

PHILOSOPHY OF BIOLOGY: OUTLINE OF A TRANSCENDENTAL PROJECT

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Received 8 September 2004; accepted 25 October 2004

ABSTRACT

This paper analyses the actual meaning of a transcendental philosophy of biology, and does so by exploring and actualising the epistemological and metaphysical value of Kant's viewpoint on living systems. It finds inspiration in the Kantian idea of living systems intrinsically resisting objectification, but critically departs from Kant's philosophical solution in as far as it is based in a subjectivist dogmatism. It attempts to overcome this dogmatism, on the one hand by explicitly taking into account the conditions of possibility at the side of the subject, and on the other hand by embedding both the living and the knowing system into an ontology of complexly organized dynamical systems. This paper fits into the transcendental perspective in acknowledging the need to analyse the *conditions* of knowability, prior to the contents of what is known. But it also contributes to an expansion and an actualisation of the issue of transcendentalism itself by considering the conditions of possibility at the side of the object as intrinsically linked to the conditions of possibility at the side of the subject.

1. INTRODUCTION

The main aim of this paper is to examine the actual relevance and significance of a transcendental philosophy of biology. Leaving aside the question whether transcendentalism is relevant for philosophy of science in general¹, this paper focuses on the specific relevance of transcendentalism in studying living systems. In doing so, it is considered

¹The transcendental move is certainly not a standard one in philosophy of science. There are some, more or less scattered, attempts to develop typically transcendental concepts and methodologies within philosophy of science. There is in particular a renewed, mainly continental, science-philosophical interest in objectivity and constitution in philosophy of physics and mathematics (Auyang, 1995; Bitbol, 1998, 2000; Friedman, 1994; Petitot, 1997a, 1997b). With regard to biological phenomena, however, a transcendental science-philosophical interest is still less prominent, even if Kant's viewpoint on living beings has had recurrent attention, mainly from within organizational (cf. Maturana and Varela, 1980), structuralist (cf. Goodwin, 1990, 1995; Goodwin and Briere, 1992; Webster and

useful to explore and actualise the epistemological and metaphysical value of Kant's viewpoint on living systems. Indeed, with regard to living systems, Kant initiated a basic transcendental gesture that can be seen as a turning point in the reflective space concerning living systems, just as his transcendental move in epistemology created a new, highly constraining and up to this day almost inescapable space to reflect upon the status of objective knowledge of non-living systems.

Most innovating is Kant's assumption that living systems intrinsically *resist* any attempt of objectification, and demand as such for an approach qualitatively different from the one developed in relation to non-living systems. More specifically, Kant articulates the transcendental issue with regard to living systems on the basis of an *intrinsic impossibility* to find the universal concepts under which living systems can be subsumed. To him, the knowing subject cannot but connect to living systems by *assuming* their intrinsic purposiveness (the "as if"). Kant thereby grounds his solution in the communicative wishes and abilities of the knowing subject, which are implicitly assumed to hold universally for all human beings.

This article finds inspiration in the idea of living systems intrinsically resisting objectification, but critically departs from Kant's philosophical solution. Indeed, its aim is to take *explicitly* into account, alongside the conditions of possibility at the side of the object (the living system), the conditions of possibility at the side of the knowing instance (the subject). It therefore criticizes Kant's viewpoint in as far as it is based in a subjectivist dogmatism. Moreover, it attempts to overcome this dogmatism by embedding both the living and the knowing system into an ontology of complexly organized dynamical systems. It thereby subscribes to the transcendental idea of the priority of the *conditions* of knowability. However, it also contributes to an expansion and an actualisation of the issue of transcendentalism itself by considering the conditions of possibility at the side of the object as intrinsically linked to the conditions of possibility at the side of the subject. In this way, this project finds resonance with certain issues discussed in the phenomenological tradition, and in particular in current attempts to naturalize phenomenological insights.

In a first part, it is shown how the opposition between reductionism/holism has been determinative in the debates about living systems, how philosophy of biology has frequently subscribed to this opposition, and how it could be overcome by a transcendental viewpoint. In a second part, Kant's viewpoint on living systems is briefly set out. In a third part, some points of actualisation are discussed and the major characteristics of an actualised transcendental philosophy of biology are presented.

2. PHILOSOPHY OF BIOLOGY IN BETWEEN REDUCTIONISM AND HOLISM

Throughout the centuries, there have been philosophers and scientists to agree upon the fact that living systems are qualitatively different from non-living systems, and require a specific treatment accounting for this difference. The intuition underlying this agreement involves, at least initially, two hypotheses (Fagot-Largeault, 1995: 231). The first is that all living beings have something in common: there is some principle that

Goodwin, 1982) or complexity (dynamical structuralist) viewpoints (cf. Kauffman, 1993, 1995, 2000).

permits to transcend their phenomenal variety and unifies them under the heading of living systems (*unity of life*). The second is that living systems constitute a specific level of reality, distinct from non-living matter, but possibly also from human culture (*specificity of life*). These two hypotheses constitute an *ontological space* (dualistic or tripartite respectively) within which questions about living systems are enclosed.² Within this ontological space, the challenge is two-fold: (i) to find the principles that succeed in unifying living systems beyond their phenomenal variety, (ii) to find precise criteria to distinguish them from non-living and/or cultural systems.

What happened with this endeavor in relation to living systems? Three things can be noted.

