the discussion on teleology.

An abstract formulation of the problem permits to create some clarity in this apparently confused and divergent multiplicity of data.

We can posit that teleological phenomena confront us with the relation between different levels: between the one of the parts - the local level - and the one of the whole - the global level. Starting from such a minimal and abstract approach we can now formulate the teleological problem in a Kantian way: "How can we understand that in a system the parts mutually define each other and are defined in their turn by the whole, in spite of the fact that this whole precedes the parts at the same time in a certain way, and determines them in their form and content already before it exists as a whole?"

The relation between the parts and the whole, as becomes clear in the presentation of the question above, has a paradoxical character. If we presuppose a determining effect from the global level before this global level exists, then the teleological character has a paradoxical status. The assumption of a determining effect from the future, the so-called reverse causality, has been the main reason why teleological explanations were said to be metaphysical.

We know that Kant, on the basis of what he calls the contingent and rich diversity of the internally purposive forms, introduced his philosophy of the 'as if'. We must look at internally purposive forms 'as if' they were developed out of the conception of a purpose.

If to-day we still have to depart from this 'contingent and immense diversity', and whether we still have to understand the teleological question as widely as Kant, is highly debatable though. We shall not go into the discussion with Kant however. We merely want to emphasize some new developments which are to be found in the present issue.

For the time being it is at least clear that the discussion on teleology, both in biology and in other domains, is connected with *reduction and emergence*. The evolution within the domain of the means to experiment with the relation between local and global, both mathematically and artificially, has considerably heightened the attention for alternative and more refined conceptions around emergence and reduction. The current connectionism plays an essential part in this to-day. Seeing as it is closely connected with the analysis and the making operational of different conceptions of emergence.

Several of the articles presented here try to develop new concepts, which are more refined than the former strong definitions of reductionism, and than the metaphysical conception around emergence.

The change that took place in the approach of teleology during the seventies, which we referred to at the beginning of this introduction, is certainly quite conspicuous. What it was about there was much more a study of the teleological explanation, supported by the use of the term in every day language. We can say it was an approach of 'the second order', since it was a study of the formal aspects by which a teleological explanation (S does B in order to do G) can be distinguished from a traditional causal explanation.

We think that this aspect is not to be found in this collection at all.

Further we can also remark that the teleological problem, as it was conceptualized by Kant, has essentially to do with the aspect of *form*. The current morphodynamic approach appears - because of the developments in connectionism, but particularly because of the morphological theory of René Thom that was developed before already - to reconcile the philosophical tradition in a remarkable way with the current scientific tendencies.

Finally, it remains for us to inquire into the nature of the general epistemological renewal of the theories under discussion here. What are the consequences of it for concepts such as explanation, truth, for the status of the empirical? What we have in mind here in particular is the new dimension which the notion of 'soft constraints' can introduce in the field of epistemology.

With some of the authors in fact the peculiarity is to be

noticed that certain concepts have been removed. The most essential of these is certainly the one of control. In the place of this we encounter everywhere the idea that several local, soft constraints, the determining effect of each of which is not as such determinant for the result, will lead to a global product.

From an epistemological point of view we are confronted here with a conceptual gap: which alternative concepts other than those of sufficient ground and necessary condition will be adequate? An additional question, which mostly remains in the background, is the one of the explanatory value. Does the connection of explanation with the sufficient ground, through these soft constraints, not become impossible? Will the explanation, as Isabelle Stengers poses it, have to be replaced by description?

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We can see that the teleological debate is taking place nowadays predominantly within two domains: the one of biology and the one with regards to meaning.

That the relation local/global within the domain of *biology* plays an important role, will come as no surprise. The relation, as it was described in its paradoxical form above, and which was recognized by some in the morphogenetic development, has given rise to the formulation of vitalistic principles. This again led to a virulent opposition from the mechanistic views in science.

It has become common practice in de last 30-40 years to employ the conceptuology of the self-organization to characterize this relation, even if the epistemological nucleus is rarely or ever explicitly brought up in this context. The conceptual shifts do not imply that there is a lot more clarity in this domain. The discussion on teleology, however, becomes almost entirely a discussion around self-organization. The themes which are underlying from an epistemological point of view, are still those of the reduction from a certain level to another, those of the emergence of properties on a higher level from local interactions on a lower level.

