Life after Kant: Natural purposes and the autopoietic foundations of biological individuality

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**Abstract.** This paper proposes a basic revision of the understanding of teleology in biologi- cal sciences. Since Kant, it has become customary to view purposiveness in organisms as a bias added by the observer; the recent notion of teleonomy expresses well this “as-if” char- acter of natural purposes. In recent developments in science, however, notions such as self- organization (or complex systems) and the autopoiesis viewpoint, have displaced emergence and circular self-production as central features of life. Contrary to an often superficial read- ing, Kant gives a multi-faceted account of the living, and anticipates this modern reading of the organism, even introducing the term “self-organization” for the first time. Our re-reading of Kant in this light is strengthened by a group of philosophers of biology, with Hans Jonas as the central figure, who put back on center stage an organism-centered view of the living, an autonomous center of concern capable of providing an interior perspective. Thus, what is present *in nuce* in Kant, finds a convergent development from this current of philosophy of biology and the scientific ideas around autopoeisis, two independent but parallel develop- ments culminating in the 1970s. Instead of viewing meaning or value as artifacts or illusions, both agree on a new understanding of a form of *immanent teleology* as truly biological fea- tures, inevitably intertwined with the self-establishment of an identity which is the living process.

A clash of doctrines is not a disaster, it is an opportunity.

*A.N. Whitehead*

# Introduction

* 1. *The Kantian heritage*

This article is an immodest reformulation of a central issue in the philosophy of biology: the topic of natural purposes or teleology. The motivation for this attempt is that we perceive a great need to bring to the fore a remarkable and recent convergence between the re-awakening of the philosophical discussion concerning natural purposes (with Hans Jonas as the central figure), and an independent but convergent stream of thought concerning biological individu-

ality and the organism (with the autopoiesis school as the central figure).1 These two streams reinforce and extend each other to such an extent that we boldly advance the conclusion that, after two centuries, we can move *beyond* the unstable position set out by Kant in the *Critique of Judgement*, and therefore provide a fresh re-understanding of natural purpose and living individuality. It has become a common place in modern biology to shun teleological think- ing or to reduce it to mere methodological fiction, then called teleonomy (Pittendrigh 1958). The overwhelming preference is to explain biological facts as the statistical results of natural selection which *post factum* give the sem- blance of goal-directedness (Dawkins 1987). Purpose-directed structures or events are only allowed in an “as-if” mode; a teleological explanation can always be substituted by a (teleonomic) factual description (Nagel 1977). Nevertheless, talk about purpose or function, even though regarded as “as if” descriptions, is pervasive and persistent in Biology. The least that one can say is that there is a certain paradoxality concerning the role of teleology in bio- logical matters – a paradoxality, whose solution is central to the understand- ing of biological science. In spite of being shunned, “Nature’s purposes is arguably the most important foundational issue in the philosophy of biology” (Allen et al. 1998, p. 2). The answer to the question of what status teleology should have in biology decides about the character of our whole theory of

animate nature.

The subject has, of course, a long history. The Greeks experienced nature as an ever-present horizon, most clearly set in Aristotle’s dictum: the final cause is a necessary precondition for the mechanical cause. But in medieval times the idea of finality radically shifted to divine will and design, the source of all meaning and purpose. The enlightenment opposed to that the even more radi- cal position of human mind as the measure of things, where nature is only seen as mere object for the human subject. Recent times have shifted to post-mod- ern views on nature as a purely historical locus, contingent and relative. How- ever, as we will argue in this paper, in sharp contrast to such views, there is a live current in modern thinking that advances a re-discovery of teleological thinking, aligning with the marginal but steady need for many biologists to take teleology seriously, that is persistent from the XIXth century on up to the present.2

Now, any discussion about teleology in science and western thinking alto- gether is inescapably grounded on the prodigious basis provided by Immanuel Kant. The fundamental twist in Kant’s analysis is to postulate that the laws governing organic reality were a bias added by the limitation of our intellect. He insisted that

the innate reasoning categories of mechanistic causality that humans appropriately bring to their analysis of *nonliving* reality were incapable of doing justice to the activities of the living realm. To make sense of life as a phenomenon, human judgement was forced to postulate . . . an additional principle of teleological causality. (Harrington 1996, p. 5).