Firstly, history shows that there have been *two basic modes* of approaching living systems, with an alternating weight in philosophy and in science. On the one hand, there has been the search for unifying macro-structural or morphological characteristics, based in the argument that the phenomenal form of living beings is the starting point in any attempt of unification. On the other hand, there has been the search for unity on the basis of micro-structural components, atoms or cells, based in the assumption of a compositional unity of life that can sufficiently account for its specificity (Fagot-Largeault, 1995: 237ff.)

Secondly, at least since the development of cellular theory in the 19th century, and still more since the molecular revolution of the last century (Harris, 1999; Morange, 1998 [1994]), the morphological approach has decreased in importance in comparison to the *micro-structural* one. Indeed, recurrent and passionate struggles notwithstanding,³ the search for microstructures has been far more successful as a unifying tool than any research on macrostructures developed until this day. Even if they played, and continue to play, a crucial role in the initial assessment of living systems, macrostructures have simply not succeeded to provide biology with a real unity.

Thirdly, the current success of the micro-structural (molecular) approach has not lead to a complete eradication of the morphological stance. Until this day, the latter continues to challenge the overall ambition of accounts that purport to *adequately* explain living systems in micro-structural terms only.⁴ This leads to a situation of *indecisiveness* in which neither micro-structural nor macro-structural characteristics in themselves

²The ontological space remains the same, even if life turns out to be, in second instance, reducible to the workings of non-living matter. Quite similarly, the space within which discussions about the mind take place, remains most of the time Cartesian or dualistic, even in the most overtly anti-Cartesian or anti-dualistic approaches that purport to overcome any categorical distinction between mind and matter. For a nice illustration of this discussion in philosophy of mind, see Burwood *et al.* (1999).

³Cf. the intense struggle between the two projects of unification, described by D'Arcy Thompson, between Goethe and Virchow: "As Goethe said long ago, 'Das lebendige ist zwar in Elemente zerlegt, aber man kann es aus diesen nicht wieder zusammenstellen und beleben'; the dictum of the *Cellularpathologie* being just the opposite, "Jedes Thier erscheint als eine Summe vitaler Einheiten, von denen jede den vollen Charakter des Lebens an sich trägt." (1917, IV: 344, quoted in Fagot-Largeault, 1995: 237).

⁴This is the basic significance of current theories of complexity that have the aim to constitute a genuine alternative to reductionist approaches in biology. For a detailed

succeed in having a decisive impact, but in which both take turns with the interests and purposes, ideals and hopes, of the persons concerned.⁵

In the majority of cases, *philosophy of biology* has accompanied, through reflection, these alternating stances. It either took sides with the reductionist option and thereby often fell back on the styles and reasonings of a philosophy of science developed first and foremost in relation to physics (cf. Hull, 1998). Or it joined in with holistic, deconstructivist and even mystical criticisms of reductionism in an attempt to capture the irreducible singularity of living systems, neglecting or at least minimizing the importance of reductionist arguments to this end (Oyama, 1985, 1993, 2001; Oyama *et al.*, 2001). Following Webster and Goodwin's (1982: 6) description of contemporary biology in terms of "an unhappy marriage between atomism and a materialistic (and often mystical) holism," it can be said that philosophy of biology has to a large extent adhered to the terms of the same marital contract. As a matter of fact, in as far as it remains within the bounds of a micro-structural *versus* a macro-structural approach, it does not put into question the terms of the contract itself. In other words, it does not go beyond the ontological space drawn by the two hypotheses sketched previously. And yet, that is perhaps exactly what a philosophy of biology should do.

Indeed, as living systems seem to confront us, apparently more than any other system, with an *impossibility* or at least a *difficulty*, to find unifying principles or distinctive criteria that would allow for their objectification, either in micro-structural, or in macro-structural terms, or in terms of a combination of both, it might be a good move to scrutinize the ontological space itself within which the questioning takes place. Could it be that precisely the *resistance* against the kinds of questions asked, and thus the resistance toward the ontological space, i.e. the space of conditions of possibility, within which phenomena are asked to fit, is, more than anything else, indicative of what life is about?

The hypothesis that will be explored here is that a transcendental account of living systems helps clarify and even overcome the opposition between reductionism/holism or micro-structural versus macro-structural approaches as just sketched. To conceive of philosophy of biology, and more generally of philosophy of science, in transcendental terms, implies, firstly, an analysis of the conditions within which the systems under study can be experienced, and secondly, an analysis of the conditions under which this experience can be systematically arranged in view of a knowledge that is objective, universal and necessary. In other words, a transcendental philosophy does more than simply working within a certain ontological space. It sets up an analysis of the ontological space itself. This space can be conceived of as a space of conditionality, of experience

discussion of complexity in relation to biological systems, see Van de Vijver *et al.* (2003).

⁵One possible answer to this situation is to consider both approaches as two extremes on a continuum, between which various forms of complementarity can exist. This often leads to a form of epistemic pluralism. Whereas pluralism can have the advantage of decreasing dogmatic oppositions, it also can have as a drawback to discharge proponents of the burden to clarify the sources and conditions of agreement and disagreement. Our aim is to attempt to go beyond epistemic pluralism by clarifying as explicitly as possible the sources of agreement and disagreement.

on the one hand, and of objective knowledge on the other hand. Clearly, since Kant, the major methodological characteristic of a transcendental philosophy is the priority given to the issue of conditionality, with at the horizon the ambition to find unifying principles and distinctive criteria on the basis of which phenomena can be objectified and constituted. These principles have to guarantee the “secure road of science,” as he states in his introduction to the *Critique of Pure Reason*. In studying living systems, however, Kant had to acknowledge that those systems are not to be constituted and objectified as non-living systems are. There is an intrinsic difficulty of finding the “secure road of a science” here.

