

## Politics of ultimate stuff

— on deriving nature from first principles —  
and related metaphysical processes of negotiating  
what the matter is.

*Angenommen, zum Beispiel, was angenommen werden muss, dass der Inbegriff der Erscheinungen nicht eine blosse Welt, sondern notwendig eine Natur, d.h. dass dieses Ganze nicht bloss Produkt sondern zugleich produktiv sei, so folgt dass es in diesem Ganzen niemals zur absoluten Identität kommen kann... Durch diese Ableitung aller Naturerscheinungen eben aus einer absoluten Voraussetzung verwandelt sich unser Wissen in eine Konstruktion der Natur selbst...<sup>1</sup>*

F. W. J Schelling: *Einleitung zu dem Entwurf eines Systems der Naturphilosophie, Ausgewählte Schriften (Surhkamp), I, 278*

*...This doctrine of necessity in universality means that there is an essence to the universe which forbids relationships beyond itself, as a violation of its rationality. Speculative philosophy seeks that essence... Philosophers can never hope finally to formulate these metaphysical first principles... The term 'philosophic generalization' means 'the utilization of specific notions, applying to a restricted group of facts, for the divination of the generic notions which apply to all facts. In its use of this method natural science has shown a curious mixture of rationalism and irrationalism. Its prevalent tone of thought has been ardently rationalistic within its own borders, and dogmatically irrational beyond those borders. In practice such an attitude tends to become a dogmatic denial that there are any factors in the world not fully expressible in terms of its own primary notions devoid of further generalization. Such a denial is the self-denial of thought.*

A.N. Whitehead: *Process and Reality (1929/1976) p.4-5*

### A speculative question

What is the ultimate stuff of nature — atoms, fields, minds, thoughts, gods, emptiness, propensities, processes? Who is entitled to ask this kind of question? To discuss it? To answer it? To declare its further discussion illegitimate, irrelevant or impossible?

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<sup>1</sup>Assuming for example, as must be assumed, that the essence of phenomena is not just a world but necessarily a nature — i.e., that this whole is not just a product but at the same time productive — then it follows that complete identity can never be reached within this whole... Through this derivation of all natural phenomena from an absolute assumption our knowledge transforms itself into a construction of nature itself..."

### A speculative suggestion: process metaphysics

In some earlier articles<sup>2</sup> I have tried to argue and develop a version of process metaphysics. Discussing some of the central ways *time* enters contemporary scientific theories I tried to support the claim that if we can understand nature as *process* all the way down, in a particular radical sense, this can help us gain a better grasp than that allowed through our prevalent notion of nature as made up out of simple enduring, immutable, mobile *substances*. In this article I reflect on the sense and legitimacy of making this kind of claim.

Whitehead's *Process and Reality* is a major source of construction elements for such an alternative modern metaphysics based on processuality; my own suggestions are largely based on his. There are other thinkers who have worked systematically and constructively towards such a shift of basic metaphysical notions. I would like to particularly point to Schelling, Hegel<sup>3</sup> and Bergson, because they very clearly share with Whitehead the use of a particular kind of argument: the derivation of the traits of real nature, as we have come to know it through the channels of the natural sciences, as consequences of "first principles" of process metaphysical insight, principles which are apparently taken to be absolutely valid for reasons which transcend these sciences. In some cases such principles even seem to be taken as valid grounds for criticism of the picture of natural things and their natures drawn from the sciences. This kind of aprioristic metaphysical move in the philosophy of nature is very often the target of philosophical criticism. Even if metaphysics is now generally viewed with much more friendly eyes than a few decades ago, the particular brand of speculative philosophy of nature is still frequently singled out as the paradigm of "bad" metaphysics, as residues of dogmatic irrationality.

The reason I am particularly interested in the "deduction of nature from first principles" kind of argument is that some of my own previous work has provoked some readers by carrying obvious resemblances with arguments of this sort in Bergson and Schelling. Is this a fault which should be remedied? I don't think so. I propose to take seriously exactly this family of speculative processual philosophy of nature. I believe this mode of thought is not essentially dogmatic, or aprioristic in a sense that downplays the significance of the adventure of experience, even if it is sometimes so construed even by its friends. I hope to make this clear in the following.

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<sup>2</sup>The previous chapters in this collection

<sup>3</sup>Hegel's version of the figure of *derivation of nature from first principles* is significantly different from Schelling's more straightforward top-down procedure. The structural difference this produces between Hegel's and Schelling's philosophies of nature will be treated in a separate article.

Process metaphysics is often formulated in contrast to *substance*, as I just did. But this contrast depends very much on the notion of substance intended. Thus, classical Aristotelian substances, with their inherent formal activity, are in that essential respect very processual. The same may be said of the Leibnizian version of substance, the monad, whose most basic trait is self-expressing activity: the thesis of identity of necessity and creativity makes it somewhat ambiguous but I think it only makes sense as a deeply processual metaphysics. What modern process metaphysics is formulated in contrast to is a particular very significant *modern modification of the notion of substance*: no longer ordinary middle-sized, active, degradable things but ultimate stable things, the explicitly non-teleological units of mechanical analysis, when these are taken as ultimate stuff. Usually it is primarily microscopic substances that are in question — elementary particles and the like — but it could be any object with a fixed core or essence, small or large. In any case, what process metaphysics attempts to bring into focus as an essential feature of things is that they are not just passively and positively around, awaiting observation, true representation, technical processing, exchange or consumption: they are striving to become, only partly successful, they are sprouting, rusting, perishing, at odds with themselves or each other, they are coming up with new unseen tendencies, incredibly beautiful, weird or irritating, on the fly, while all the time merging with the histories of other things — not least human beings and societies — and splitting apart from them. Further, the process metaphysical submission is not primarily the claim that this *is* so (although of course the process metaphysician will have to accept challenges along the line that it cannot possibly be so) but rather that this is a trait whose realization is *relevant* to all kinds of projects of dealing with stuff. That is, of course, pretty much all projects. (Including speculative ones whose alleged decoupling from things in the real world is a complete misrepresentation. Without active speculation we would be passive victims of abstractions and quickly lose touch with the concrete.) This pragmatic idea of *relevance of a metaphysical structure* is what I expressed initially by suggesting that a process metaphysical understanding may enable a *better grasp of things*<sup>4</sup>.

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<sup>4</sup>The idea of a pragmatic approach to metaphysics is expressed by Whitehead in *Process and Reality*: the most important thing is not that a statement is true, it is more essential that it be relevant (A. N. Whitehead: *Process and Reality*, 1929/1976, Chp. 1). In this respect Whitehead's philosophy seems to be the culmination of a tendency within at least part of the classical tradition of American pragmatism towards the development of a pragmatist notion of metaphysics. This strikes some as a contradiction in terms. Pragmatism immediately seems connect with a radical modern project of undermining all metaphysics by restricting the horizon of meaningful talk to what works in practical action. But pragmatist metaphysics acknowledges the need of considering the practices of constructing and stabilizing natural and cultural objects and structures, and especially of sorting out when and how to count something as agency, as not settled a priori but happening along with other practices and ongoings. It may even recognize the value of parts of the metaphysical tradition as helpful. Of course a main stream of pragmatist thought is still strongly opposed to any contamination of healthy pragmatic discourse with considerations of the nature of things — Rorty, of course, is a defender of this puritan line. The proposal of a marriage between pragmatism and metaphysics is also met with suspicion from the other side, from those who take metaphysics to be an important issue — they will fear that the seriousness of the notion of metaphysical truth is evaded by being made relative to the contingent practices and

A better grasp in which sense? This is the topic of this article: the questions of when and why metaphysical statements about the stuff of things are relevant, useful, legitimate. Which kinds of derivations or arguments may be invoked to support them? Also I am going to discuss their political dimension which is not always noticed. So, there will be a continuity, from the specific suggestions of process metaphysical interpretations given in the previous papers, into this more general problematic of metaphysical tinkering as itself involved in a processual reality (scientific, cultural and political); but the present consideration should be workable on its own.

### The modern double denial of a philosophy of nature

Metaphysical discourse of the nature of things is exactly the kind of thing we have learnt to understand our modern culture as *not* involved in, especially if such discourse involves speculation or connects in any way with those anthropomorphizing aspects of culture associated with myth and religion. This is a central aspect of our way of recognizing ourselves as moderns, in contrast to premodern kinds of thought and culture. Interestingly, particularly in high modernity there is not one but at least two ways in which modern thought fiercely denies the metaphysics of ultimate stuff: Firstly, it is *science* that determines the nature of ultimate stuff; and secondly, the question of the nature of things is *meaningless* and should not be answered.

Thus phrased together, there is an obvious overkilling self-contradiction in the modern double denial. Still the two denials coexist as dominant figures in modern thought about metaphysics, and Richard Rorty, for one, is explicitly and highly modern enough to give voice to both. Rorty says<sup>5</sup> that ideas like the organicist, processual and pantheist vision of nature developed by Hartshorne — Rorty's former teacher — are very sympathetic for their poetic beauty and edifying effect, but misguided and misleading in their claim of connecting with something beyond human discourse. Such claims always represent, to Rorty, a move in the direction of limiting the free creative unfoldment of discourse/practice by requiring respect for authorities beyond, even if the beyond is depicted, as Hartshorne does, in a more friendly, democratic and benign form than traditional claims of ultimates. For Rorty, this is still a case calling for his general criticism of claims of a *privileged access* to something beyond discourse, such as the entire traditional philosophy of mind based on claims of the subject's privileged access to its own intentional states.

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interests of particular groups or cultures. My suggestions entail the claim that the marriage is happy and desirable, the misgivings in the families on both sides misguided.

<sup>5</sup> "Answer to Hartshorne", in *Rorty and Pragmatism*, 1995

Instead of wasting his poetic gift on trying to dream up something depicted as real, and hence implying a privileged access on behalf of natural philosophy and a corresponding external authority constraining discourse, Hartshorne should set free his own powers and those of his listeners, to simply and openly build and construct in the realm of discourses and dreams and sensibilities, whose limits can be endlessly expanded through creation of new modes and standards of expression. The interesting thing, however, is that the other realm is there anyway for Rorty — the world of natural things such as electrons and neurons which populate many of Rorty’s examples — but it is absolutely different from the rich, man-made world of self-expression; it is the prosaic dull material that engineers and scientists have to deal with during working hours (we can only hope for them that they will be edified by opera or postmodern philosophy in the evenings). Nature has nothing to do with aesthetics, inventiveness and free self-expression. Science simply reports what is out there, and we should simply accept the kinds of things it reports as real, be “relaxed physicalists” in Rorty’s words. In short, the institutions of science and its textbooks and its more or less popular renderings from which Rorty and most of us learn about neurons and electrons are a channel of privileged access to the nature of the physical world underlying discourse.

Maybe what Rorty says about the accessibility of the true nature of things can be rendered in a less inconsistent form, maybe not. Let us not be concerned too much about his particular expression. What I would like to focus our attention on is the very essential modern idea that the world of natural facts and objects is completely separate from, transcended by, the cultural world of values, poetry and politics — and that this transcendent place is our only home.

#### **Holes in the modern surface**

Apart from the possible formal problem of inconsistency, there are two important objections of a more material character that can be made to this physicalist-and-transcendentalist view.

The first objection regards the character of the privileged channel through which the non-speculative, prosaic information about nature is supposed to flow into this transcendent home. It insists that science and technology do not innocently project a picture of reality that we could sit around and be “relaxed physicalists” about without quite a lot of work of conceiving, educating, confining, expressing things — interacting with their stuff even so heavily that neither theirs or ours remain the same — and finally the interpretation to organize it comprehensibly, making nice color plates of electrons, neurons, etc. Furthermore, as the work of the emerging tradition of science studies is making more and more obvious, the work of science and

technology is itself the construction of a world in many ways as full of agencies, sensibilities, standards of evaluation and politics as the “cultural sphere”, and the limit between the spheres is historical, variable, permeable, in need of constant work of separation.