The teleological problem does not only confront us, however, with the phenomena of the (biological) development of 'order' out of 'disorder'. It also faces us with the problem of the emergence of *meaning*. The relations between syntax and semantics, between perception and meaning, between perception and cognition, be-

tween brain and mind are investigated here. Meaning is sometimes linked up with functionality on the macro-level, functionality which arises from the dynamic interactions on the micro-level.

A peculiarity is to be mentioned here though. Namely that the meaning, as an emerging product, is not only approached in *analogy*, but also in *continuity* with the teleology within the domain of biology and physics. The teleological problem, in its complexification from the biological order, thus leads to a complexification of, and a closer relationship with, the problem of intentionality.

It is precisely those two aspects which are being treated in this issue. For one thing we find here the elaboration, mainly from the morphodynamic side, of a theory of meaning which is explicitly brought in analogy with the critical phenomena out of physics and with the thermodynamic phase transitions. For another attention is being paid, and then mainly from the radical constructivistic side, to the development of meaning in continuity with the biological functionality. Both options do not exclude each other though.

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We mentioned above that the teleology, as to its terminology, is to-day being examined mainly within the context of the so-called self-organizing phenomena. It has become almost infeasible not to think here of the diverse popularized interpretations which have engrafted themselves on some basical insights, through which extrapolations towards cosmical, moral, and other themes have known a wide diffusion.

This issue of *Philosophica* does not aim at giving a survey of what to-day is going on in this fashion-determined movement. It does aim on the contrary at opening a perspective on some new theoretical insights which have to be situated beyond and above all fads and crazes. The articles can, as to this, speak each for themselves. The short presentation which we shall give here, in conclusion, of each of them, only serves to illustrate in which way the summarily indicated elements of the current discussion are to be found in them.

The current radical constructivistic approach, which departs from the autopoietic theories of Maturana and Varela, is particu-

larly successful in Germany. Ernst Von Glasersfeld, Gerard Roth and Helmut Schwegler are a few among the best known representatives of it.[1]

A recurrence to the first sources of the teleological discussion - we are thinking of course of the final causes of Aristotle - should not be absent in a collection like this. Surely not if one knows that the attention for Aristotle is steadily growing in the so-called 'natural philosophy'.[2]

The text from *Ernst Von Glasersfeld, "Teleology and the Concepts of Causation"*, situates the share of the Aristotelian doctrine of causality in the controversy around mechanism and teleology. These relations of causality are being examined with a view to a renewed making operable of certain aspects of the final causes in the scientific context. It is quite wrong to think that the final causes should only offer metaphysical prospects. The rigorous separation of mechanism and teleology is, therefore, untenable. That this belief continued to exist so long finds its origin in a conceptual confusion. It was rekindled in this century by the behavioristic aversion which again was merely interested in the concept of teleology.

The historic-conceptual approach of Von Glasersfeld brought him to the examination of concepts such as cause, explanation, mechanism, induction, representation ... The analysis is being concretised on the basis of some well-known interpretations of the teleology, developed from a scientific point of view: especially those of cybernetics, but also the programmatic or 'teleonomic' interpretation in biology are being employed there.

This article offers a wealth of clarifications in connection with the divergent uses of the teleological terminology. It also provides some insight in the deficiencies of cybernetics within the field of teleology, and describes the way to remedy these deficiencies.

Gerard Roth and Helmut Schwegler are investigating in their article *"Self-Organization, Emergent Properties and the Unity of the World"*, the relation between emergentism and reductionism. They are dealing both with the relation between biology and physics, and with the one between mind and brain. Both the subtle conceptual refinements which they propose here - for instance the non-reductionist physicalism or the physicalist emergentism - and the way in which they conceive the central idea of radical constructivism - the properties of an object and the possible ways to interact with that object are defined on a mutual basis - is felt by us to be a genuine relief. It really

strikes a different note from the often too metaphysically held interpretation of emergence, and also from the often too metaphorical way in which the central idea of constructivism is interpreted.