To make the significance of the transcendental viewpoint in relation to living systems clear, Kant’s basic assumptions about living organisms are now discussed. It is shown how these are intimately tied up to the epistemological solution he proposes, allowing us to highlight the fundamental metaphysical shift that hereby takes shape.

3. KANT’S VIEWPOINT ON LIVING SYSTEMS

It has to be clarified from the outset that the importance that is here attributed to Kant’s viewpoint on living systems is not as such indicative of his historical importance in biological or philosophical debates on the matter. It is certain that Kant was informed and aware of the scientific and philosophical developments of his time, and it is also clear that he incorporated these in his own philosophical reflections. But this does not therefore imply that he had an equally important voice in the pregnant biological debates of his time, such as the discussions about preformation versus epigenesis, or ovism versus spermism (Maienschein, 2000; Müller-Sievers, 1997; Van Speybroeck *et al.*, 2002b). The point we wish to make here with regard to Kant is not historical, but epistemological.

Two Basic Assumptions About Living Organisms

Throughout his philosophical work, Kant assumes that living systems are qualitatively, principally and essentially different from physical, non-living systems. In the second part of his third *Critique*, Kant develops his idea on the basis of two more detailed assumptions.⁶

– On the one hand, living systems display a *unity* that is related to their essence as globally functioning, actively integrated, cohesive and purposive entities. Living systems are in other words organised *essentially* in view of certain purposes – they are “natural purposes” (*Naturzwecke*) in which nothing whatsoever is the result of chance. More specifically, Kant states that everything in a natural purpose “is *both cause and effect of itself*” (CJ, §64, p. 249; Ak., Bd. V, p. 370, italics added), which expresses their intrinsic cohesive and purposive nature.

⁶English translation of W. S. Pluhar, *Critique of Judgment* (including the first introduction), Hackett Publishing Company, Indianapolis, Cambridge, 1987. *Critique of Judgment* is abbreviated as CJ. References to the English translation are followed by the edition of the Academy, given as Ak.

– On the other hand, the forms of living systems that appear to us are *excessively diverse*, or *essentially contingent*, which makes it impossible to understand or explain them in mechanical terms.

To Kant, these two assumptions are inescapable. He accepts them dogmatically, uncritically, so much so that he is sometimes called a straightforward vitalist.⁷ Beyond the discussion about Kant's vitalism, however, it is important to see that these assumptions make up the starting point of his transcendental analysis of living systems, but also, as in any transcendental analysis, its blind spot, a point that is not to be further analysed.⁸ Just as the assumption of the universal and necessary kind of knowledge at play in Newtonian mechanics constituted the blind spot of Kant's transcendental analysis in the *Critique of Pure Reason*, the two assumptions about living systems are the blind spot, the unquestioned givenness, of the second part of his third *Critique*. Given the essentially purposive nature of living systems, given the extreme diversity of their forms, how can they be explained or understood? In other words, what are the conditions of possibility of this type of systems? Or else, what is to be assumed to make their possibility or their essence understandable? These are the major questions Kant addresses in the second part of his third *Critique*. His transcendental analysis purports to account for what he sees as the essence of living beings in terms of their conditions of possibility.

Epistemological Solution

Kant's answer goes as follows:

Firstly, he subscribes to a clear, *dichotomic* distinction between a mechanical and a teleological approach of living systems. According to him, living beings cannot be adequately accounted for in terms of a blind, mechanical causality, as it will be impossible to capture in this way their essential purposiveness. If in nature *nexus effectivus* was followed, that is, if one simply considered nature in mechanistic terms, one would have to admit that it would have been able to progress in thousands of other manners without ever attaining unity following such a principle (CJ, §61, p. 236; Ak., Bd. V, p. 360).⁹ His conclusion therefore is that living systems cannot be explained mechanically – it will *never* be possible to find the universal concepts under which living systems can be subsumed – and will for ever escape objective knowledge.¹⁰

⁷Henri Atlan, personal communication.

⁸From a transcendental viewpoint, the blind spot is to be identified with what falls outside the scope of active determination or constitution by a knowing instance. As such, the blind spot is defined as a non-determined point that is accepted dogmatically.

⁹That is why natural laws are inadequate to account for the specific organisational unity of living systems, in as far as those laws fit within a Newtonian paradigm, that starts from universal concepts under which particular phenomena are subsumed. In the case of living systems, however, universal concepts cannot be supplied for, hence the need to start time and again from the particular, contingent, phenomena and to attempt to link universality to this type of contingency.