For Kant, the organism could not be understood in purely mechanistic terms. But this did not imply that it would definitely not work in those terms: Kant thought that a *judgement* was simply not possible for the human mind (Plessner 1982). It is this latter point that still provokes a misunderstanding by many readers: Kant neither ruled out mechanism, nor did he declare it to be “the real reality” beneath the phenomena. He was only completely pessimistic about the possibility that organic life could be explained in purely mechanistic terms

– and hence did not believe in the possibility that once “a Newton of the Grassblade” could deliver a reductionist *and* complete account of the organic world (Cornell 1986, p. 408). Kant thus makes

. . . both the mechanical and teleological principles with respect to organism mere max- ims of inquiry of comparable, but not total, explanatory power. We simply do not know what, if anything, is “behind” life, “causing” its basic purposive quality in some ultimate sense (Plessner 1982, p. 247).3

In brief, Kant introduced an unstable middle position which is a central con- cern of this paper as an attempt for resolution. Being an adherent to New- ton-style physics, he nonetheless reserved for the organism another kind of thinking: the living was to be conceived in terms of *natural* purposes. This notion explicitly touches the self-organizing properties of living matter: it can be argued that Kant himself introduced the term “self-organization” in its modern sense into biological theory. Nonetheless the received view (in Neo- Kantism, but especially also in the Anglo-Saxon philosophical tradition) is a strong reductionism that allowed discourse about organisms “as if” they be- have teleologically, but sees them in reality as strictly mechanistic. It is this reading that has been most influential today, which enthrones Kant as a fa- ther of reductionist biology. In this paper we will argue, along with a number of modern writers, that Kant in his *Critique of Judgement* (referred to as KdU hereinafter) developed the possibility of a third way between a strong teleol- ogy and a brute materialism. Our main contribution here is to advance a reso- lution of this unstable position into a fully mature re-understanding on the basis of modern developments of biological research and thinking, to which we now will turn.

* 1. *Teleology and organism in current biology*

The term teleology has remained quite ambiguous in biological science since Kant’s time, and has become even more so after Darwin. Many current prob- lems stem from a mixing up of two main understandings of the term. Broadly, we can discern an *external* seemingly purposeful design, which was Darwin’s main concern (Lennox 1993), and which he conceptualized as the result of contingency and natural selection (Löw 1980; Zumbach 1984).4 *Intrinsic* tel- eology on the contrary is concerned with the (Aristotelian) internal purposes immanent to the living which was *Kant’s* main concern (Ayala 1970). It is also that kind of purposefulness and goal-directness that can account for every- body’s naive intuition: we strive to go on, to develop, to keep ourselves in a dynamical balance (Spaemann and Löw 1981). For Aristotle, the *ego ago propter finem*, the structure of one’s own movement according to a *telos*, can be understood from the paradigmatic case of the organism. Because of this original nature, the experienced telos is the paradigm of an immediate expe- rience as such. For Aristotle, the causal, mechanical world is an abstraction drawn from the most important *causa finalis* (Löw 1980).

In our present scientific world, following a received and narrow interpre- tation of Kant, it is just the opposite: the teleological behavior of living be- ings is an illusion, an appearance hiding the underlying mechanism. In current biology, the situation is quite ambivalent: On the one hand for many biolo- gists any notion of teleology appears as in blunt opposition to the central dogma of Darwinism. On the other hand, recent work has developed an account for biological form and the living in terms of self-organization and morphologi- cal laws in frank opposition to the adaptationist program.5 Here we will be concerned with the paradigm of self-organization of the living as autopoiesis which is part and parcel of modern criticism of the strictly adaptationist tra- dition wherein there cannot be any place for teleology except in its teleonomic sense. In the following we will exploit this tension within modern biology to surmount the main difficulties concerning the role of teleological explanations in biology.