We can also read certain epistemological consequences of the constructivistic object-vision. For instance with regard to the untenability of certain positions: the 'traditional' emergentism becomes a truism, the reductionism an 'ex-post'reductionism.

To us this way of proceeding by means of the questions: 'What is rendered possible, as an epistemological position, by it?', 'What on the other hand becomes untenable by it?', seems to provide a better view on the specific usefulness of the radical constructivism.

In connection with that it would be worthwhile to apply the two kinds of criticism on the emergentism and the reductionism just mentioned, to the current connectionism. Precisely in that literature there are quite a lot of delusions with regard to emergentism, and, at the same time there is often a hidden ex-post reductionism.

We applied to *Isabelle Stengers* for a text on the notion of 'constraint'. For after having asked repeatedly for further explanation during some of her lectures, there still hovered a promise around this concept which we never seemed to get a full explicitation of.

The text that we publish here, *"Comment se passer de la finalité?"*, is a critical analysis of the autopoietic theory of Francisco Varela and Humberto Maturana, and at the same time a description of the confusions prevailing within the schools of thought which range under the denominator of self-organization. The concept of constraint, as opposed to the one of control, has a central place in her argumentation.[3]

Let us illustrate this by the distinction between the physicochemical self-organization (dissipative structures) and the reflexive self-organization of the constructivism. Except for the very simple confusion between those two, there also exists a confusion with regard to the importance they can have within the field of finality.

There is for instance the mistaken supposition that the first systems have to be brought in relation with finality. In a way this supposition is even less justified than it is in the classical thermodynamic systems, since the dissipative structures cannot even be characterized by a potential. The physico-chemical self-organization will rather lead us to the question of the presuppositions which we associate with the identification of a system. It

will also lead us to the inquiry into the conditions under which a preexistence of a purpose can be assumed.

Isabelle Stengers proposes to tie up finality, repetition and the reference of the parts to the whole and with each other. The problems in connection with finality always presuppose a certain temporality, a temporality which is absent in physical chemistry. We may call it the temporality of repetition. It refers to a relative identity of a system which is maintained by the repetition. Here we can see that a.o. Bergson, but also Darwinian interpretations are followed, which increasingly give to terms such as adaptation and optimalization a purely retrospective and circumstantial meaning. This goes against the theories of Varela and Maturana, who define life in terms of the relation between the parts with regard to the whole.

The most radical critique on the 'constructivist' of Maturana and Varela has to do though with the fact that two registers are played on.

Either the central concept, the autopoiesis, refers to the actual means to describe and understand the living, which is considered on the basis of its specific identity. This option has to do with the experimental side of the concept. Within that option the aspect of becoming can no longer be taken into account. When there is question of becoming, of learning, then the specific identity has only the statute of a 'constraint', which has no explanatory power whatever.

Or the autopoietic interpretation refers to a general metabiological point of view. There the distinction between the specific repetitive identity and becoming disappears. It is posited that any behaviour whatsoever must correspond to the autopoietic organization, otherwise the latter will disintegrate. Every possibility of direct knowledge disappears from that moment onward.

This text makes us acquainted with a way of interpreting the concept of 'constraint' epistemologically. In the case of the dissipative structures the notion of control loses its pertinency. The development of a dissipative structure has to be conceived in terms of several soft constraints. It is susceptible to tiny changes in the 'circumstances'; it can go through a history. The constraints, that is, make it possible that in the process of which it is a necessary condition, certain circumstances get a meaning which did not exist yet before the process started. At the same time that constraint does also acquire a meaning for the system.

The concept of constraint does not at all provide, according to Stengers, the premisses for an operation of deduction. It is still a necessary, but not a sufficient ground for what is being

produced.

The discussion with regard to realism - is it possible to produce evidence of the existence of a mind-independent reality? - is for the most part implicitly present within the context of the study of teleological phenomena. This also remains the case where teleology is approached mainly by way of emergentist concepts.

In what sort of way the two themes are tied up with biology, and particularly, under what conditions the question about the relation between a specific sensory state and a corresponding object is a teleological question, is being dealt with by *Mohan Matthen* in *"Biological Realism"*. The latter aspect is also to be found though under the heading of the 'naturalism'. As a consequence we find here also an analysis of naturalism and realism, on the basis of the specific interpretation of the teleological relation.