¹⁰Note that Kant here continues to treat classical mechanics as the ideal, prototypical example of objective knowledge, that is as such complete or at least completable in its account of non-living systems. Instead of introducing the idea of an incompleteness in

Secondly, as a mechanical, blind causality is out of the question in dealing with living systems, an alternative type of causality will have to be assumed, namely a circular causality in which the parts and the whole mutually determine each other. In this regard, Kant literally states that living systems are self-organisational systems: “(. . .) just as each part exists only *as a result* of all the rest, so we also think of each part as existing *for the sake of* others and for the whole, i.e. as an instrument (organ). (. . .) Only if a product meets that condition, and only because of this, will it be both an *organised* and *self-organising* being, which therefore can be called a *natural purpose*” (CJ, §65, p. 253; Ak., Bd. V, pp. 373–374, italics added). A living system is *organised* because nothing whatsoever is the result of chance, and it is *self-organising* because its essential development is to be understood wholly internally. In other words, Kant adopts an internalist viewpoint because he finds the arguments for an externalist solution non-receivable. Being a thinker of the Enlightenment, he does not allow for an explanation of living systems in terms of an external (divine) organizing principle.

Thirdly, even if Kant does not subscribe to an *external* organizing principle, he will neither objectify living systems in terms of an *internal* organizing principle. Instead, he proposes to give up mechanical explanations altogether, and to focus on an adequate account of living systems by respecting their essence in other manners, that is, by attempting to *understand* them instead of *explaining* them in mechanical terms. To that end, he states that it is necessary to act *as if* living systems are intrinsically purposive entities. In this, the “as if” captures the intrinsic impossibility to objectify this purposiveness on the basis of an internal organizing principle, as well as it expresses the need to transcend the excessive singularity and diversity of the living on the basis of a (subjective) regulatory principle.¹¹

any knowledge operation, whether it concerns living or non-living systems, Kant prefers to qualitatively distinguish living from non-living systems, and to conceive of living systems as falling outside the scope of mechanical explanation. In addition, his viewpoint explains why the third *Critique* deals as well with the beautiful and the sublime (first part), as with the intrinsic purposiveness of living systems (second part). Both escape objectification and thus require a treatment different from the one proposed in the first *Critique*.

¹¹Kant calls this principle the teleological principle, which is a *necessary and subjective* principle of reflective judgment. It is not a necessary and universally objective proposition that is *a priori* knowable. A teleological principle presents the difficulty of always being particular, being of the order of “There is purposiveness”, whereas a principle which would apply universally, would for example be “Every thing has its purpose”. Since teleological judgments are unable to *a priori* determine (construct) their object, they are unable to attain objective universality; their universality is a subjective one. Reflective judgment therefore requires a transcendental, subjective principle: “Hence judgment must assume, as an *a priori* principle for its own use, that what to human insight is contingent in the particular (empirical) natural laws does nevertheless contain a law-governed unity, unfathomable but still conceivable by us, in the combination of what is diverse in them to [form] an experience that is intrinsically [*an sich*] possible. Now when we find in such a combination a law-governed unity cognised by us as conforming to a necessary aim that we have (a need for understanding), but at the same time is in

Discussion

History of philosophy illustrates the attraction of Kant's solution. In particular the distinction between objective knowledge (in terms of mechanical explanations) and subjective, albeit necessary knowledge (in terms of the "as if"), as applicable respectively to systems that obey natural laws and systems that somehow complement and overturn these laws with their own "self-made laws," resonates in philosophy as well as in the sciences. It returns, for instance, more than a century later, in the form of the distinction between "Erklären" and "Verstehen," underlying another, purely disciplinary one, between natural and human sciences. Moreover, it prefigures many of the more recent discussions about the special status of philosophy of biology, in comparison to philosophy of physics (Hull, 1974, 1998, 2000, 2002). But let us not proceed too quickly, and examine more closely Kant's proposal which will appear to be, just like its 19th and 20th century reminiscences, not as straightforward as it may seem at first sight.

To begin with, a close reading reveals that there is in the third *Critique* an intimate mixture of epistemological and ontological claims.¹² Kant *presupposes* an internal circular organisation in living systems because otherwise he is incapable of making sense of their essentially purposive nature. In other words, his *wish* to understand living systems by respecting their purposive essence is determinative for the statements about their specific structure in terms of circular causality. Or still, Kant states that the parts and the whole *have* to determine each other, otherwise the Idea of the whole would not allow to determine the form and the relations between the parts, even if only as a principle of knowledge, and not as a cause.¹³

itself [*an sich*] contingent, then we present this unity as a purposiveness of objects (of nature, in this case). Hence, judgment which with respect to things under possible (yet to be discovered) empirical laws is merely reflective, must think of nature with regard to these laws according to a *principle of purposiveness* for our cognitive power; and that principle is then expressed in the above maxims of judgment. (. . .) Hence it is a subjective principle (maxim) of judgment." (CJ, V, p. 23; Ak., Bd. V, pp. 183–184, italics supplied).

¹²With regard to epistemological and ontological claims, it is clear that Kant has contributed to including the latter into the former, basically by subscribing to the idea that also objective knowledge is a matter of *perspective*, that is, the result of actively articulated choices and priorities on the part of the knowing subject. Within this viewpoint on objectivity, in which the object is actively constituted, ontological matters – in as far as they are identified with the thing in itself – can be seen as lying beyond any perspective, or even, as drawing the borders of what is objectively knowable. In 20th century philosophy of science, it has become less common to identify ontological issues with the thing in itself, but the idea of perspective and of something that lies beyond the perspective has continued to play a crucial role in distinguishing epistemological from ontological matters. In this regard, Wittgenstein's work can be mentioned, as well as Quine's quite ambiguous way of relating ontological issues to conceptual schemes on the one hand (what there is, is to be clarified by analysing conceptual schemes), and to something that transcends conceptuality as such on the other (conceptual schemes *say* what there is, what there *is*, is another matter) (Quine, 1953 [1948]).