The second objection is that nature itself is also in our home, that it is not just accessible through the privileged channel of science (or mediated from it via textbooks and popular science shows). Nature is distributed throughout our life — no matter how densely packed this life is with practice and discourse — in places like bodies, voices, family relations, food, gardens, landscapes, and the residues of materiality in any artefact. Actually, as soon as one starts looking for it, the dynamic dividing line between the natural and cultural (semi-) spheres cuts right through any object or utterance one could possibly make, grasp or view. The paper or screen you look at right here, for example. So that access is everywhere if anywhere.

These two objections point to two complementary ways we have never ceased touching the nature of things, even though we have learnt to think about both of them in the “relaxed physicalist” fashion: as subordinate to the abstract products that are the true modern’s only ultimates. Therefore, the two objections also correspond to the resources of two cultural undercurrents which propose ideas of ultimate stuff more or less different from the modern standard ontology of ultimately stable substance, working more or less explicitly towards a processual ontology. The first objection corresponds to the recent tradition of *science studies*, social and anthropological approaches to science and technology, a tradition which seeks to develop vocabularies in which it can express the rich web of human agency, tuning and tinkering behind the smooth surfaces of modern things. The second objection corresponds to the older tradition of *Naturphilosophie* / *philosophy of nature* which I will start treating now.

#### **What can be derived from intuition?**

This tradition of *philosophy of nature* holds that we have a richer and deeper involvement with nature than that which comes forth in official expressions of science and technology, and that we can, and should, derive from this direct involvement a more complete understanding of what nature is. This is the drift of Bergson’s appeals to *intuition* and Schelling’s to *Anschauung*, for instance. Schelling, Bergson, and many others have pointed out the clashes between direct participatory prehension and the abstractions through which the official scientific outlook is mediated. And for both of these thinkers, one of the most central, systematic discrepancies between the abstraction and immediacy is just the question of *temporality* and *processuality*, the understanding of change and becoming.

Their simple point is that whenever we encounter nature directly, it is in process and transformation, but that whenever we mediate nature via technology and abstractions, it is constructions of stabilized objects and regularities which are magnified to the point of being dominant or even exclusive. In short, nature is turned from becoming into being.

Of course there are some who have taken the realization of such systematic discrepancies as a point of departure for an unqualified romantic reaction against science and scientific culture altogether, paradoxically producing the same kind of high modern move as Rorty's, towards aesthetics and self-expression as an autonomous human sphere, with the slight addition of a nature only relevant as aesthetic object. And there are points at which both Bergson and Schelling seem close to that kind of conclusion — when, e.g., Bergson complains that our increasing involvement with technology and science inevitably brings about a “spatialization” of time which has all but destroyed our sensibilities for original, lived time — a condition that can only be remedied by a new development of sensibilities through art.

But the main intentions of Bergson's and Schelling's philosophies of nature are very far from being antiscientific. Rather, they believe strongly in the progress of science and scientific culture, and see the role of their philosophy of nature as an important contribution to that, by giving a coherent interpretation of abstraction and lived experience. In other words, they are both very “modernist” in the sense that they are committed to what I would like to see as the truth that is there, after all, at the heart of the double modern denial of metaphysics we just discussed: science is metaphysically significant, and it progresses towards deeper insights into the nature of things. It is just that its abstractions in isolation are not a ready made interpretation of everything. Nor do we need to despair, but some serious work needs to be done: the abstractions of science are in need of thorough creative interpretation in order to bring out this significance. I think Bergson and Schelling are on the right track in this kind of reformist modern commitment; and the suggestion that I am going to develop below even implies that we should strengthen it in a particular sense.

Particularly in Schelling's case, this commitment leads to the famous grandiose project of *Naturphilosophie*, the speculative production of a complete, coherent structure out of everything known of nature, organizing it into a *hierarchy of derivations* whose first and most unquestionable step is simply the processual nature of reality. But Bergson, too, sought to derive particular aspects of science from a first principle rooted in temporal intuition — leading to the requirement of a revision of particular content of physical theory, as we shall discuss towards the end of this paper.

A very important resource of alternative modes of thought has been the science of biology whose objects are obviously very mutable and active. My point is not that biological institutions or writers are generally supporters of nonmodern views of the nature of things — on the contrary, the claim that organic life is ultimately reducible to the entities and laws of fundamental mechanical physics is typically seen as essential to biology's claim of a status as truly scientific. Still, as long as biology has been around as a scientific enterprise separate from mechanical physics, there have been dissident thinkers speculatively proposing that biology offers the better metaphors for general ontology, interpreting mechanics as a special case of organic being, rather than the reverse<sup>6</sup>.

When the shape of the intuition based kind of project has traditionally been seen as thoroughly deductive and hierarchical, it is in consequence of this image of the distribution of legitimacy: Legitimacy stems from an access to the true nature of things which is already complete but exists only in the one extreme end of the world, the immediate and concrete participation in life as opposed to the sphere of concepts and abstractions. Hence, the shape of the speculative project becomes the channelling of understanding from the direct and unquestionable insight in that pure sphere into the realm of shadows and representations, which will finally be transformed into, and recognized as, a mode of participating in life, too. I think this dualist and aprioristic scheme is not really an adequate representation of the force of this type of speculative work by Bergson, Schelling and others, whether they thought so themselves or not. I think their speculative contributions to the understanding of nature and science began a move of speculation beyond fundamentalism, a move very outspoken in the Whiteheadian vision of natural philosophy whose distinct features I will outline. But Whitehead also proceeds in a way that sometimes looks very aprioristic and deductive, and some Whitehead-inspired arguments central to my earlier papers have that character as well. I will use a reflection on some of these arguments as a point of entry to general considerations

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<sup>6</sup>There are several interesting aspects in this coupling between the science and biology and the development of general organicist models of thought. For one thing, it is not simply that as biology evolved, new models became available for metaphysical thought, it is just as much the reverse: the development of an organicist metaphysical notion of living things was part of the movement of inventing the science of biology. Also, the shift attempted by organicism, from mechanics to biology as a paradigm of being, is a kind of homecoming to original Aristotelian structures of scientific thought which were clearly informed by the organism as the most fully substantial kind of thing. Finally, the organic models of thought provided by the developing science of biology — or *returning* to philosophy from biology, perhaps — can be thought of as a third point of departure for projects of non-standard philosophy of nature, besides intuition and social studies of science. Don't worry about the number of leakage points in the surface of modern ontology, dear reader. It is not essential to keep them apart. I will argue later that they have quite a lot in common and are presently beginning to merge. I like to think of them as vegetation that once sprouted out through separate small holes in the almost perfect surfaces of a stone temple, but are now beginning to embrace it. Sokal and others are already campaigning to preserve the remains of the Angkor Wat of modern scientism against total destruction by monkeys and tourists. If you want my idiosyncratic Hegelian opinion on this matter, there is such thing as scientific rationality, and it is holy but need not be preserved. Rather built and grown.

of the power and legitimacy of assumptions, derivations and other structural elements in speculative philosophy of nature.

### An unattempted derivation the second law of thermodynamics

In an earlier article I found<sup>7</sup> that the second law of thermodynamics can be derived as a necessary consequence of the “categorical scheme” of process metaphysical assumptions laid out in Whitehead’s system. Now, this kind of derivation looks very much like a “construction” from an intuitively apprehended first principle of processuality in the spirit of Schelling’s philosophy of nature. Indeed I think Schelling might well have made a somewhat similar derivation of the Second Law, had it been well established physics a few decades earlier. Furthermore, Bergson actually did produce a kind of argument and/or vision that the decay associated with the Second Law follows from his apparently contrary principle of creative, order-producing processuality,

*“So, from an immense reservoir of life, jets must be gushing out unceasingly, of which each, falling back, is a world... The evolution of species within this world represents what subsists of the primitive direction of the original jet and of an impulsion which continues itself in a direction the reverse of materiality...”<sup>8</sup>*

The “falling back” is what Bergson also called that world’s “degradation” and associated with entropy, while the “gushing forth” is what he saw as the most fundamental principle of nature, life or creativity. In Schelling, the overall picture is very similar: from a primordial unlimited source of creativity and activity, the dead things and patterns of the world come about in a kind of temporary downfall or restriction. There are two reasons why I point to these two similar projects of deriving natural “degradation” from even more fundamentally natural “gushing forth”: in order to acknowledge my own Whitehead-inspired project’s deep similarities with them, and in order to point out an important difference. What he has got in common with them is the idea of a cosmology of radical processuality and becoming, as well as the non-modern sense that the nature of things is within reach of argument, imagination and negotiations. The essential difference is less obvious: Schelling and Bergson speak of process as flowing from a “reservoir” of creativity and becoming, somehow beyond the particularities and differences which have come about in the world: the more particularity the less primordial processuality; whereas

in Whitehead processes are radically worldly and local, rooted in different concrete particular situations (local “universes”) of predecessor processes. Therefore, even if Schelling’s and Bergson’s process notions of ultimate stuff allow for a kind of derivation of the Second Law, it will tend to repeat this classical deist form: non-mechanical activity winds up the cosmic clock, creating a state of high “mutability” whereupon it ticks down mechanically. In contrast, the Whiteheadian derivation I suggested revolves around the immanent, worldly production of orders. In Schelling and Bergson, degradation is still something which follows *after* creative ordering, although they both make these two poles less absolutely distinct than more traditional interpretations (creative activity of God vs. passive mechanism of world, or arbitrary initial conditions vs. necessary laws). In Whitehead’s scheme there is nothing which is not ordering process, hence degradation will have to be within the ordering if anywhere.

When I first noticed the possibility of the *derivation* of the Second Law within the Whiteheadian framework, it came as something of a surprise, as I had only wanted to produce an argument for the somewhat weaker statement that there is *no contradiction*.

A contradiction with a well established physical theory would of course have posed a serious problem for the metaphysical claim in question, Whitehead’s metaphysics of process, whether seen in the light of truth, relevance or usefulness. Some Whitehead scholars have concluded from this apparent clash that the scope of Whitehead’s metaphysics must be limited to life processes, and not taken to apply to processes in the physical world generally.

Bergson, as we will see, did not find this kind of conflict was a problem on the side of metaphysical insight. In his view the legitimacy of the intuition was so unquestionable that he seriously proposed that a physical theory — Einstein’s special theory of relativity — be revised in order to be in accord with it. And even though I agree with the general consensus that Bergson failed to actually produce a coherent alternative idea of temporality and relativity, I will argue that this is not so much due to the strength of his faith in intuition, but rather lies in a lack of speculative flexibility in his *expression* of the intuition in explicit first principles.

However, my own faith was not strong enough to accept an apparent contradiction as something that would leave the intuition based metaphysics unaffected and require a revision of the physics. Instead, I followed what seemed a promising line of argument to show that the contradiction is indeed only apparent. For the details

<sup>7</sup> Chp. 4 in this collection.