The current theories with regard to the perception of colour serve as a starting point in order to delineate, illustrate, and investigate those philosophical positions.

The most interesting aspect of Matthen's interpretation is certainly the place that is given to the error, the mistake or the mis-representation.[4] Neither by way of an evolutionary theory, nor by way of an idea of functional normality is it possible to adequately calculate in the part played by error. Within the confines of a computational theory, which departs from the purposes of a specific perceptual process and considers the result as a more or less successful approximation of those, we can, on the contrary, duly account for the mistakes which occur in the relation between perception and external world.

The question of realism cannot be decided upon within this theory in an aprioristic and non-globalizing way. Whether a mental state permits to know something about the external reality, has always to be decided upon on the basis of experimental results.

Francis Bailly intends to come in *"Levels of organization, level changes, finality"* to an abstract, operational use of the concepts of emergence and complexity. Unseparably connected with this is the necessity to make the concept of level - and then in particular the fact that it is characterized by a certain autonomy - more explicit.

On the basis of an analysis in various disciplines the following two minimal requisites for these concepts were postulated: on the one hand an intensive quantity of the system in question has to become infinite; on the other hand this infinite limit must go

together with a change of what is called a pertinent object, both in the theoretical and in the empirical description.

The concept of emergence possesses a stronger connotation than the one of complexity. Instead of referring, like the concept of complexity, to a critical transition of a regular state to another, we have to do here with a generalized criticity in the way the system is functioning. Because of this, the concept of emergence can better serve the purpose of characterizing teleological phenomena in biology, the ones of which we have discussed the problematical part-whole relation.

Next to the greater rigour which this approach necessarily implies - it frees the debate of all sorts of illusions - it also makes it possible to return with greater clarity to the central characteristics of what is traditionally connected with emergence and finality: discontinuity, critical transition, functional integration connected with a level of organization. The distinction between the physical level, the biological one, and the level of meaning, is again being confirmed quite clearly and conceptually sustained.

Certain problems appear with all the more pregnancy: we are thinking here in particular of the way in which functionality is connected with the pertinency of a level, and of the relation, which is kept rather implicit, between the functionality of a biological organization and the origin of it, and also of the relation which the author is suggesting at the end, between an epistemological choice and a corresponding organizational level. This suggestion opens new and quite interesting perspectives for the function of abstract-formal investigations in science.[5]

In another text of this issue, namely the one by Jean Petitot, the connectionism is explicitly inquired into. In *Why connectionism is such a good thing? A criticism of Fodor and Pylyshyn's criticism of Smolensky"*, Petitot takes up the already generally known debate between Smolensky and Fodor-Pylyshyn.

The introduction of the theme of teleology - which is here specifically concentrated on the emergence of higher cognitive structures from lower perceptual levels, or else, on the emergence of language from its physical and neurophysiological bases - he readily takes as an occasion to point out one of the central weaknesses in Smolensky's argumentation.

On the fact whether the sub-symbolic level has some cognitive importance or not, there is quite a lot of disagreement. Have we only to do here with a new implementation, strongly separated from the functional architecture - dixit Fodor and Pylyshyn - or is something more involved here? Smolensky is

only speaking about a 'semantic shift' in the transition to sub-symbolic explanations. The epistemological development of the concept of emergence, on the basis of which he could have indicated the cognitive-structural importance of the sub-symbolical level for the symbolic one, we do not find elaborated with him.

Petitot's morphodynamic approach is showing both the weaknesses in the debate, as the different ways in which these shortcomings can be remedied.

Instead of underestimating the part played by the emergence and thereby dismissing the connectionism on the basis of the argument that the sub-symbolic level can't say anything about constituent structure (as Fodor and Pylyshyn are doing), we must try to understand in which way syntactic-semantic forms emerge. We must, in other words, develop a dynamical structuralism, on the basis of mathematical theories about dynamical systems, which can be used to express that process of emergence. Then it would probably appear that the sub-symbolic level is structural all right - even though no symbolic interpretation is involved, still this structural aspect would invalidate the critiques of Fodor and Pylyshyn - and that the symbolic level is characterized in the structure by a certain autonomy.