¹³It is impossible to go into Kant's text here in detail. It has been shown elsewhere, however, on the basis of the *Critique of Judgment* and Kant's *Opus Postumum*, that Kant

Moreover, it is striking to see how Kant's conception of living systems is articulated as an answer to what he sees as an intrinsic *impossibility*, namely the impossibility to know objectively this type of system on the basis of universal concepts. The answer for him consists in the acknowledgment of the *need* to add something, a supplement of meaning on the part of the knowing subject, a supplement of knowing, so to speak, or a supplement of thinking. This supplement is required to make sense of those systems, to understand them or to communicate with them.¹⁴ The acknowledgment of this basic metaphysical gesture is of fundamental importance. On the one hand, it indicates that there is a need to add something *to the extent that* something escapes (classical) processes of objectification. On the other hand, it indicates that there is room for *choice* and potential engagement: in principle, the knowing instance can choose to consider living systems as purposive or not to the extent that it wishes to make sense of them. Therefore, Kant's account of living systems makes room, in a very specific way, for the issue of subjectivity, and more in particular for the necessity and universality related to subjectivity. Let us explain this in more detail.

Kant technically speaks of the *subjective necessity* of the teleological, regulatory principle in discussing the specific connection human beings have with living systems – “a necessary aim that we have (a need for understanding) (. . .) we *must* think of nature with regard to these laws according to a principle of purposiveness *for* our cognitive power” (CJ, V, p. 23; Ak., Bd. V, pp. 183–184, italics supplied). To him, it was beyond any doubt that a supplement, understood in terms of the “as if”, was absolutely required in an adequate understanding of living systems (even if he did not phrase his solution in terms of a supplement). He did consider the teleological principle as subjectively *necessary*, thus holding for any reasonable human being. He accepted this form of subjectivism *dogmatically*. This was so because any connection, or any communication with living systems would fail in the absence of this supplement. Beyond this, however, Kant makes it clear that the teleological principle has no universal application at the side of the *object* at issue, but does apply universally at the side of the *subject*. In other words, the teleological judgment cannot determine *a priori* its object, it cannot reach objective universality and is always particular, but it does have necessity *at the side of the subject*. However, this necessity is not psychological (or anthropological), because the subject can choose to deny the need for connecting with living systems. Subjective

himself was aware of the fact that the definition of self-organising systems is intricately linked to the ways of knowing them. For a detailed argument, see Van de Vijver (1999, 2004).

¹⁴The term “supplement of meaning” was inspired to us by A. Philonenko's introduction to the French translation of Kant's third Critique (Philonenko, 1984:12ff). Similar terms, such as “supplement of knowing” or “supplement of thinking” have been introduced in a quite different, e.g. psychoanalytical context, a.o. by J.P. Lebrun (1997: 80), to indicate similar issues, namely the need for a subject to add (his own) meaning as an answer to the encounter with the impossibility called the lack. The term “supplement”, or the phrase “to add meaning”, is somewhat unhappy, as it suggests a completion that is to be realised through this supplement. As will be shown further on, an alternative reading is possible, in which an answer to an impossibility is not seen in terms of a completion, but is instead connected to an operation of negation or selection.

necessity is different from empirical or factual necessity. The necessity of the regulatory principle is epistemological in a *transcendental* sense. The wish is no psychological wish but a wish inherent to subjectivity as such.¹⁵ So, Kant's more or less implicit and somewhat uncritically accepted convictions regarding living systems, can be fitted into a basic, transcendental, perspective. But the question here is: are things really similar in both *Critiques*? Is the Copernican revolution that Kant operates in the first *Critique* on all points comparable to the one operated in the third *Critique*?

This brings us to the core of the discussion. In our view, the third *Critique* contains the germs of an epistemology that is far more revolutionary than the first *Critique*. Moreover, it highlights the metaphysical shift involved in a transcendental approach much more clearly than the first *Critique* does. It is true that Kant does not elevate the need for a "supplement of meaning" into a philosophical topic or problem. He clearly settles into the safe home base of the regulatory use of the principles of knowledge. Beyond his personal viewpoint, however, the transcendental approach as articulated in the third *Critique* opens up the possibility and even the need to investigate the conditions of necessity or universality located at the side of the subject. More importantly, it requires an investigation of these conditions concomitantly with the conditions of necessity located at the side of the object. Indeed, Kant does so by intrinsically linking the need for a supplement of meaning to the impossibility of objectification in the case of living systems. In this way, the third *Critique* reveals, more clearly than, and also differently from the first, that knowledge is the result of a co-constitution, a co-determination between two terms. It involves on the one hand the knowing (observing) instance, with its choices, purposes and interests, and on the other hand the living (observed) system. Philonenko (1984: 12) stresses in this regard that Kant's viewpoint of living systems revolutionized the metaphysics of his time, by shifting from a substantialist to an *intersubjectivist* and *communicative* metaphysics. We believe Kant already did so in the first *Critique*, but less prominently and less radically so. Indeed, the first *Critique* examined the conditions of possibility related to objective knowledge, and considered these conditions as deducible objectively. It thereby diminished the weight of the knowing subject by reducing it to an