<sup>8</sup> H. Bergson: *Creative Evolution*, 243, 245

of the argument I have to refer to the article dedicated to it<sup>9</sup>. The overall idea is related to the points made in Schrödinger's famous little book<sup>10</sup> on the apparent clash between the order-producing activity of living organisms and the Second Law's requirement that all spontaneous natural processes be accompanied by an increase in entropy, also expressible as a transition from ordered to less ordered states. Schrödinger points out, firstly, that the kind of order produced by living organisms is of a more complex type, not reducible to negative entropy. However, this does not solve the problem, since the organic types of order do require low entropy, so that their growth does indeed require a decreasing measure of entropy in the organism seen in isolation from the environment. But secondly, of course, an organism is very far from being the kind of thing that can be described with any kind of relevant approximation as an *isolated* physical system — isolating it in practice would immediately turn it into something very different from a living organism<sup>11</sup>. On the contrary, the living organism exists by virtue of a constant exchange with the environment which is systematically asymmetric regarding entropy: taking in matter in a state of low entropy and giving back matter in a state of high entropy. In this respect the organism is just like the heat engine, but instead of delivering useful work to an external agent (the owner) the organism organizes itself (and, at least for higher organisms, its immediate environment). Even so, Schrödinger's argument is not enough to solve my problem however, because the claim of Whitehead's process metaphysics is not just that some, but that all natural processes involve spontaneous self-organizing activity. Obviously everything in the universe cannot simultaneously be behaving like steam engines — there would be no hot coal and cool air — everybody and everything would already be busy cancelling out every conceivable difference in the world<sup>12</sup>.

The key to the solution lies in the very radicalness of the idea of omnipresent creative self-organization which is just what seemed to create the problem in the first place. If something is a process, according to Whitehead's categories, it is in the business

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<sup>9</sup>Chp. 4 of this collection.

<sup>10</sup>Erwin Schrödinger: *What is Life*, 1943

<sup>11</sup>This is obviously just a slight extension of the classical holistic argument of organicist philosophy of nature, about mechanical dividing analysis not being applicable to what is essentially organic. Cutting an organism in halves, or cutting it off from exchange with an adequate environment., have strikingly similar effects..

<sup>12</sup>As P.H. Lindhard has pointed out to me, this argument is not strictly correct without a specification of the exact sense in which I use the phrase "like heat engines". In fact, the general understanding is that everything in the universe *is* simultaneously behaving like heat engines in the sense that every system tends towards greater entropy according to the Second Law. This is perfectly consistent under the standard assumption that there has been an initial universal state of very low entropy, not too long ago for it to have run down already. What is not logically possible however is that within every local system order is being built up at the cost of a greater entropy increase outside its borders.

of creatively finding ways of *making* a difference. Even spatial — or spatio-temporal — extension is construed<sup>13</sup> as produced by self-organizing processes and process collectives, as a relational pattern, so that the geometric properties of this extensive pattern are suggested to be not only actively constructed but also historically variable. This implies that no standard of spatial ordering is universally applicable — in Whitehead's words the fact that spatial relations are expressible in just 3 dimensions is a local and temporary accident, for example — new modes of spatial extension *and* ordering are created on the fly. Any particular quantitative measure of order, including those defined over the kinds of distributions relevant in systems studied with thermodynamical methods (e.g. particular requirements on distributions of heat or particles, in real spaces or phase spaces) will be attached to particular fixed modes of congruence. Thus it will not reflect such emerging orders, however outspoken or faint they should be thought to be.

This argument delivers what I wanted. No matter what one otherwise thinks of the idea of everything being made of spontaneously and creatively order-producing processes, one problem it does *not* create is a conflict with the second law of thermodynamics. In fact we even obtained, as a kind of extra bonus, that it *implies* the second law, because the measure of the degree of implementation of any fixed standard of order will be decreasing as processes strive towards organization according to new patterns of order. Where Schrödinger's argument situates organic self-organization within thermodynamics, we have made the reverse move of situating thermodynamics within organic self-organization, and it seems to be able to live and breathe well enough there.

The idea of taking organic self-organization and order production as a general metaphysical or cosmological feature of everything may strike some as far-fetched. At this point I am not claiming to ground it, we are playing with the idea without having it grounded in any kind of irresistible support, neither deductively from some self-evident principle even more primordial, or inductively from some large pool of empirical evidence, or by reference to Bergson's and Schelling's intuition. Each of these groundings gives, as I will try to show, a much too narrow idea of the source and legitimacy of this kind of vision. It is speculative, in the sense outlined by Whitehead in the initial quote. That is, what it does is to take a set models and entities from one science, *in casu* biology, and interpret some of its features as universally significant via the notions of ultimate activity and self-organization. Speculative constructions in this sense are not uncommon, it is just that this one is strikingly different from the presently dominant speculative scheme: the

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<sup>13</sup>This construal is worked out systematically in Whitehead's "Method of Extensive Abstraction", presented in several of Whitehead's works, most completely in *Process and Reality* (1929/1976), part IV.

universalization of generalized mechanics via the notion of ultimately stable and separate micro-particles (what was once known as “corpuscular theory”). However, the proposed alternative vision of universal organicism is not just a peculiar speculative adventure of Whitehead, Bergson and Schelling, it is common to a line of thought which grew a serious rival to mechanicism in the 19<sup>th</sup> C (with the invention of biology and of “deep time”) but lost most of its territory again to mainstream modern universal mechanistic visions during the greater part of the 20<sup>th</sup> (with the reconstructed modern physics seemingly realizing the old mechanistic dream of immutable corpuscles — if only by paying heavy taxes at the back door, to non-mechanical beasts like non-locality and probabilities). To further complete the picture of a kind of symmetry between these two speculative cosmological visions, there is a strong tradition of deriving the Second Law of Thermodynamics from first principles of mechanicism. In effect this is what happens when deterministic and reversible microphysical mechanism is held to be the cause and explanation of the phenomenal world’s characteristic irreversibilities and indeterminisms.

The argument deriving the second law of thermodynamics from Whitehead’s process metaphysics did not really require all of the particular nuts and bolts in the details of Whitehead’s system. When I started writing this article I still thought that the same general kind of organicist derivation might just as well have been built with the pieces from, e.g., Schelling’s philosophy of nature. Indeed a kind of derivation-like “construction” of the Second Law could very well be made with Schellingian pieces, but I realize now that it would have been very different in the one central aspect we found when discussing the Bergson quote above. Classical organicism thus retains, to some extent, a kind dichotomy which is fundamental to classical mechanicism (even if somewhat shifted in the direction of a matter of degree rather than a clean duality):

Active, Work	Passive, Waste
Living, Organizing	Dead, Chaotic
Transcendent	Immanent
Unique, Freely chosen initial conditions	Repetitive, Necessary laws

This dichotomy is total in mechanicism, in the sense that the right hand side is the real world and the left hand side is implicitly taken or explicitly stated to be the subject (the experimenter or machine/factory owner), the deist Creator, or the

ineffable, or some monstrous combination of these. As Norton Wise has shown<sup>14</sup> this dichotomy is also a particular kind of gendered structure which was still very dominant in late 19<sup>th</sup> C imagination and hence in spiritual products of the Victorian age such as Darwinism and statistical mechanics, a structure presumably growing forth from concrete early modern family life forms.

It is probably because of the shaping influence of this unholy family kind of structure on 19<sup>th</sup> and 20<sup>th</sup> C thought that, even if classical organicism might explain thermodynamic decay as deeply connected with order production, the connection would be constructed in terms of two very different kinds of processes, one of them organizing things, bringing about the livelihood so to speak, and the other one spending it. Therefore, even though thermodynamic decay would be accounted for as rooted in “organic” self-organization, the structure of the account would not be radically different from that of classical mechanicism: organization or setting-in-motion comes from outside, whereupon the ordinary world’s mechanisms wastes it away. On the bottom line, the way entropic decay would be derivable from creative ordering in this kind of picture is really only “what goes up must come down”.

Whitehead’s late and revised version of organicism takes an interestingly different path exactly at this point. Activity and creativity is local, a characteristic of the specific processes of the world, rather than an “infinite source” apart and aloof. This is why order forms must be invented on the fly: patterns of organization relevant to the real situation, sometimes more or less radically new, but always bound to be a local act of *ordering something particular that the ordering process itself is incarnated in*, of giving unified expression to a particular and historically grown kind of situation. It is tempting to express this by claiming creativity to be *immanent*, in the sense that it is worldly, but it is also *transcending* in the sense of adding something — small or large, usually very small — beyond what used to be the world so far.

Accordingly, the connection with thermodynamics that I proposed to unfold from Whitehead’s process metaphysics is essentially different from “what goes up must come down”. It is the order production itself that is interpreted as responsible for the decay of measurable order, rather than some contrary principle of attenuation, resistance, gravity or inertia (or even some only apparently or virtually separate moment of attenuation in infinite creativity itself — the model developed by Schelling in some detail). If we can imagine that real, local processes are themselves the active sources of the world’s many forms of order, even to the extent of radically inventing them, they could not just maximize one ideal of order, or a particular set

<sup>14</sup>M Norton Wise: *Work and Waste: political economy and natural philosophy in 19th C Britain*, Hist.Sci xxvii (1989), p. 392-449.

of them. They could not even stay close to previously realized ideals. Creativity itself would make them drift off, not just randomly but with some more or less vague striving for order, including new orders not yet stable or widespread enough to be the basis of congruence and measurement. While existing and hence positively definable order forms wane, new forms, not yet measurable, would be in the process of becoming, in Whitehead's view. Further, this kind of historicity would penetrate nature all the way down, so that even the patterns like "basic" natural laws and dimensionality of space are negotiable. So obviously any definition of the relevant spatial distributions of heat or particles to define entropy would be too.

### Legitimacy of speculative assumptions

To sum up, the second law of thermodynamics can be derived from a first principle of processuality, and this can even be done in several ways. One kind of derivation can be extrapolated directly along the track of Schelling's and Bergson's modes of natural philosophy and Bergson's work even contains a poetic outline of it. The derivation I suggested is a modification of this which overcomes a kind of dualism — the dichotomy of ordering and decay, of teleology and dysteleology as fundamentally distinct and opposed — that traditional organicism has shared with its arch-enemy, mechanicism. The "*price*" one must pay for this is the somewhat uncommon thesis that nature must be regarded as not only historical but also anarchistically and immanently creative "all the way down". Basic regularities, even those defining space and time, must be taken to be variable "habits of nature", in the words of another radical evolutionary cosmologist, C.S. Peirce. And it is essential for the proposed kind of derivation that the history of this variation must not be taken as expressing an original order gushing forth, or a master narrative setting the standards of emerging orders from above, below or beyond local concrete processes.

If stability and homogeneity of the cosmos is the most natural state of affairs, this "*price*" is high. On the other hand, our total "*cost*" in terms of assumptions would be reduced by passing from the dualist picture common to mechanicism and what I just labelled "classical" organicism — with two separate metaphysical principles behind order and decay, the latter natural and the former more or less an exception to nature — to an account of both sides understandable as consequences of of one nature of things.

Now of course it can be asked if we need to accept any price of assumptions to derive the Second Law from at all. Could it not simply be accepted ("relaxedly") as a contingent fact in its own right? I don't think the strategy of avoiding any claim and attempt of coherence has anything useful to offer, and I even suspect that it is not

possible to really think this way. In any case, the traditions to which the proposed derivation is an alternative do not simply take the Second Law as a brute inexplicable fact either, but seek to make it understandable through deriving it either from non-processual, temporally isotropic laws of fundamental mechanics, or from some kind of transcendental character of the human subject's condition, or from some monstrous<sup>15</sup> combination of these premises. As Isabelle Stengers has pointed out, university textbooks in physics tend to account for the ambiguous relations between microphysics, statistics and thermodynamics through more or less implicit principles introduced via examples from "real life" — implying that thermodynamics is not only grounded in microphysics but in something common to all fields of practice. I have argued elsewhere<sup>16</sup> that more formal accounts of the Second Law are dependent on some kind of implicit premise of striving, anisotropy and processuality — e.g., when assigning the roles of initial conditions, final conditions and spontaneous process — the premise which is explicitly unfolded in the process metaphysical account.