The role of teleology not only has to be evaluated anew because of the obviously persistent practice in biology to invoke teleological explanations while at the same time denying their consequences. Hidden in this lack of clarity lie central philosophical problems of biology that have shown to be hardly solvable in the still dominant style of anti-teleological, neo-Darwinist conceptions. In spite of all technical success of reductionist biological think- ing the central question of biology remains an open problem (Mathews 1992),

and reductionist accounts are still unable to define in precise terms the living process” (Kull 1999).

This situation stems from the systematic tendency to marginalize the real, living individual which includes organisms such as the *lived* body (a *Leib*, not only a *Körper*), as a unitary locus capable of experience. In other words, if there is any systematic absence in the thinking about modern biology, it is a fully developed notion of an *organism*, instead of a an array of genetic and physiological processes whose unity is left unaccounted for: “The organism as a real entity, existing in its own right, has virtually no place in contempo- rary biological theory” (Webster and Goodwin 1982, p. 16). This absence has been underlined for decades from several sides. Especially under attack have been the current paradigm’s naive genetic objectivism, its inability to account for many problems of development, but also its failure to explain phenomena of biological diversity, inventing *ad hoc* hypotheses instead. The intention of this paper is not to address these broad issues in their complexity; the few points provided above will have to suffice.6

We will argue that without paying full attention to organismic complexity, which includes the organism in its most basic lived dimensions, modern biol- ogy is bound to miss central insights for understanding life, and it will suffer from the resulting paradoxes (Bedau 1996). (For instance in “defining” life by an encyclopedic listing of qualities living systems usually have). As Spaemann and Löw (1981, p. 139) observe, the challenge that the living or- ganism presents to the rational interest in a unity of nature and experience is seen by many authors as a kind of scandal that needs to be banished. One of its most flagrant manifestations is the way this echoes into the current debates concerning the mind-body problem, yet another important dimension that will not concern us here.7

In contrast to Kant we are no longer dependent only on speculations con- cerning self-organization in nature. These recent advances, however, have been mostly ignored by those philosophers who have revived the question of tel- eology. In the following we want to re-take from an empirical standpoint the arguments Kant had pursued to explain natural purposes. We will propose a reading of Kant’s notion of teleology that explicitly rejects a narrow interpreta- tion based on the *Critique of Pure Reason*. Rather, we will argue for an “intrin- sic teleology” arising from biological autonomy and biological individuality (Varela 1979).

This line of argument, we have said, dovetails with an organismic philoso- phy, most remarkably developed by Hans Jonas at about the same time. Jonas proposed a “pre-autopoietic” concept of organism already in the early 1950s

and in an astonishing way precedes and philosophically extends the findings of autopoiesis. Jonas, in speaking of “necessity” and “freedom” as the basic features (and paradoxes) of organic life in its minimal form, offers a reading of the problem of causality and teleology that can contribute much to the cru- cial question in how far the organism is the creator of a “real teleology” – a notion implied in the concept of autopoiesis. And because autopoiesis is an empirical theory of life, the minimal organism thus provides the door – con- tra Kant – to a non-reductive yet “hard” explanation of the living. Both lines of argument lead to the conclusions that a notion of *intrinsic teleology* is pos- sible.

Thus, our way of naturalizing teleology will be just the opposite of the clas- sical reductionist approach made by certain authors, who attempt to solve the problem by transforming teleological statements in a simple ”naturalistic” description (Nagel 1977; see Bedau 1992 for criticism). We think, in contrast, that an integration of teleological descriptions can only be possible by taking them seriously: by accepting that *organisms are subjects having purposes according to values encountered in the making of their living*. This means clearly to reintroduce value and subjectivity as indispensable organic phenom- ena, a theory of the organism as the dynamics of establishing an identity and, hence, as a process of creating a materially embodied, individual perspective.