¹⁵It was only with Husserl's phenomenology that these basic distinctions acquired full clarity. Husserl (1952, 1975, 1984a,b) showed that transcendentalism does not only search for the conditions under which experience is to be arranged to arrive at objective knowledge, but also investigates the acts of the subject necessary to arrive at objective knowledge. In other words, not only the object falls under essential laws (i.e. the conditions to be fulfilled in order to be valid as an object of knowledge), but also the knowing subject falls under essential laws: what conditions does an entity have to fulfil to be valid *as a knowing subject*? According to Husserl, at the side of the subject, the conditions are twofold: psychological (real) and transcendental (ideal). The transcendental-ideal conditions pertain to subjectivity as such, not to a particular, factual subject. Subjectivity does not inevitably lead to contingency, the perspective is not entirely (but also) dependent upon the contingent make-up of the knower. Some constraints at the side of the subject are universally and necessarily valid. As a transcendental psychologist (categories are inborn), Kant failed to clearly make these distinctions. He thereby kept the transcendental status of subjectivity, as well as its required necessity and universality unclear and largely implicit. This was no longer the case in Husserl's phenomenology.

objectified system of *a priori* concepts and forms. The third *Critique*, however, in dealing with beauty and with living systems creates room for the idea that the knowing subject is in a more profound sense, *meaningfully*, engaged in the operation of connecting with living systems. In as far as the meaningful relation to living systems depends upon the *wish* to communicate with them, it could be said that the knowing subject participates in the purposive essence of living systems by adding his own directionality. Any knowledge of living systems bears witness to both forms of directionality or purposiveness, linked respectively to observer and observed. The “supplement of meaning” is therefore no longer only determined by the conditions of possibility of an experience with a view to its eventual objectification, as was the case in the *Critique of Pure Reason*. In contrast, the supplement of meaning is, in addition, a function of the modalities of relation the knowing subject can have or decides to have with the object of study.

So, the major importance of the third *Critique* in our opinion lies in revealing a crack in Kant’s philosophical system and in his philosophy of objective knowledge in particular. In a sense, the third *Critique* “de-dogmatises” the transcendental system by initiating the idea that the analysis of the conditions of possibility is itself grafted upon the initial postulates. The pureness of (blindly) postulating something, and examining its conditions of possibility afterwards, as if the movement of postulating itself had no impact on the analysis, as if the postulating instance itself had no impact on the analysis, appears to be untenable in the case of living systems. Hence, the need for an explicit relational account of the supplements of meaning, that reveals, in the same movement, the ways in which certain systems are understandable *to us*. In this way, a transcendental theory, a theory of conditions of possibility, unfolds itself as a theory of engagement.¹⁶

4. AN ACTUALISED TRANSCENDENTAL VIEWPOINT IN PHILOSOPHY OF BIOLOGY

Today, a more critical assessment and explication of the choices and perspectives, e.g. an elaborate theory of engagement, may lead to a more profound exploration of the transcendental space Kant initiated with regard to living systems. It still is a space that obeys what Philonenko has called a “logic of meaning” (1984: 12) and it does acknowledge the potential value of a metaphysics of intersubjectivity and communication, in comparison to a substantialist metaphysics. But it is a space in which conditions of possibility are no longer set apart as untouchable and untouched products of a conscious or transcendental subject. In contrast, the exploration of the conditions of possibility is seen as instantiating the engagement of a knowing instance with the phenomena under study. Exploring this space is, in our view, one of the major goals of a transcendental viewpoint in philosophy of biology.

Within such a framework, two intuitions play a crucial role.

Firstly, whereas Kant saw the resistance of living systems to processes of objectification as an intrinsic obstacle to be overcome, here it is taken as the means *par excellence* on the basis of which living systems can and will reveal their specificity and uniqueness. In this regard, a precise articulation of this resistance is required, in close connection with,

¹⁶In his *Opus Postumum*, Kant will bring precisely on this point a further elaboration in terms of the physiology of the body. For a discussion, see Van de Vijver (1999, 2004).

or in parallel with, the means of connection (the supplements of meaning) developed by a knowing instance.

Secondly, the analysis of the types of engagement of a knowing instance can be undertaken in a relevant way on the basis of the patterns of *interaction* between the systems under study and the knowing instance, and this *at various levels of organisation*. Hereby, a metaphysics of communication and intersubjectivity is firstly understood as a metaphysics of interaction, which does not necessarily carry along the idea of a unique centre of interactive practices (classically, the human subject), but instead opens up the perspective of a multiplicity of, temporary and localized, centres and levels of activity where engagement is ever again initiated. Research in philosophy of biology developed from within an explicit transcendental frame-contributes to the articulation of these issues. A very important issue in this regard is the one of structuralism.

The Current Challenge of Structure: To Embed Reflection in Stratified Interactive Practices

In philosophy of biology, attempts to overcome the unhappy marriage between atomism and holism are most frequently developed from within a structural viewpoint. In this, the idea of structure or organisation can be seen to capture the ways in which parts specifically function within the constraining context of a broader whole. Even if various mathematical and informational techniques have been developed over the past decennia (cf. Goodwin, 1990; Petitot, 1985, 1991), it cannot be said that they turned the concept of structure into a genuine explanatory concept. Actually, Waddington's (1947) viewpoint appears to be still correct, stating that there has been a tendency "either to regard *organisation* as one of the irreducible fundamental bases of all biology, or to invoke it, as though it were a well-defined concept, to fill up any awkward gaps in a theoretical structure. (...) I think it will be found that the scope of the notion, *as an explanatory principle*, is not so great as has sometimes been suggested. On the other hand, it does provide the key to *an extremely valuable method of thought*" (Waddington, 1947: 143, italics added).