Indeed, it might be argued that the radical process derivation is not suggested so much as an alternative but rather as a completion of traditional derivations. If this implies a criticism of traditional accounts of the Second Law, its point of attack is not the traditional metaphysical attempt, more or less explicit, at reduction to more fundamental principles; what is criticized is the "explaining away" that happens if the fundamental principles explicitly invoked are in fact only able to account for certain aspects of the phenomena in question, and if other aspects are systematically suppressed in order to make things fit into the rationalization. Staying in the economical metaphor, a cost cutting move is not wise policy if it reduces benefits or results even more. This is significant in assessing the above mentioned "*price*" of the explicit process metaphysical assumption — in fact I think it points to something central to this and many other metaphysical discussions.

The economic metaphor is common in metaphysical arguments: the criterion of success often taken for granted on both sides of a dispute is the achievement of the maximum explanatory "*result*" with the minimum "*investment*" in terms of claims and commitments. The rationale of trying to reduce the Second Law to more fundamental principles could be expressed as the reduction of the number of independent assumptions. However, as the suspicion of hidden processual

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<sup>15</sup>This is the playground of Maxwell's demon: the limited capabilities of human knowledge combined with the deterministic trajectories of microphysics, producing for us non-demonic subjects the spectre of a non-deterministic and anisotropic macro-world. The so-called Anthropic Principle kind of explanation is the apotheosis of monstrosity at this level: all of nature's determinateness compressed into one drop of disembodied, non-specific human "observer"...

<sup>16</sup>Chp. 3 and 4 of this collection



assumptions in traditional accounts illustrates, even if arguments of “economy of thought” may often be powerful and relevant, they depend on certain backgrounds, border conditions and *paribus cetera* clauses which are anything but innocent — not unlike situations where formal economical comparisons are brought to bear on economies in real life.

Metaphysics is not just in the business of comparing a range of preexisting conceptual options with regard to maximal economy, its most important contribution is to *modify* that range. The way to achieve this is to show something previously unconceived to be conceivable. A great example of this kind of argument is the one by which Newton and others produced the separation between time and process which was almost inconceivable for Aristotle but has almost become commonsense by now. To us moderns, it makes sense to ask, with W.H. Newton-Smith and many others, *why there should not be an interval of time without anything happening*<sup>17</sup>. In other words, an elegant displacement of conceivability suddenly produces, in the adversaries’ camp, the need of an extra, “expensive” claim, to the effect of the *necessary nonexistence of vacua*, where before there was nothing particular to claim: in Aristotle, for example, time is not even all movement, but particular kinds of even, repetitive, countable movement.

Subtly, the metaphysical null hypothesis — the “default value” of the metaphysical variable with a computer programming metaphor<sup>18</sup> — shifts through the construction of new conceivable structures, so that the previously far-fetched now comes forward as the simplest interpretation. I think Newton-Smith is completely right, this kind of expanding speculative procedure is reasonable and legitimate. So, nothing wrong with the status he implicitly confers to creative speculation. If I disagree with this speculative vision itself, it is not for its being speculative but for the one-sided, abstract source of the models which are speculatively worked out into an expansion of the general scheme. The notion of pure time, independent of all particular kinds of change, is a powerful procedure in the construction of mechanics<sup>19</sup>, but systematically stripped of all its dynamic involvement in clocks, planetary orbits and canon balls, it is a poor concept, not much of a candidate for metaphysical

<sup>17</sup>W.H. Newton-Smith: *The Structure of Time*, 1981

<sup>18</sup>The value given as part of the structure at outset and conserved unless something else is assigned by some subprogram. The null hypothesis is of course a statistical metaphor: the expected normal background pattern against which the probability of some effect, say the disease modifying effect of a drug, is tested. The statistical metaphor has the advantage of stressing that there is no option of leaving the null hypothesis open.

<sup>19</sup>It is the meta-procedure that says: whenever there is a conflict of two or more particular timekeeping procedures, do not hold on to any of them as defining the extension of time but construct a new one from which the aberrant readings of the other clocks can be handled as mechanical effects. This knack served very well for 200 years of physics, only of course in the last 100 has it needed to be replaced with Einstein’s more subtle version.

economizing without heavy “explaining away” or, what is really the same, without most of the expenses being covered by secret benefactors not mentioned in the official balance sheet.

I would like to propose an analogous speculative exercise aiming towards a similar shift the economical balance regarding the thesis of strong historicity or mutability of nature: Consider the idea of regularities of nature in general as systems of relations. A priori such relational patterns can be conceived as more or less global or local, and more or less permanent. Now ask *why there should be a completely stable and global pattern* in these regularities. Clearly, the “space” of possible worlds allowing variable patterns would then be very much larger than the one restricted by the requirement that *patterns must necessarily be stable*. Another expression of the same problem in slightly different clothing: why should the manifestly heterogenous conditions in the universe have absolutely no interference with the layers of basic patterns, if they are transmitted in the same causal links? But if they are not so transmitted as part of mundane ongoings, they would need some other source, adding something extramundane to the “price” paid in terms of assumed fundamental entities. This argument of course is closely related to the classical Leibnizian argument against absolute time and space: these concepts produce the need of extramundane factors arbitrarily selecting, e.g., at what time the world began. Or, in Leibniz’s own jargon: something happening without sufficient reason.

However, something important still gets hidden in the background, I think, as long as speculative metaphysics is discussed as the variation — even if now conceived as a more or less *creative* variation — of conceptual and explanatory forms seeking “economical” generalizations over a universe of facts. What is still hidden is the factor that implicitly made a lot of the difference when this kind of argument was convincing: the *material* side of this production of conceivabilities<sup>20</sup>. The conceivable

<sup>20</sup>An interesting example of the systematic use of arguments based on pure conceivability is W.H. Newton-Smith’s *The Structure of Time*. Newton-Smith argues that Aristotle and others are wrong in taking time and space to be real only as aspects of things happening in the world. The temporal vacuum is conceivable, Newton-Smith argues, subtly shifting the burden of evidence by construing Aristotle’s position as implying the claim that temporal vacua are *logically inconceivable*. To show Aristotle to be wrong here, Newton-Smith constructs “possible worlds” that sometimes “freeze”. It is enough that it is *logically possible* for time to be there and go on, click or pass ahead as it were, independent of the clicks of any real clock or any other event or movement. This possibility implies that the existence or nonexistence of intervals of time in which absolutely nothing happens is a *contingent* fact about the way the world we live in happens to be configured, not a *necessary* truth. Now, the idea that such temporal vacua are conceivable is already present in St Augustine and Newton, indeed the meditative exercise of conceiving it seems to have been always intimately connected with the modern Western mainstream concept of time, hypostatizing this complex of metric terms and coordination procedures into an underlying metric set of moments *in which* movement and change happen. There is nothing illegitimate about such a meditative procedure of constructing conceivability, indeed I believe metaphysical speculation will always be involved in this kind of suggestive exercise, and that such speculation is important and necessary. The aspect I would like to question is the very *formal style* of speculation here: is there really an absolute sphere of conceivability and logical possibility independent of what happens to be the case in the world? The Leibnizian concept of *compossibility* is aimed exactly at expressing a commitment that speculation should respect

depends on the concrete historical form of life, including instruments, objects, livelihood and power relations. If we moderns have been able, since the time of Newton, to conceive of pure time, this is not just due to a stroke of genius in Newton that happened to bring to light at that time a possibility that had always been lying around in the nature of things. Rather, his “absolute, pure and mathematical time” of the *Scholium*<sup>21</sup> was a brilliant organizing construction out of elements in a situation including clock construction, intercontinental navigation, competing empires, telescopes, growing market economy and post-reformation Christian theology. Andy Pickering<sup>22</sup> has singled out the development of “free standing machines”, especially canons, as a particularly significant element of this

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towards the concretely reasonable in this kind of context: if something is possible, it is never simply so in isolation but together with the entire branching web of facts interdependent with it, i.e. truly as a possible *world*: an entire concrete one. Obviously the temporal vacuum would be in trouble if we accept such a criterion of conceivability. This *compossibility* criterion is one aspect of what I just termed *material* as opposed to *formal* conceivability, the other aspect is its *historical* dimension that I shall return to shortly.

As a further example of immaterial conceivability arguments, I would like to briefly return to Rorty’s relaxed physicalism. Rorty belongs to a group of anglo-american philosophers who are fond of a science-fiction type of argument based on a pretty immaterial kind of conceivability. Suppose science will one day have achieved a mapping of mental states on brain states, he says, how could the advocates of the inner being of consciousness then defend their cause? Rorty takes the mere conceivability of this as sufficient to imply whatever the actual achievement would imply regarding the nature of minds and thoughts, presumably because it is then just a contingent fact that it happens to be not achieved yet. Now, even though I applaud Rorty’s attempt of undermining the tradition of mental substantialism that Rorty sees as the antithesis to his relaxed physicalism, I think this kind of conceivability catapults physicalism into very thin air if not into the nonexistent vacuum: in an important sense there is no conceivability there at all, at the hub of the argument, as long as there is no indication of how to imagine the natural and technical channels of the mapping procedure. For reasons very different from substantialism I submit that it is not a possibility lying around for neurologists and engineers to fill in with boring technical details of no philosophical significance. A specific organicist reason to doubt the feasibility is that organisms and thoughts may not cooperate towards existing as concatenations of separately positively existing states at all: decompose thought into stable separate positive units of meaning, for example, and it no longer *thinks*. But there is another reservation I find more interesting: I don’t think we should take any conceivability to be separable from concrete historical conditions of real life, where concepts breathe, grow and shape stuff. The principles of the digital computer are very real now, as a space of conceivable physical machines and machine metaphors — but if we claim them to have been conceivable and possible 500 years ago, this would be in a sphere so absolutely separate from the actual world that it is hard to see that it could have any communication with it, and it would be a strong restatement of the platonist world of eternal ideas that Rorty is so much opposed to (bracketing out for the moment the interesting discussion whether Plato ever intended anything as absurd as this “platonism”). To complete the picture a bit more, I think one needs to admit that formal arguments of conceivability do have *some* legitimacy although it is mainly negative, without the positive creative power of developing concepts out of new situations. For example, I would admit for formal reasons of conceivability that the metric sets of physical space and time must have a high degree of stability and solidity, almost as if they had separate existence, because it is inconceivable for a defining measuring rod to change its length or for a defining clock to change its pace. But the further step, the invention of the concept of pure underlying physical extension, is part of a dynamic move of pressing coordination towards ever greater refinement. It has an implicit but very strong positive and material power by virtue of this process of ongoing refinement of metric definition — a historical role and power ignored in purely formal arguments about it. Finally I would like to admit I am implying that *realism*, in the sense adopted in many philosophical disputes, is associated with the immaterial idea of what concepts are doing. Claims of realities beyond any communication with the concrete world refer to abstract, formal possibilities, not to concrete compossibilities. If conversely this is read as a confession of the heresy of *idealism* I have no objection, as long as the idea is taken in its full living, material sense.

<sup>21</sup>I. Newton: *Principia Mathematica*, Cajori transl.

<sup>22</sup>A. Pickering: *Cyborg History and the W W II Regime*, *Perspectives in Science*, 1995, vol 3, no.1, p.1-48.

early modern situation: a paradigm of external relatedness, clear-cut boundaries and trajectories, pure efficient causality, and complete separation of means and ends, subject and object. There is a man in this picture of the free-standing canon, but he is there only in terms of a very restricted set of relations. The man simply prepares the initial condition and then stands back at a distance, letting the mechanism proceed by its perfectly determined path. (Is this the root of the “schizophrenic” dichotomy between laws and initial conditions?) If this kind of relations are abundant, dominant, foregrounded — if the handling of things in this style is particularly efficient or prestigious — then this is what is given to the construction of generalizations, or a great part of it. The premodern and the late modern worlds have both contained radically different conditions of conceivable things and worlds. I don’t think we should take Newton to be *wrong* in making metaphysical constructions expanding the logically conceivable from within that particular form of life — such a denial of the locally and historically bound would (or at least ought to) lead us to skeptical conclusions regarding any metaphysical statement, from anywhere, including our own position — but rather that we should view metaphysics as an activity which is always local and still holding legitimate claims on approaching truths of the matter. This is not paradoxical if the truth of the matter itself is always local and in the business of digesting a local universe, given a particular range of forms and structures of life there.