* 1. *Outline of the paper*

This introduction has laid out the basis on which we can now examine its parts in further detail. The paper unfolds in three main sections:

In Part II we recapitulate in some detail the principal thesis in “the most neglected sector of Kant’s Critical Philosophy [that] is his collection of re- marks about biological phenomena in the second part of the *Critique of Judge- ment*, the Critique of Teleological Judgement” (Zumbach 1984). We emphasize the many ways in which the text has strong non-reductionist tendencies which were the basis for a continuous stream in German philosophy of biology, where it inspired partly romantic natural philosophy (Löw 1980), and also contrib- uted greatly to the program of organismic biology (the so-called German school of teleomechanism) with towering protagonists such as Johannes Müller and Karl Ernst von Baer (Lenoir 1982).

In Part III we take up the challenges left open by Kant and project them into two concurrent trends in modern thinking developed independently, roughly in the period 1950–1970. On the one hand, we focus on a cluster of mostly German thinkers leading to a revival of the philosophy of nature and

of the question of teleology as its central knot. Although multiple, we delve mostly on the work of Hans Jonas as the most emblematic and profound. On the other hand, we focus on a school thought about the living as a process of establishing an identity based on biological research rather than philosophy, with the emblematic notion of autopoiesis as the characterization of the liv- ing. (See References for a full bibliography of these two trends).

Part IV draws the inevitable conclusion that there is enough progress in our understanding between Kant’s time and the recent trends in science to advance a way out of the unstable aporias identified by Kant, and that a renewed view of what can be called *intrinsic teleology* can be defended.

# Kant between ”transcendental agnosticism” and irreducible teleology

* 1. *The context for Kant’s critique of teleological judgment*

Kant’s stance on some essential issues, as is well known, is multifaceted and often ambivalent, and may depend on the chosen quotations (Löw 1980). This is partly why there have been a corresponding multiplicity of interpretations of his work, giving rise to schools. In Germany, for instance, Kant has been explicitly claimed as philosophical root by both the German romantic *Naturphilosophie* and the strictly physicalist program of Helmholtz and oth- ers (Spaemann and Löw 1981). So ironically Kant has provided inspiration to conceptual opposites in order to accomplish what Kant himself had thought to be an impossible task: to give an objective account of the organic world. Of these competing interpretations of the Kantian heritage it is the reductionist- leaning reading that has been most influential in the Anglo-Saxon world (Löw 1980).

Indeed, Kant himself was very focused on how the transcendental subject and the world are related. He attempted a number of approaches and thus a movement is clearly visible in the course of his writings that partly accounts as the source of his ambivalence. Therefore it is necessary to view the Kantian philosophy not as a hieratic monument but rather as a work in progress, start- ing from the *Theorie des Himmels* as a first major work, and ending with his remarks in the *Opus Posthumum*. As is apparent in the unfinished building blocks of this last work, Kant’s struggle is centered around an ever more deep- ening of the question how external apperception is possible in a thinking sub- ject, starting from the pure scientific experience of his pre-critical phase and the *Kritik der reinen Vernunft*, then moving on to aesthetic experience and with

that, arriving at the analysis of the organic world. Because man as a thinking subject is also a reality of the external world, hence part of nature, the critical work had not been exhausted with the first two critiques.

Now, in his initial phases, nature for Kant was an objective system of physico-mathematical relationships construed by the subjectively necessary apperception of space and time and the categories of pure reason. It is the structure of reason that forces experience to be of a Newtonian kind of world. There are no subjects apart from the transcendental unity of self-conscious- ness – the “I think that must be able to accompany all my representations” (KrV, B, p. 132).8 Hence there are no embodied living beings in any irreduc- ible sense. Kant admits that a breaking down of organic entities to their un- derlying inorganic basic components is certainly possible, and even if not yet accessible, should be attempted (KrV, B, p. 555).