Waddington does not phrase the issue of structure or organisation in transcendental terms, but his account does nevertheless indicate the transcendental status of the concept. Indeed, a structure is not something that can be objectified (explanatory principle), it is something that needs to be *presupposed* before any objectification. Structure provides the perspective, and hence the method of thought, as Waddington had it, within which the functioning of parts and wholes is made coherent and understandable. Even if it is informed by factuality, structure always also precedes factuality. This is why Derrida can state that "a certain form of structuralism has always been the most spontaneous move of philosophy" (Derrida, 1967: 237, our translation). Indeed, the structural assumption is indicative of a "transcendence" of pure factuality on the basis of reflection. In the structural move, the putting between brackets of the naturally given, to use Husserlean terms, is automatically implied.

However, the idea that structuralism is the most spontaneous move of philosophy has until now remained deeply faithful to the idea that the human subject, as reflectively engaged and intentionally directed upon its research object, is the unique centre of all

knowledge. Moreover, the human subject, in its reflexive activity, most often remains totally disembodied and materially unconnected or unengaged with regard to its research object. Therefore, a more integrated view on reflection and knowledge is required, applicable to all living systems on the one hand, and faithful to the embodied interactive practices of those systems on the other hand. This does not mean that the specific place of the knowing subject needs to be abandoned. It means that it needs to be articulated in a very detailed way in connection with other knowing instances (e.g. other living systems or organisational layers). This involves an analysis of the ways in which the human subject is determined (constrained) by other instances, while determining (constraining) other instances in its turn. So, the typically transcendental idea of reflection, understood in terms of conditions of possibility, needs to be *stratified* and intimately connected to *interactive* practices of knowing instances.

Research in transcendental philosophy of biology therefore involves a detailed study of the following issues:

Firstly, it asks for an articulate theory of organisational layers, whereby the specificity of each organisational layer is understood in terms of (i) the specific connectivity or *cohesion* between the elements (Kant's circular causality),¹⁷ (ii) the specific patterns of *interaction* this cohesive organisation implies between the elements, (iii) the specific patterns of interaction of one organisational layer in relation to other organisational layers. Current theories of complexly organized dynamical systems have the ambition to fulfil precisely this task.¹⁸ Their theoretical attractiveness lies in the fact that structures are considered as highly constrained and constraining phenomena and this constraining impact is understood in an interactive, energetically based way (cf. Christensen and Hooker, 1998a,b, 2000a,b; Collier and Hooker, 1999; Collier, 2000, 2003).

Secondly, the development of a general theory of *functionality*, intimately related to the organisational or structural viewpoint just sketched, is required. Indeed, as structures are mutually constraining, enabling, and interpreting contexts, the challenge is to understand their mutually constructed and maintained integrity in terms of *stabilization* and destabilization. This is a functional issue. Within a complex dynamical viewpoint, the idea is that organisational levels or contexts are not statically identifiable on the basis of fixed constituent components. They emerge within surrounding levels and systems, on the basis of local interactions and in the absence of a "central directing agency." The construction and maintenance of integrity therefore amounts to an interpretation of surrounding levels. In other words, the emergence of a living system, by the very fact of constructing and maintaining an integrity in between other organisational levels

¹⁷Cohesion is "the closure of the causal relations among the dynamical parts of a dynamical particular that determine its resistance to external and internal fluctuations that might disrupt its integrity. (. . .) This determines a *cohesion profile* that gives the (probabilistic) conditions under which a thing will both retain and lose its integrity, determining its boundaries under a range of conditions. We thus describe cohesion as the "dividing glue" of dynamical entities." (Collier, 2004: 4).

¹⁸Even if these ambitions are realised in a highly abstract and general way today. For a discussion, see Van de Vijver *et al.* (2003)

(physical, chemical, social, psychological, . . .), implies an interpretation of these levels. Forcing a bit upon the meaning of the term, it might be said that the biological level constitutes in itself a *reflection* on the chemical and the physical levels. Biological systems in particular actively constitute and interpret their environment, including the underlying organisational layers they are constituted of. It may be unusual to think in this way about reflection and interpretation, but it has the advantage to create the possibility of (temporarily and locally) de-dogmatising the central place and function of the human knower by making him an integrative part of interactive practices of living systems at large.

Thirdly, a crucial issue for a transcendental philosophy of biology is *integrity*. Biological systems actively construct and maintain their boundaries, and distinguish inside from outside on the basis of their cohesive organisation. The existence of these boundaries implies that they can interpret their surroundings. To interpret, to give meaning, implies a *selection*, and therefore a *negation*, of certain aspects of the stimuli given in the interaction with the surroundings. Therefore, acquiring an integrity involves the capacity to select certain aspects of the stimuli (and this at various levels), and to negate others. It can be said that it is this selective capacity, this capacity to negate certain aspects of the stimuli, that is indicative of the fact that an actively interpreting instance is at work. More radically, *the capacity to negate or to select could be seen as constitutive for the integrity of the biological system* (cf. Ganti, 2003). This idea has important methodological consequences. It implies that the relation between a living system and its environment can be conceived of as a relation whereby something gets shape (a living system) on the basis of the negation of something else. In our opinion, this issue can be connected to the previously discussed issue of the resistance of living systems to attempts of objectification. Indeed, Kant stated that a supplement of meaning was required to make sense of living systems, and agreed that this supplement was indicative of the lack of objectification. Similarly, it can be said that the interactions on the basis of which living systems constitute themselves, are the answer to, or are even co-constructive with, the various negations and selections operated on the encountered stimuli. In this way, it can be said that living systems are supplements of meaning in themselves.