The vision of a rational metaphysical project with a real concern for truth, growing forth from the rationality of a particular life form under the conditions of locality and historicity, is a main spring of Hegelian thought. A radical and explicit statement of such a programme for metaphysics is the first chapter of Whitehead’s *Process and Reality*. An adequate treatment of the philosophical potentials in this general view of *metaphysics as itself process* is beyond the present discussion, but one aspect I should briefly touch here is the nature of the claims of general truth. If there is no such beast as a global, perspective-independent reality, and particularly no positive universal state of affairs, general truth must be something different from representation of this beast. Rather, it must be features of local experiences and projects refined and expressed in a way that can stand the ongoing expansion of the sphere of experiences and projects, and it must always be *relatively general truth*<sup>23</sup>. In this sense general truths will be at work transcending the local, but never finished and by reference to a given transcendent.

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<sup>23</sup>If there is such a thing as *absolute truth*, it will have to be the local historical life form’s grasp of its own complete situation, history and activity. This would be absolute idealism, if it wasn’t that in the present philosophical climate any use of the term idealism is thought to imply “antirealism” which is again associated with the absurd claim that the subject is an entity so powerful as to encounter no subject-independent resistance... So maybe this point needs a new label, e.g. “dynamic rational relational realism”?

Allright. What we were trying to do was assessing the conceivability of the radically processual cosmology that took the role of premise in the derivation discussed in the previous chapter. In a more general discussion of possible virtues of such a cosmology I find it very interesting that it also allows a reflexive interpretation of metaphysics as itself process in its own strong sense — i.e., particularly strongly expressing features generally ascribed to processuality. But the reason I touched on this process interpretation of metaphysics itself at this point was merely to support the rather trivial observation that *the conceivable depends on the concrete situation*. Just in case someone were to object that this would void metaphysical discussion of claims to real truth, I am now in a position to reply that this is so only if one binds the notion of general truth to an abstract and unknowable God's-eye perspective, and further, that there is a more realistic alternative concerning the role of metaphysics: it is the discovery of rational coherence of the local universe.

Returning to the conceivability of a radically processual cosmos, I suggest that the late modern situation is *making* this kind of thing conceivable in a way it wasn't before. More accurately perhaps, this situation has elements and features out of which creative thought has been able to build such concepts. If conceptual thought is one way of synthesizing entire concrete life situations, I think we can indeed point out some major features emerging in this late or high modern situation which form an hospitable growth medium for the synthesis of radically processual conceptual structures. Once more, we can consult Andy Pickering for a good explication of paradigmatic features: we should now look at objects like computers and ecosystems as paradigmatic, he says. The style of relations now gaining prominence in real life is rather hybridization, complexity, self-controlling or even self-organizing systems, parallelism, instability, all kinds of traffic across previously well guarded frontiers between minds, organisms and machines. As real life *situations* are getting more and more complex and processual, the *objects* of science, once associated with context-independence and stability, seem to be getting ever more associated with instability too: species evolve, continents move, atoms and even elementary particles decay.

Whitehead's metaphysics amounts to a grand-scale proposal that all of this instability and complexity is not a veil of ignorance and perspective effects covering a true underlying world of ultimate stuff in the shape of the "old" modern world's furniture — stable, simple "corpuscles" situated in independently existing containers of space and time — but typical of reality itself. The islands of simple *stable* pattern that we had learnt to look for and to extrapolate as paradigmatic of rock bottom reality are still there, and still acknowledged as important. But they are reinterpreted as expressions of self-organization in local families or "societies" — reduced to natural size, as it were.

Seen in isolation, this reductive interpretation is nothing but a formal and immaterial metaphysical move in the sense I just criticized. The statement that it is conceivable for all known regularities, substances, conservations, inertias and stabilities to be temporarily attenuated processuality could be seen as an arbitrary pick from a great host of absurd possibilities. Isn't it conceivable in the same sense that the entire known universe exists within a computer simulation of the Big Bang that someone forgot to turn off, or that the bald golden mountain king of France is standing in your bathroom every time you leave it and turn off the light?

To understand the drift of process metaphysics it is essential to see that it is proposed as something more than a formally conceivable projection of the configurations of the previously accepted furniture of the universe into a metaphysical space expanded by the introduction of extra dimensions and items whose existence or nonexistence make no difference. As Whitehead himself said, philosophy deals with the universal, "provided that we confine ourselves to what communicates with immediate matter of fact. But what does not so communicate is unknowable, and the unknowable is unknown, and so this universality defined by 'communication' can suffice"<sup>24</sup>. Rather than conjuring such abstract dimensions, process metaphysics seeks ways of strengthening the way thought is rooted in the concrete. And Whitehead's version of process metaphysics is particularly clear about the concrete being a historical situation always already full of constructions — not a separate original sphere of lived intuition. The focus is real concrete life, but with an awareness that it is historically variable and also so complex that the work of expressing its most essential characteristics conceptually is nowhere near an end — it is probably endless, Whitehead contends.

### Conceivability and grand-scale cosmological speculation

We are still considering what it takes for a metaphysical assumption to be plausible. Classical criteria are that it must be formally conceivable and that something like the ratio between "cost" of metaphysical assumption and "yield" of explanatory power should be favourable compared to other models. What I have just been doing is criticizing these criteria for being too formal: what they require is mostly reasonable, but they are not able to reflect the material side of reasonable requirements for plausibility, the horizon of the concrete totality of a historical, local form of life.

If we have now made a move somewhat contracting the expansive speculative width of metaphysics not into drops of formal grammar but to assemblages of middle-sized

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<sup>24</sup>A.N. Whitehead: *Process and Reality*, 1929/1976, p.4

material bulk — local concrete matters such as the free standing machine and its operator or the machinic and human agencies mingling in the production and use of radar equipment — then we probably need to make it clear that this does not make cosmological speculation a foreign element. Creative cosmological speculation on a grand scale plays an important role in Whiteheadian process thought, as well as in Bergson and Schelling, just as in fact it does for the dominant substance metaphysical tradition. Cosmology is as inescapable as metaphysics, but it can implicit or explicit. Even if we were to claim that there is nothing but local practical matters, this would be very much of a cosmological statement. Actually this is exactly what Whitehead's process view claims — with the provision of Whitehead's careful expansive explication of what local practical matters involve, of course — even while boldly admitting that the issue and concern is cosmological.

A particularly provoking and interesting piece of cosmological speculation in Whitehead is the concept of *cosmic epochs* as very large families of processes sharing a characteristic set of regularities. The implication is that even the most basic regularities are variable, including the laws of nature and the systematic types of rhythms by virtue of which spatial and temporal relations can be coordinated. Whitehead calls one such local family “the electromagnetic society”, which would again be a local subfamily of “the geometric society” — something like a group of epochs with spatio-temporal geometries like ours. Whitehead's 1929 speculations on these “epochs” have a striking resonance with aspects of late 20<sup>th</sup> century Big Bang models in physical cosmology. Even though the estimated temporal and spatial extension of the physical cosmologists' epochs are tiny fractions of a second, this is just how we should expect to “observe” another Whiteheadian “epoch”, remembering that epochs are process families whose patterns and rhythms are so radically different that even the relational patterns making up extension are different.

How does this reference to cosmic matters far beyond our local practical business fit in with my contention on Whitehead's behalf, just before, that there is nothing else? It fits beautifully, when we remember two things. Firstly, according to Whitehead's process thought, whatever is a fact, even if it is local and situated, is no less full of past and history. Its local causal “universe” (its backwards light cone, in the jargon of relativistic physics), that is, the set of all completed events that have an influence on it, is all there, “repeated” or “prehended” either negatively or positively. In other words, fully knowing what a concrete situation is about is not independent of knowing about its history, even if ordinary concerns rarely take this as far as the epochs at the dawn of electromagnetic interactions, or to other kinds of epochal limits like the dawn of indoeuropean language, or of market economy for that matter — but there is in principle no limit to local concreteness in respect to enfolded histories — which does a lot to explain why local concrete situations are so complex

and full of implicit dynamisms and tendencies. Secondly, this epochal aspect of process cosmology can very well be formulated as a *reduction* of cosmological commitment, compared to the standard vision of a rock bottom of absolutely stable regularities. This is the argument we have already been playing with a few pages ago, mimicking the move of Clarke and others in the absolutist tradition to reveal a great cost of metaphysical assumption carried by the relationists. However, rather than continuing the rather formal and empty legal game of moving burdens of evidence to the other party, we could point to the positive role of expansive or generalizing speculation: we are trying out, as Whitehead says in the initial quote, how certain features of the local situation which have been brought to light in a particular kind of enterprise will work if creatively applied to what is otherwise available to us. That is, the entire “universe” under our diversity of enterprises.

Of course, as we speculate ahead into this infinitely expanding scope, the available content of positive detail fades out. I am not sure how to imagine cosmic times and places outside of the local family of related processes characterized by such laws of nature as electromagnetism. I must confess I have similar problems with imagining the size and shape of the new order produced by an evolutionary cosmos while reservoirs of measurable thermodynamic low-entropy are running down. Should new orders be thought of as breaking through to dominance in a kind of cosmic catastrophe or as gradually and softly taking over in the background, unnoticed? (I think I prefer the soft way, but nature does not always seem to respect that kind of preference... On the other hand maybe the frequency of cosmic catastrophes is bearably low if the last one was the famous Bang.) I don't have an awful lot to offer in terms of positive cosmological-poetic images myself. That may be a great philosophical task for someone with Plato's poetic gift — something like an updated *Timaios*. Parts of Whitehead's *Process and Reality* fall in that genre as well: exactly the genre that Rorty advised Hartshorne to give up.

However, what is important here is that natural philosophy can and must discuss the core structures of cosmological imagination without finally deciding about all of the colorful details of their instantiation in remote epochs, societies, etc. In fact, for Whitehead, as well as Bergson and Schelling, it would be a misunderstanding of the task of speculative cosmology to try to fill in the details of natural science in such a top-down deductive fashion.

In this context it enlightening to consider Schelling's sketch a picture of what would have been then (1797) immense cosmic dimensions, when he presented the idea of a sort of cascade of natural productivity emanating via our and other suns. The universe according to Schelling is a series of expressions in which unlimited productivity gradually gets attenuated so that it can take finite shapes. The shapes it

takes, in Schelling's picture, are themselves both products and productivity, and when they further produce, the products will be of a lower and more broken grade of productivity, down to the point of dead bodies or pure products. The suns would then be the first station visible to us, and the first and purest mediation would be, conveniently, the white solar light whose breakable unity Goethe had investigated in the *Farbenlehre*. But again, Schelling did not paint this picture in much detail, and actually the few details that are there seem to be meant pretty much as just an illustrative example. Indeed he says something important about the way detail gets filled in. The detail in the philosophical construction of nature doesn't simply get derived from first principles, nor does it simply derive from observation. The whole point of his natural philosophy is that something richer is taking place: we take part in the *construction*<sup>25</sup> of natural objects — and natural philosophy is the essential project of learning to do so consciously. This means that every detail of the cosmos must become constructed as flowing from the dynamic logic of the system, but it must also flow in real nature which is at first not conscious, so it must also be empirical. The building of natural philosophy, then, proceeds by tracing the structures of productive nature in experience, and then constructing along with it, making that structure our own. "The spirit of the true experiment" is the summit of constructive natural philosophy and of nature's self-expression in one and the same movement. (For Schelling, the structure thus expressed was bound to be organic and to be emanating from a singular, divine source of life which is the core of our own essence, too. As far as I can see this binds the vision to the dualism I criticized a few pages ago, keeping creativity in a sphere beyond the multiple local becomings in the world — or else at most to a dynamic monism equally incapable of respecting their locality.)