It was Kant’s conviction, then, that all processes in nature could be explained in terms of mechanical causality. Final phenomena, on the contrary, only could be viewed as processes taking place in the interpreting human consciousness and hence could be dismissed from a true picture of nature (Löw 1980, p. 285)

– for many this view is still valid today (see, e.g., Grünewald 1996). A sci- ence of nature could only be called so ”if the laws of nature that are its base are known (*erkannt*) *apriori* and are not just laws of experience” (*Akad.-A*. IV, p. 468). The corresponding idea of an objective nature thus is a system of purely mathematical relationships. Biology therefore, as a science, is only valid insofar as it is reducible to strictly causal laws.

But this reductionism, as Kant already knew, had a weak point: Not every- thing could be so neatly subsumed under the apriori principles of pure rea- son. This fact apparently bothered Kant more than many of his followers, who would stop within the theoretical frame of the *Critique of Pure Reason*. But for Kant himself it was especially the empirical and not apriori character of biology that posed a grave problem, because “its first principles must ulti- mately be found in experience. It must assume that certain bodies are organ- ized and the particular form of their organization must be taken as given in experience” (Lenoir 1982, p. 29).

In fact, Kant had to fight on two fronts: he was defending his view against

*l’homme machine* as well as against the teleology of the Wolffians (Löw 1980,

p. 126). This hesitating on an intermediate position is already visible in his early critical phase: Since for making possible causal explanations inside the world, Kant, as a frame of his idea, had to postulate the whole world as an idea of pure reason. Kant had to anchor causality in a purely intelligible world of mathematical relationships. He had to found his supposition about causal- ity in a theory of the world as a whole. Concerning biology, this can no longer

be overseen: In organisms the faculty of judgement is confronted with a host of such “wholes”, so that the “integrating force of the idea of the world re- turns in the idea of purpose on a regional level in the *Critique of Judgement*” (Spaemann and Löw 1981, p. 134).

* 1. *Self-organization and intrinsic teleology*

The problem is that the empirical manifold of organic nature apparently can- not be founded on *a priori* knowledge.9 Because the faculty of reason is only able to construct theories in the a priori mode, biology cannot be constructed, it must necessarily transcend the sole capacity of reason:

According to the position developed by Kant in the *Kritik der Urteilskraft*, therefore, bi- ology as a science must have a completely different character from physics. Biology must always be an empirical science. Its first principles must ultimately be found in experience. (Lenoir 1982, p. 26 passim)

This is consistent with the idea that there are “concepts embedded in our bio- logical conceptual scheme – concepts of design – which cannot be constructed from the conceptual resources of physics” (Zumbach 1984. p. 89). To deal with this empirical manifold Kant analyzed a faculty of reason that up to this point he had not paid so much attention to: the faculty of judgement.

To reconcile the faculty of judgement with the laws of nature given apriori, Kant was moved to introduce an *ad hoc* correspondence of world and reason by “happy chance” (KdU, Introduction, 184) to guarantee the fitting of em- pirical experience and categories of reason. To keep the coherence of his tran- scendental system, this chance correspondence was nonetheless given the status of an apriori principle (*Akad.-A*. XX, p. 210). The one commanding feature of this faculty of judgement concerning nature was that it viewed na- ture as *teleological*. As an apriori principle nature has to be thought *as if* it is made with the aspect of purpose.10

Now there are several levels on which finality can be seen. Living nature can be viewed under the aspect of “objective, material, outward purposiveness”, that is, “relative finality”, or as “objective, material, inward”, that is, ”abso- lute purposiveness.” The former deals with the theological question of useful relations of natural things to one another as they have been made by God, e.g., questions of the sort if rivers have been created to serve man for navigation. Kant massively rejects explanations current at that time based on relative purposiveness: This is to interpret natural objects simply as means – and to do that would only be possible if the goal these means are serving for had the

character of an objective purpose of nature, a notion strictly refuted by Kant’s transcendental approach (Spaemann and Löw 1981).