Petitot develops his argument on the basis of a radical criticism of the formalistic (logical-combinatory) approach of cognition and of the postulate of innatism connected with it. It is a criticism of which he has already shown the pertinency before in all sorts of domains.[6]

In the article by *Jan Van Dormael, "The emergence of analogy. Analogical reasoning as a constraint satisfaction process"*, the emergence of analogy is conceived as the result of an irreversible, consequence-driven process whereby at the end the solution is being found. The formalization of an actual consequence-driven process on the basis of the theory of counterfactuals, in which an a priory purpose is not to be found, does not only seem to us to be important on the level of logic, but offers prospects moreover for a less circular theory on the use of analogies.

This article is, as we see it, the only one which takes up the 'as if'-idea of Kant again. Perhaps not so astonishing, in view of the complexity, the 'contingent and rich diversity of forms' which is to be found within the domain of analogical thinking. Perhaps it is also wrong on our part when we immediately, together with the 'as if', only think of Kant. The distinction between the fundamental complexity of certain phenomena and

the introduction of the regulative Idea does not seem to be noticeable here anywhere. The success of the analogical thinking even depends on the refusal to distinguish different sorts of reality, " ...the lack of differentiating between planes of reality".

That the justification of the use of an analogy will become at the least problematic, will not come as a surprise to anybody who is familiar with the self-organizing theories. Andy Clark already remarked that these theories might very well prove to be opaque on the level of the explanation. "The observation of the growing of a banana tree is extremely interesting, but doesn't tell us anything about the internal structure and the way of functioning of it."[7]

Is there an irreconcilability between the ex post facto construction and the justification, one could rightfully ask?

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NOTES

1. For an interesting survey of the literature in this domain: S. Schmidt (ed.), 1987, *Der Diskurs des radikalen Konstruktivismus*, Frankfurt am Main, Suhrkamp, pp. 475.
2. We remind here, for instance, of the importance René Thom attaches to the Aristotelian conception of causality in: *Esquisse d'une Sémiophysique. Physique aristotélicienne et Théorie des Catastrophes, Paris, InterEditions*, 1988.
3. There are already several publications by her around the different meanings of the concept of self-organization. I. Stengers, 1985, Les généalogies de l'auto-organisation, *Cahiers du CREA*, nr. 8: Généalogies de l'auto-organisation, pp. 7-105. With regard to the concept of constraint, we refer to: I. Stengers, Transformation de la signification du concept de contrainte, in J.-P. Brans, I. Stengers en P. Vincke (eds.), *Temps et Devenir. A partir de l'oeuvre d'Ylia Prigogine*, Genève, Editions Patiño, pp. 27-28.
4. In other articles he has also dealt with this topic: M. Matthen and E. Levy, 1984, Teleology, Error and the Human Immune System, *The Journal of Philosophy*, vol. 81, nr. 7, pp. 351-372; M. Matthen and E. Levy, 1986, Organic Teleology, in N. Rescher (ed.), *Current Issues in Teleology*, Lanham, Univer-

sity of America Press, pp. 93-101.

5. These problems are more explicitly under discussion in: F. Bailly, F. Gail, R. Mosseri, Dynamical Model and Embryogenesis, Proc. of the European Congress on System Science, Lausanne, Oct. 1989, pp. 559-571.
6. J. Petitot, 1985, *Morphogenèse du Sens I*, Paris, PUF; J. Petitot, 1985, *Les Catastrophes de la Parole. De Roman Jacobson à René Thom*, Paris Maloine.
7. A. Clark, s.d., Artificial Intelligence and Evolutionary Epistemology, Manuscript, p. 14.
8. More specifically dealing with this is: J. Van Dormael, Analogical Reasoning: a Logical Inquiry in "Archaic Thought", in E.M. Barth and J. Van Dormael (eds.), 1990, *From an Empirical Point of View*, Ghent, Communication & Cognition.

Editorial note: The original plan was to publish all papers mentioned in this introduction in a single issue. However, because of the length of some of the contributions, it seemed more appropriate to devote two issues to the theme of self-organization and complexity. Thus, the reader should be warned that he will not find all articles discussed in the introduction in this issue. In addition, the next issue, volume 47, will contain one extra paper on this topic.