In Whitehead's view good and proper speculation requires not only that the scheme be filled in with details as experience proceeds, it even must let new facets of experience penetrate to the core of the system. It is an essential aspect of speculative work to avoid holding on to any general pattern, explicitly or implicitly, as beyond revision in the light of experience, just as no experience should be held beyond the requirement of interpretation lighting up universally relevant features. Such a scheme is itself a process, the ongoing project of making more coherent sense of a greater totality of experience. Its criteria of success include flexibility as well as coherence, wideness of scope, and relevance. What makes this vision of the speculative project deeply congenial to programmatically "intuitive" approaches like Schelling's and

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<sup>25</sup>This is actually Schelling's own exact words. The wording is strikingly similar to forms of 20<sup>th</sup> C constructivism. Of course Schelling's sense of construction should not be equated with "social construction" or historical construction of facts and artefacts — the anchor point of Schelling's metaphoric is constructions in geometrical proofs. However it does have some basic notion of constructive activity in common with 20<sup>th</sup> C uses of the term.

Bergson's is that the population of facts that it accepts a commitment to express and handle coherently is not exhausted by the object fields of the sciences. That is, it includes not just the theories and the theories of all the sciences and the positive observations they help select, organize and make communicable, but also various kinds of more participatory relations — experiences of what Whitehead called "overseen halves of the evidence".

This type of additional "evidence" in need of explicitation is the mediating activities of the mediators of conventional evidence. Primary examples are background bodily processes mediating the dominant senses<sup>26</sup> and background constructive practices mediating timekeeping<sup>27</sup>. Whitehead is in close agreement with these two other thinkers in the choice of typical examples of overseen halves, our own participation in the processes of life as biological organisms is pivotal.<sup>28</sup> There is also close agreement about the general character of the implications of a usually "overseen half" — it is process, productivity, creativity.

This is a deep affinity between the process metaphysical kind of principles I took as my point of departure, in the derivation of the Second Law, and the notions of ultimate stuff proposed by Bergson and Schelling. But we have departed from their appeal to *intuition* as an unwavering source of legitimacy of such principles. Or with an alternative wording, we have *modified* the usual sense of such an appeal<sup>29</sup>, affirming the ongoing project of (re-) constructing systematic thought by finding ways of incorporating something beyond the conventional notion of objective evidence. Bergson and Schelling are right that aspects of concrete, participatory bodily and

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<sup>26</sup>See e.g. Whitehead's remarks on eye and sight in *Process and Reality*, p. 121 and 141.

<sup>27</sup>See e.g. Latour on the ongoing construction of time, *Trains of Thought*, Common Knowledge, 3, Winter 97, V. 6, pp 170-191., a practical description of the patterns of construction systematically described in Whitehead's *Method of Extensive Abstraction*, *Process and Reality*, Part IV.

<sup>28</sup>Another group of participatory perspectives are the *social* ones, hardly directly treated by Schelling and Bergson and only in very broad terms by Whitehead — in later developments of the philosophy of science the social perspective comes to the foreground, of course, but rarely with the intact speculative commitment of constructing metaphysical and cosmological structures which will include sociality in a coherent understanding and further explore its overseen halves. Hegel, of course, made a veritable breakthrough in this direction, of making scientific rationality at home in its social embodiment. Some present developments in science studies are taking up this important project with new vigour.

<sup>29</sup>I change the strategy from departure to modification on the fly, while writing this sentence, because the very formulation "appeal to intuition" makes me remember Whitehead's remark "The sole appeal is to intuition," which is placed at a very pivotal point in *Process and Reality*: at the end of the presentation of the first category, the "Category of the Ultimate", the central characterization of processuality. Otherwise we would need to part company with Whitehead. But this would obscure the point I find central in this discussion: the notion of evidence as something in need of adequate channels of explicitation, and the notion of the speculative scheme as the ongoing creative development of more adequate channels. These notions are more explicit in Whitehead than anywhere else, which is why I think we should rather redefine intuition than part company with his scheme at this particular point.

aesthetic character, should be (re-) connected with the root of systematic thought. But we need not assume that these aspects can themselves be grasped immediately, without mediations. This assumption of solid immediacy, in fact, runs counter to the project of a wakeful and participatory expression of the (many kinds of) “overseen halves”, of all the underground mediations. But even if we manage to drop such “romantic” ideas of immediacy, we can acknowledge that an important step is taken when attention is directed to the content of “intuition”, concreteness, that which is not (yet) explicit in abstractions but still implicit in life, as a legitimate source of insights into the nature of things.

The trouble that still remains is of course, the assessment of what can legitimately be derived. If the first principles are not just of movement but themselves in movement, if we are not to trust that intuition will deliver them to metaphysics in the finite positive form of a set of axioms, the task of determining exactly what it is legitimate to derive from them has not become easier.

#### **Legitimacy channelled in movements of derivation**

If metaphysical assumptions are legitimate and more or less unavoidable, and if they all have the legitimate and more or less unavoidable tendency of gushing forth into cosmological speculation, the construction of an entire cosmos, then it would be nice to get a better grasp of the kind of movement or derivation in question.

When the “deductive” style of much of natural philosophy is often seen as very suspect, the most frequent complaint is that it is unscientific because it favours fixed, aprioristic dogma at the expense of direct empirical evidence. For example, a standard challenge against the natural philosophies of Hegel and Schelling — even raised by many who are otherwise sympathetic to German Idealism — is that Hegel and Schelling were simply mistaken since scientific developments after their day contradict the more or less detailed cosmological visions that they pretended to derive — visions which happened to fit suspiciously well with science of their day. But as we just saw, Schelling explicitly recognizes that the speculative vision should be “filled in” with details concrete experience. This may look even more suspect, as if speculative philosophy is trying to escape the rightful fate of its unchecked first principles by becoming more vague in its claims of positively deriving reality, and instead organizing whatever evidence that happens to turn up as its own “filling in”. We also saw Whitehead going even further, claiming not just that detailed evidence from the “outside” should be admitted “inside” the speculative scheme in the bottom layers while the first principles stay unaffected at the top, but that the speculative scheme is and should be involved in the business of creatively fitting the

top to the bottom as well as the reverse. From the position of the modern critic of the project of natural philosophy, this Whiteheadian move may seem even more of an evasion, or even like a complete abandonment of top-down natural philosophy as something different from the humble ordinary bottom-up strategy of working things out in science and daily life — the fallible, hypothesis-testing way whose instantiation in theoretical science is described by Popper, who also made the point that this is but one expression of a general characteristic of much more than theoretical science, maybe even of life as such.

Such an abandonment is exactly what it is, if natural philosophy was ever understood as something radically different from this kind of common-sense structure of science and life. Or particularly if natural philosophy was ever seen as a project separate from science, pretending an authority to prescribe what science should find. But there is something which is not abandoned, and which I believe is much closer to the real sense of the grand deductive moves in natural philosophy: the project of creatively building a *coherent* structure of thought which lights up more experience than the elements made available through particular scientific or technical projects, particularly when these are viewed in isolation from their incarnation in a real life form — practical, organic, social, etc. The requirement of coherence is a drift towards synthesis in which the most general elements sometimes have the character of fitting details of science into, even to derive scientific results from, structures which are primarily of another origin — e.g. from structures experienced in other sciences, or even in social or political or religious aspects of life or bodily experiences. Just as well as it implies that the most general structures produced by science should be tried out as principles lighting up all this “extrascientific” experience. Speculation in this sense can still very well appear “aprioristic” from a particular abstract point of view, and should have the courage to do so. “Particular abstraction” here means, considering only what is focused on as positive and relevant evidence within a particular project, a particular kind of interest, the field of objects of a particular science for example. The sense in which it should have the courage to be “aprioristic” is not just that it should invent bold hypotheses, but it should do so with a preference for particular kinds of hypotheses guided by metaphysical, cosmological, ontological insight. This insight, or prejudice if you prefer, has to do with the formal and material constraints on conceivability, as discussed in the previous section, so that it is to a large extent shaped by the structures of the form of life, even if it is essential that it is creatively mediated by the speculative process itself, doing previously unseen things with these forms and matters, educating previously unseen or unspeakable structures in them.

I think we have a new, much more dynamic and interesting image emerging here, in Whitehead’s model of what natural philosophy is trying to do (admittedly, with

strongly variable degrees of success). And I think the real contributions to natural philosophy make more sense when read in this light.

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What sense could it make then, in terms of transfer of legitimacy, to derive the second law of thermodynamics from Whitehead's scheme of process metaphysics, or from Schelling's for that matter?

Firstly, it is hard to see that there could be any transfer of legitimacy or credibility "downward", from principles to matter. The "top" of the system, for Whitehead, is not even a fixed principle based in unquestionable intuition, but a result of an ongoing attempt of synthesizing a heterogenous and historically variable bunch of experience forms. Whereas that which the deduction leads "down" to is a well established principle of physics hardly in need of this kind of support.

Secondly, legitimacy does not legitimately travel "upward" according to classical rules of inference — at least not without a formal recognition of Peirce's still debated suggestion of a productive logic of "abduction" or inference to best explanation, a suggestion which bears a strong blood relation to Whitehead's notion of a speculative metaphysics which is itself in process, and also contains an echo of a Schelling-like sense that such productive reasoning is allied with an intuition of what is "naturally simple"<sup>30</sup>. Without that kind of criterion, which already enfolds a more or less explicit notion of the character of ultimate stuff, we cannot support anything by deriving known truths from it. However, this goes for any first principle, not only this attempt of explicitly formulating a process metaphysics. For example, if formally we have no warrant for claiming "abductive" evidence for process metaphysics in the fact that it implies the Second Law of Thermodynamics, the statistical standard derivation of the Second Law produces no support either, for the claim that ultimate stuff is stable deterministic particles.

When the "derivations" of mainstream and alternative traditions of philosophy of nature have something worth listening to after all, it must be something different from the isolated formal derivations downwards or inductions upwards that its proponents sometimes seem have claimed to offer and its opponents traditionally debunk. Rather than transferring given legitimacy in one direction, down or up — as in the ideal cases, when geometric proofs are constructed out of axioms and ultimately simple elements, or when a generalizing statement is made over a well defined set of unambiguous elementary facts — what is happening is much more like a fitting together, a tinkering with nuts and bolts, and a test drive. Legitimacy, then,

must lie in the coherence, flexibility and relevance of the construction, its ability to *cope*, rather than flow from sources beyond it which it might claim to have more or less *privileged access* to.

### Metamorphosis, cosmos and polis

It is told that Schiller and Goethe were once on a walk, discussing Goethe's idea of the *Urpflanze*, the original plant, from which he argued that all plants — or at least all flowering plants — must have descended under morphological transformations of a basically common structure. Goethe was of course very much a participant in his time's reaction against *Verstandeswissenschaft*, the ideal of a science based on abstraction, formalism, external relations, and immutable objects and laws, paradigmatically represented by Newtonian mechanics. For Goethe it had been an important project to unfold an alternative ideal of science which would stay as close as possible to the concrete, living, colorful world of experience. Now, on this walk, Schiller pointed out to Goethe that the *Urpflanze* is not something available in actual experience at all, and Goethe is said to have suddenly realized with enthusiasm that, indeed, this is not an experienced item but an *idea*.