So Kant’s interest concerning teleological explanations touches *intrinsic*, and not relative purposiveness. This conception is not without a certain reso- nance with an Aristotelian tradition. Nonetheless, it was Kant who elaborated for the first time the similarity of this *intrinsic teleology with a modern un- derstanding of self-organization*. For Kant things that organize themselves are

– in opposition to purposes of nature – called *natural purposes*. These are the organisms where the Kantian notion of intrinsic teleology has its original place. Two issues are closely related here: First, the organism’s structure is contin- gent in the highest degree; we cannot understand the necessity of their exist- ence by a priori principles. Second, they are nonetheless related to a principle of reason – and this principle now is their teleological understanding. Natural purposes – organisms – are goal-directed in the following sense: “A thing ex- ists as a natural purpose *if it is* (though in a double sense) *both cause and effect of itself*” (KdU § 64, 370, Kant’s emphasis). This interrelation of means and goals describes a circular situation: parts of an organism are there through the exist- ence of the whole and the whole is responsible for the parts. But not only this: there is also a processual, dynamical aspect already implicit, when Kant says:

In such a product of nature every part, as existing through all other parts, is also thought as existing for the sake of the others and that of the whole, i.e. as a tool (organ); . . . an organ bringing forth the other parts (and hence everyone bringing forth one another). . .; and only then and because of this such a product as an *organized* and *self-organizing* be- ing can be called a *natural purpose*. (KdU § 65, 373, Kant’s emphasis).

Because of this self-organizing circularity, which will be our leading thread in its relation to the autopoietic interpretation of the living in what follows, all relations of cause and effect are also relations of means and purpose. Be- ing a natural purpose then, as an interrelated totality of means and goals, is strictly intrinsic to the organism – it is in fact the only way we can view it, and by the way, just the way we normally, *prima facie* and intuitively, view the living.

Thus what is important for Kant exceeds by far what Zumbach (1984, p.

129) means, when he writes:

Biology is autonomous because we *explain* the presence and arrangement of biological parts in functional terms. This introduces a mode of explanation into biology which is generally reserved for explaining the features of artifacts.

This is less the character of Kant’s position than it is that which is meant to- day by teleonomy. How organisms work is just *not* the way artifacts work:

the latter always point to an external purpose they are made or used for, the former *are* purposes with the goal of keeping existent by organizing them- selves. We will soon see how far this distinction between artifact and organ- ism as a principle of reason can be substituted by a material one in the work of Jonas.

* 1. *Causality and teleology*

Kant’s way to look at organisms, however, is also transcendental: the teleol- ogy we observe in natural purposes is not necessarily the mode in which they really exist but merely our way to view them. Contrarily to the teleonomy interpretation (regard organisms as goal-oriented as a heuristic until we find the adequate causal explanation), Kant leaves no doubt in KdU that our hu- man minds must necessarily explain organisms in teleologic terms; we are intrinsically limited (see Merleau-Ponty 1994, p. 45). This is the case because in the empirical domain we must use the faculty of reflective judgement that searches, for each particular, the general law (or maxim) under which it is subsumed (KdU, § 69, 385). Kant postulates that

certain products of nature, according to the particular structure of our reason, *must* be *viewed by us* as created deliberate and with purpose; without demanding, though, that there really be a particular cause that has the idea of a purpose to its defining ground. . . (KdU

§ 77, 405/6; Kant’s emphasis).

So now, what is the relationship between finality and causality in Kant? Ob- viously, in biology, organisms should be explained in mechanical terms as long as this does work; only after that fails should one invoke teleology. Thus there is a competition between the principle of causality and the maxim of reflec- tive teleology: For Kant teleological and causal statements are two *kinds* of judgments about things, always concerning the thing-as-such, approached in two different ways without being finally exhausted. This is what is called the Kantian *teleomechanism*, giving birth to a whole school of German biologi- cal research (Lenoir 1982, p. 12).