Sketch of an Epigenetic Implementation

It is evident that these ideas remain quite speculative at this moment and need further investigation. However, the connection with very detailed biological questions is not so difficult to make. For instance, current research in *epigenetics*, involving the issue of genetic determinism, is a clear instantiation of the problems just sketched (cf. Van Speybroeck *et al.*, 2002a). Molecular research today more and more clearly illustrates the shortcomings of a viewpoint in which the genes, or the genome, are considered as central directing agents, fitting into a picture of linear causality. The alternative frames of interpretation the currently produced data ask for, acknowledge that a linear causal picture is out of date and unfitted to capture the complex behaviour of biological systems (cf. Van de Vijver *et al.*, 2002; Van Speybroeck, 2000). More than ever, molecular biology witnesses of a tension between micro-structural and macro-structural attempts to objectify living systems. Most of the answers nowadays produced (i) in one way or

the other include the idea of circular causality (“systems” biology),¹⁹ (ii) make use of techniques and theories that are part of complexity thinking, and (iii) acknowledge the need for explicitly taking into account various organisational levels that have a mutually constraining effect (cf. Van de Vijver *et al.*, 2003).

There is no doubt that detailed biological research issues can help articulating an actual transcendental philosophy of biology, that is quite different from Kant’s (and Husserl’s) idea of transcendental philosophy. Indeed, it could contribute to a more explicit and integrated account of reflection and objectivity. Moreover, it might give “flesh” to the idea of reflection by materially embodying it in the interactive processes at work at various organisational layers.

5. CONCLUSION

In dealing with living systems, Kant started from the impossibility for the human subject to know objectively living systems on the basis of universal concepts. Living systems intrinsically resist objectification in that they cannot be subsumed under universal concepts. As an answer, Kant opened up the perspective of the need for a supplement of meaning and thereby understood living systems in teleological terms. His viewpoint was universalising, to the extent that it left the status of the supplement of meaning unquestioned by linking it to the universal reason of the human observer. Objective knowledge as exemplified in classical mechanics was the background of his reasoning. It functioned as the ideal point of reference that was opposed in a dichotomous way to the teleological frame of thinking, in which living systems cannot and will never be objectified.

This article has shown that it is possible to subscribe to the idea of living systems resisting objectification, while critically departing from Kant’s (epistemological and metaphysical) dichotomy between teleological and mechanical reasonings. Instead of placing the conception of living systems against the background of an ideal of unattainable objective knowledge, as Kant did, it becomes possible to conceive of living (including cognitive human) systems on the basis of a different, interactionist and dynamical structuralist, metaphysics and epistemology. The latter conceives of living systems on the basis of a continuous co-determination between two terms, the observing and the observed, the interpreter and the interpreted. Both terms are initially undifferentiated, but are progressively differentiated as the process goes on. The general idea is that there is a dialectics between the means of connection developed by a knowing instance and the resistance of something that is identified as an object, quite imprecisely in the beginning, and less vaguely further on in the process. The attitude is one of exploring the co-constitution of (living) things that are initially seen to escape mechanical, objective knowledge on the one hand, and the knowing instance, with its means of connection and its supplements of meaning on the other hand.

¹⁹Even if it is unclear at this moment in how far current systems biology genuinely purports to account for the “system” character of living beings, or on the contrary presents a fashionable discourse in which the “system” terminology hides classical reductionistic strategies.

This change in metaphysics and in epistemology is not without consequences. Firstly, from within this metaphysical viewpoint, mechanical thinking itself is to be seen as determined from within a particular perspective, it is itself indicative of a specific access, which might be adequate for certain types of systems, but not necessarily for all. Objectivity as based in mechanical thinking is no longer the ideal point of attraction, as was the case with Kant. In contrast, mechanical thinking and its related universality become a matter of perspective, albeit a quite special one. They are the stabilized, “invariant,” products of materially embodied and locally situated engagements (cf. Kolen, 2004). Secondly, from within the viewpoint proposed here, the aim of philosophy of science, and hence also of philosophy of biology, is to contribute to a multiplication, a clarification and an integration of possible and relevant perspectives, exploring in this way the concomitant constitution of the object and the knowing instance. Reflexive activity of philosophy of science does not have in the first place a justificatory or synthetic function with regard to the sciences. It has a function of opening perspectives, i.e. a liberating function with regard to the (practical and theoretical) evidences at play in the sciences. In this way, philosophy of science can clarify the perspectives from within which the sciences are currently working, with the aim of contributing to a clarification of the ontological, methodological and epistemological assumptions at work. This implies a basic shift in comparison to Kant’s viewpoint. For Kant, philosophy contributes to the clarification of the conditionality related to objective knowledge, a knowledge that was to him evidently given. For Husserl, philosophy also contributes to the clarification of the conditionality linked to the transcendental, conscious subject, which was equally evidently given and present to itself. Today, philosophy can contribute to a clarification of conditionality itself, by multiplying and localising the perspectives and by clarifying the priorities and choices linked to each of them. It can even contribute to their integration, in as far as it requires an informed, explicit and non-dogmatic analysis of the involved conditionalities.

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