I take the sense of Goethe's realization to be that his program of a science staying with concrete life was really about something very different from the empiricist epistemology which was already a close and natural ally to the newtonian mechanist ideal of science. What is empirically available in that tradition's sense is the array of separate, singular registrations of momentary content, ideally represented by the A and B type experiences in Hume's famous empiricist reconstruction of causality, or by the clock-and-position readings of certain mechanical experiments or astronomical observations. (Of course there could be qualitative botanical or astronomical observation just as there were optical experiments which do not count as committing this sin of immediately reducing the phenomena to shadows fitting the abstract schemes...) Goethe realized that the way to characterize the new and more living kind of scientific enterprise he wanted to help bring about was not a modification of the balance between abstract formal theory and abstract atomized evidence, but exactly something participatory or intuitive that he took to be prior to both.

Goethean intuition, or apprehension of the *Urpflanze* as an *idea* in his own sense of the word, points to the kind of insight that he thought allowed him to grasp the reality of evolution without positively observing all of its results let alone its movement through them. Of course there is an important "empirical" job to do collecting relevant evidence, such as specimens of plants, fossils, rocks (and as

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<sup>30</sup>C. S. Peirce: "Abduction and induction", in *Philosophical Writings of Peirce*, p. 151-6.

Goethe's own example shows, the true inspired scientist should certainly not be aloof and apart from that job, it is rather necessary that he has its multifaceted sensual reality close enough, it may well be in the resistance of the digging rather than in the calm effortless observation in the natural history museum that the empirical really gives itself to him) and also abstract classification schemes are useful tools, guiding the collection of facts. But once there is a sufficient row of facts or specimens, it is intuition that makes the leap into them, so to speak, making contact with the life that connects them. This is possible exactly because their life is part of ours: we have, or are ourselves, an echo, if not of each particular plant species then of the general history of a life form in gradual expressive, convoluting and complexifying metamorphosis in response to the resistance it meets in its environment. This idea of the concrete actual life being full of past(s) and history(ies), even to such an extent that it "repeats" roads taken long ago, like an embryo repeating phylogenesis, is of course deeply congenial to the Whiteheadian notion we discussed a few pages ago, of the actual local process repeating patterns that happened even beyond our "cosmic epoch": for both Goethe and Whitehead it took work, whether described as "poetic" or "speculative", to bring forth such echoes to significant expression in the midst of a situation where other patterns dominate. This cosmological structure is also deeply congenial to two other moments of Goethe's world picture: Firstly, the life history of the human individual — such as Faust or Wilhelm Meister — as a series of "broken teleologies" in which great expressive life projects suffer and even disastrously break down as they encounter resistance from the grounds and seasons of life, enabling and necessitating the transformation into a new, deeper and richer life project. Secondly, the nature of light shows the same structure in Goethe's view: the rich colors of the concrete world arise when the white light meets resistance, is broken by the *Trübe*, opacity; hence Newton and others are wrong in taking light to consist of corpuscles with primary qualities that are sensed by us as color. Clearly the common structure of all three cases is that true nature is in the meeting, transforming and self-expressive process rather than the pure poles (e.g. white light or unbroken earth).

I am dwelling a bit on Goethe's vision not only because I find it very beautiful but also because it illustrates what we were discussing a moment ago: the close connection between a metaphysical principle and a cosmology. In Goethe's case the metaphysical point is expressed as already completely embodied in cosmology, there is no question of deriving it. You may even say that the task of deriving the principles sort of backwards fell on shoulders of people of slightly smaller poetic genius like Schelling.

Goethe was right about biological evolution (he is even acknowledged by Darwin in the *Origin* as one of the few who had already expressed some of the main structures

of his theory<sup>31</sup>), this is pretty uncontroversial today, just as it is pretty clear that he was wrong about the nature of light.

Do Goethe's suggestions make the abhorred "transgression of boundaries" when they claim or propose the validity of intuitive and speculative insights within the fields of particular sciences? Can we take such proposals seriously, as a legitimate expression of philosophy, without incurring such sin ourselves? Probably many will find that Goethe's speculations on biology do not transgress boundaries as badly as the ones on light — but if we assume the role of guardians of scientific methods and boundaries it would look a bit funny for us to accept something as methodologically proper if and only if it arrives at the results presently accepted as scientific truth, no matter how. Goethe did of course work in an environment where there were not quite so many well defined boundaries to transgress. Thus, we could argue, with Foucault, that there was no such separate object as *life* before Lamarck, and hence obviously no biology. I prefer to say that Goethe didn't really talk of biology but of cosmology — because, to the admittedly limited extent that there was a science of biology, that discipline was defined by the task of classification. The discussion of dynamic relations between the classified items was outside that science, a loyal interpretation of them, rather like our discussion of a reinterpretation of the second law of thermodynamics. On the other hand, it is difficult to avoid the conclusion that the *Farbenlehre* was indeed making claims within the limit of the established science of optics — and even if much of it can be resurrected in terms of artistic understanding and production of rich phenomena of light, shadow and color, the failure is inescapable at the point where Goethe directly attacks Newtonian optics by means of "polemical" and "crucial" experiments — and fails to realize that his well described and perfectly repeatable outcomes of these experiments are in full accordance with Newton's optics.

No matter how much of this work we will count as science, and how much as failed or even illegitimate attempts to do science, it is certainly interesting as philosophical cosmology. It is a vision of the ground we walk as not just a resource of materials for mechanical treatment but also full of histories, a historical life that embraces ourselves as participants — cf. Goethe's famous enthusiastic discovery of the *os maxillare* securing us humans a membership in the mammalian tree of branching morphological unfoldings. It is also a vision of human understanding and creative activity as typical of the basic structure of happenings throughout the cosmos, even if particularly outspoken life.

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<sup>31</sup>Charles Darwin: *The Origin of Species*. Not all structures were there of course, natural selection never seems to have occurred to anyone in the German speculative tradition — although I agree with Taylor that Hegel almost got it with his stress on the negativity of "the Earth's unrestrained violence" working on the Genus rather than the individual.



Cosmological speculation in this sense is closely connected with a political process of recognition and self-recognition, analogous to the generalized role that the Whitehead-inspired biologist Alfred Tauber claims for the *immune system as self*, stressing the constructive and even creative work of recognition as a far more vital life function than the “secondary function” of negating the non-self, and to Latour’s generalized *constitution*: distributions of memberships (positive and negative) and roles in a collective, with the important qualification that a collective is not a group of humans as roles like human and nonhuman are under negotiation in and with the constitution. Maybe with a sufficiently wide definition of politics, cosmology is politics. In any case, discussions of cosmology could be enriched by making explicit these political connotations, but even more I think real politics can benefit from realizations of its cosmological pretensions and possibilities. The (re-) discovery of this vital connection is in the air, several recent books on the subject play metaphorically on the terms of cosmo-polis (even in titles: Isabelle Stengers: *Cosmopolitiques*, Stephen Toulmin: *Cosmopolis*).

### Resourceful Being

There is a modern transcendentalist or cosmic politics which is opposed to Goethe’s vision to a remarkable degree, even if it is in many ways a late branch on the Goethe-inspired family of romantic-aesthetic counterculture. Goethe works to poetically express-and-create a participant’s access to life, earth and light, and to show that even the *Verstandeswissenschaft* of his day could betray its true meaning when used in such a *poiesis*, and I explicitly contrasted this access with the concept of *resource*, the end point of the reduction of the object as defined by a quantitative, one-dimensional, reductive, non-participatory access. Heidegger amplifies the criticism of the metaphysical structure of *resource* (which I suggest as a philologically impossible but philosophically precise translation of his *Gestell*: that which is defined in terms of being available for indeterminate *Be-stellen* (requisition) like the power in the electrical plug) and shows that such a metaphysics is not just a style of thinking in some atrophying traditions of academia but a general pattern of inhabiting the world — a cosmo-politics, really — so strong that neither thinking or practice can escape it. The *Being* available to both is on that form.

I argued, several pages ago, that our possibilities of conceiving ultimate stuff and deriving consequences from it are opened within a concrete, local situation of life, and that the space of conceivability and plausibility is incurably dependent upon this situation. The idea of a metaphysical background of pure time, pure space and simple corpuscles needed the actual experience of the early modern form of life in order to be even conceivable, just as much as the counter-idea of a background of

pure human action and existential temporality needs the experience of the late modern form — modern experience mature enough to extract and systematize the other half of Pickering’s “free standing machine” sort of relation, so to speak; this is the kind of dependence relation whose inescapability is claimed. But this claim of strong historicity in metaphysical and natural first principles would seem to undermine the very possibility of expressing anything beyond the patterns dominating the local, current form of life. Particularly, it would seem that the possibility of new insights into the nature of things, insights which might shift our politics in handling them, would be completely held in check by what Foucault called “the dark, firm web of our experience”<sup>32</sup>.

According to Heidegger, thought, imagination and action is indeed restricted by a structure or style which forms, in a very deep way, a kind of horizon. This restriction on everything which could be expressed or represented is so fundamental that Heidegger simply identifies it with *Being*: the way things (or relations or events or whatever) simply *are* within the world opened by this style of practices — in the present world, this restriction on being is the “essence of technology”<sup>33</sup>. According to Heidegger, this presently underlying structure is not only *reification* — blocking out the joint *poiesis* of nature and humans exemplified in the Greek sculptor’s respectful participation in the stone’s taking shape, *and* narrowing vision down to externally related *things*. It is rather that we have even lost sight of the concrete, determinate *things* and are left with only indeterminate *resources* — stuff whose characteristics can only be in terms of meeting preset requirements of projects — information, available energy. The 2<sup>nd</sup> Law of Thermodynamics is obviously a statement about exactly this kind of resource, it could even be argued that it is the most systematic formal statement of this type of relation. That is, when the 2<sup>nd</sup> Law is taken as a universal statement over all kinds of systems containing order or available energy, assuming one universal definition to capture them, then it amounts exactly to the systematic treatment of everything in terms of convertible, interchangeable, *resources*<sup>34</sup>. We can now see that the 2<sup>nd</sup> law was very well chosen

<sup>32</sup>Michel Foucault: *Birth of the Clinic*, end note.

<sup>33</sup>Martin Heidegger: *Die Technik und die Kehre*, Opuscula no. 1, Günther Neske Verlag

<sup>34</sup>The only reason I hesitate a bit in simply identifying the 2<sup>nd</sup> Law with Heidegger’s diagnosis of a general underlying, late-modern metaphysics of resource is that this Law also loses the naive vision of *simply available* resource which could still be read as the character of the indestructible building blocks of ideal simple mechanical systems, replacing it with the universal *decay* of resource in every spontaneous process. This could be said to recover a sense of uniqueness lost to corpuscles, atoms or elementary particles: the one-time character of the irreversible decay. However, the decay is exactly one which can be countered as long as there is more indeterminate resource to be tapped *somewhere else* to fill the hole. Also, these elementary particles etc. still vaguely carry the echo of *thingness* — if a very minimal version keeping only numerical identity but devoid of all the self-expression, uniqueness and *form* of the Aristotelian *ousia*/substance — whereas the resourceful state goes all the way to the Heidegger-diagnosed evaporation of *ousia*, breaking up even numerical identity into the platform-independent, transportable, replaceable,

as a target of metaphysical (re)interpretation. What was achieved was nothing like a reduction of the truth of the law as such, but an explicitation of the sort of relation whose terms the law operates on. It then turned out to be possible to replace its classical cosmological interpretation in terms of a unitary, unfathomably gigantic resource of low entropy by a cosmology of multiple local productions of heterogenous orders. This makes it a cosmologically interesting problem how, in practice, i.e. from the participatory point of view, something is made into a resource for something.

Heidegger's diagnosis of the metaphysics of resource has an obvious, strong affinity with the process interpretation's attempt at situating exactly this kind of resource as an idealized limiting case within a more mixed, active and anarchic reality. But according to Heidegger's analysis it is a hopeless venture to try to understand or express the kind of concreteness that *resource* is abstracted from. Resources, and the objects and practices organized according to them, is what *is* in our world. The one possibility of catching a glimpse of something beyond this kind of *being* is tracing the history of being, backwards, to the notion of thingness / substantiality at the root of Western metaphysics — which is itself already in a historical situation of disastrous forgetfulness about being. But even if Heidegger could uncover traces of earlier, different modes which were much more beautiful and intense, there would not really be anything we could *do*, practically, philosophically or politically, except for being honest about belonging to this modern kind of being, and nourishing a messianic hope that a fuller mode of being will one day be "sent".

I suggest we follow cosmologists like Whitehead and Goethe in another direction here: there *is* something that can be done, and not by some utopian accomplishment, we are to a large extent doing it already. The fabric of our practical involvement with things and processes is in fact not completely captured by the resource/project structure (Heidegger's *Gestell*) but contain a host of very different elements necessary to make that work — the ongoings that Whitehead refers to as "overseen halves of the evidence". The work of the recent decades' science studies has great cosmological significance, I believe, in making all these other ongoings obvious and impossible to sidestep in the interpretation of science. It is right at the heart of the techno-scientific projects that Heidegger saw as the beast locking us up in a being of mere resource, that we are now becoming aware of a world of agencies, negotiations, metamorphoses and becomings.

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distributed, divisible, gradually decaying resource.

If Heidegger is right that our metaphysical realities and possibilities are shot through with technology — and I think he is — then thinking must get its participatory hands on technology, just as much as Goethe stressed the participation in light and earth.

Thinking of Goethe and Heidegger it is hard to avoid the dualist image, so why not overdo it instead: Goethe walking a mountain path in his spirited friend's company, partaking of a beautiful sunset fully enveloping light and *Trübe*, stopping every now and then to absorb themselves in a rock or plant, like children. And Heidegger walking alone in the Rhine Valley by the great power plant — there ought to be smog and artificial monochromatic light to complete the picture, and he is definitely not interested, let alone absorbed, in the architecture of the dam, the hydrodynamic and electromagnetic working of the turbines, or the peculiar optical effects of monochromatic light (which would certainly have fascinated Goethe, after an initial sting of sorrow). Heidegger could join company with Rorty here, turning their backs to all of this as the dull world of technicians. But Heidegger also takes the very legitimate diabolic role of making us aware that we are not living on a mountain path any more, if we ever did: we certainly cannot continue on Goethe's track. Even if we tried we would be in the specific intensive mode of *Gestell* known as tourism. Metaphysics must wake up to find itself in a world of *Gestell*, this is undoubtedly true. But it must do more than that, it must get hands on, it must think and talk from where *Gestell* is being produced. Heidegger did not take that next step, which would have short-circuited our dualist image. We will have to do that.

This is not to say that the new story of technology emerging is one of unproblematic happy participation. No doubt the objects of Goethe's exercises in participation were more unproblematically beautiful than the ones we have to do with, and furthermore, even Goethe was not telling stories of unproblematic happiness. Pickering, Haraway and others have started to unfold the fascinating dynamics of life as cyborg, a life form in ever new configurations enfolding what used to be distinct as machinic and organic being. It is a very ambiguous story. On the one hand there is the story of capital and control growing ever more refined — circulating on its markets or fixating in its monopolies ever greater parts of what was human, conscious, social or organic autonomy. This is dark firm *Gestell* alright, also with the Heideggerian twitch that being-as-resource gains dominance in people — who might have seemed to be the ones for the sake of whom there should be resources, but in a world of resources what else could one be? But on the other hand, there is the story of the terms defining the *Gestell* relationship becoming so hybridized and multifarious that there are no clear cut polarities any more. As we give up even trying to keep up appearances of subjective subjects and objective objects, new alliances and possibilities, and perhaps most important, techno-political competences arise on the ruins. The new participatory access opened here is described with activist anger

and aesthetic creativity by Haraway, and with entrepreneurial enthusiasm by Latour, here we just extract the metaphysical or cosmological consequence which corresponds with the process interpretation of the 2<sup>nd</sup> law: the difference between *us*, the resource requirers, and *them*, the resources, is becoming ever more negotiable, fluid, historical, context-dependent. At some point it may become too bothersome to keep up the idea of a context-independent measure of general-purpose resource. This will not mean something like the disappearance of respect of natural resources, on the contrary it will mean that nature — and humans for that matter — can be exploited more intelligently and creatively, not wasting so many of their orders trying to fit them into inflexible requirements.

### Cosmological creativity

I will end these considerations with raising a point on method in metaphysical speculation. It is very important to be *creative* enough in the expression of principles. The Whitehead-inspired characterization of the process of metaphysical speculation we have been discussing sees it as a movement which is more complex than “downwards” derivations from first principles or “upwards” inductive conclusions regarding their nature. This more complex image is one of trying to generalize various structures derived from particular subfields of life and experience, that is, trying to express them in a way that can be tried out for use in more general fields beyond their “native” use; and then performing this trial by investigating if a better access is achieved. Stressing that this must happen in a *creative* manner is not so much a question of sheer novelty, it rather means that inflexible and inadequate generalizations tend to reduce and narrow the access to what is taken in, while flexible and adequate generalizations can have the value of providing a richer and more open access, in a way that is captured well by Bergson’s discussion of *creativity*.

According to Bergson, Turner’s paintings are exemplary of the function of creativity. Contrary to common prejudice, creativity is not the invention, out of thin air, of something utterly new to the world. Nothing is as easy as mixing up a few elements of expression in a way that disregards a few traditional rules of order within the field in question. In fact, Bergson says, there is no way to produce absolute disorder anyway, all existence and expression has its own orders, but let that be. Real creativity is such a great accomplishment, according to Bergson, not because it manages to disregard or overrule anything, or to introduce alternatives in the simple sense of replacing something with something else, but because it manages to truly bring something to expression that was there already in the situation but could not be lived, enjoyed or spoken explicitly. When we watch Turner’s pictures, Bergson says, we realize something about them which is *true*. We recognize it as elements of

our existence that have been there all along but not valued, spoken of, cherished, made use of in our projects of life. And of course, for Bergson, the reason it has not is obvious: we have been too busy minding businesses to do with technicalities, measurement, exchange and control, the kind of project fixation that closes our minds to the wide fields of existence which are associated with a special aesthetic and intuitive access only because they are systematically abstracted from in the kind of life and experience we cultivate.

This ideal of truthful creative expression is not just for art, it is also for thought. Creative thought is the building of concepts and metaphors for expressing aspects, relations and problems which were previously more or less impossible to deal with, maybe because of insensitivity, or maybe even because badly stated problems and concepts were in the way. It is clearly an immanent process, within the form of life, it is not and could not possibly be bringing in something from outside. For Bergson the reservoirs of untapped orders and problems in here are enormous enough as it stands.

Now, for Bergson himself, one important application of creative thought was just the kind of cosmological speculation we have been discussing, not least the interpretation of results of the natural sciences. We already know very well his key complaint about the standard interpretation of these results: it is systematically tilted in such a way that it supports the narrowing, project fixed cultivation of our sensibilities and lives. Particularly it consistently thinks away real movement, change and process. Science itself is a much more creative process than its reputation, in fact the latest discoveries and theories tend to be ever more revealing of a deeply processual nature, according to Bergson, but there is this systematic interpretation going on, minimizing and spatializing anything temporal. And, accepting the danger of repeating myself because this is important: this interpretation all happens as part of this cultivation of sensibilities, a training really, aiming at and succeeding in making us good at the old trick of the Archimedic point, at fixing things, holding on to (semi)stable patterns that allow control and efficient exploitation. This serves survival. However, Bergson seems to imply that presently survival is more threatened by our being too good at that kind of narrowing than by the opposite, so that we can learn a bit of truth from science and art without facing extinction.

The theory of special relativity is a typical case. Officially it is said to contradict the passage of time and to replace classical images of movement, time and space by some kind of generalized idea of extension in which passage and *nowness* cannot even be stated coherently. Even Einstein himself thought so. But Bergson’s intuitive insight in concrete temporality made him sure that this was a misinterpretation, and indeed there were obvious elements of the special theory which seemed to support

rather than contradict processuality. On this basis he launched an attack<sup>35</sup> on Einstein's interpretation of his own theory, claiming a reinterpretation which would reestablish the validity of concrete experienced temporality within the special theory.

Bergson's interpretation failed, like Goethe's *Farbenlehre*, but I am tempted to say that both of them were bold creative failures more full of truth than most successes. I have analysed some details of the failure of Bergson's attempt elsewhere<sup>36</sup>. In a way the error itself is not all that interesting, in any case it is no shame to have made even errors comparable with Goethe's, and in a bigger picture it is perhaps much more interesting that Bergson was right about the main drift of the argument: Einstein was wrong about the metaphysical implications of relativity, the special theory indeed supports and amplifies the notion of becoming rather than contradicting it.

All I am going to be concerned with here is what I see as the source of the error: Bergson did not manage to live up to his own very tall requirement of creativity in speculation. He took for granted a particular traditional way of expressing his intuitive insight of concrete becoming. It is from this expression, set up as a first principle expressing the nature of things, that he derived consequences that required not only a reinterpretation but in fact a revision of Special Relativity — a revision which turns out either internally inconsistent or inconsistent with experimental facts, or both. Because of this conservatism regarding the expression of intuition as principle he failed to realize the metaphysical potential of just those structures in the theory that gave him the trouble. What he could have done was to turn this trouble into a possibility, by realizing that *becoming* can in fact be given a more adequate expression by dropping the conservative form. It turns out that what needs to be dropped is the idea that local becoming entails a global temporal fact of simultaneity, but see my earlier article for more detail on that<sup>37</sup>.

Fortunately, however, Bergson's friend Whitehead found that possibility, or created it, in the Bergsonian sense of creativity. But unfortunately, while Bergson's failed attempt to deal with the matter is well known, Whitehead's elegant and successful one is enfolded in a notoriously difficult book, and has remained in there for three quarters of a century as a surprisingly well kept secret, surprising considering the interest that the discussion of temporality and special relativity has continued to command throughout all those years. Anyway, I hope to have helped it escape.

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<sup>35</sup>H. Bergson: *Durée et Simultanéité*, 1947

<sup>36</sup>Chp. 6 of this collection.

<sup>37</sup>ibid.

The standard Bergson did not quite meet in this case is indeed a tall requirement of creativity in speculation. But it is the standard that Bergson himself formulates, perhaps more clearly than anyone, although the standard can be recognized as a mode of work in great speculative projects in the history of philosophy, such as Spinoza, Leibniz and Hegel. The standard can be expressed as a method of creative speculation, closely related to the Bergsonian method of intuition as explicated by Deleuze: express overseen possibilities in the situation while overcoming false problems which are in their way. And in the case of conflicting principles, do not seek compromises reducing their radicality, but use the structures in the situation to construct new resonances in which the radical insights are augmented together.

Whitehead's philosophy is a particularly interesting instantiation of this programme, for several reasons. For one thing, it is perhaps the latest grand speculative achievement, formulated just before, or just at the time when the 20<sup>th</sup> Century philosophical climate formed stable patterns systematically against systematic thought. Also, because it has been almost forgotten there is the fascination of discovery. Thirdly, it explicitly unfolds the issue of conceiving processuality which was already an important problem on its way to the foreground in the preceding metaphysically constructive works. But, most important, Whitehead's work stresses to an unprecedented degree the vital importance of the ongoing, creative integration of science into metaphysical understanding. Science and technology being interwoven with everything in the form of life to an increasing extent, enfolded in it with ever new complexities, they do very much shape (as Heidegger correctly pointed out) the only horizon or situation available, the inescapable place within which the metaphysical process must produce its conceivabilities and metaphors. No amount of creativity voids that horizon — Bergson's point is that this is not what creativity is about at all. However, systematically taking in science and technology as precious openings for the creative process of grasping the ultimates, rather than avoiding them in order to stick with the dwindling residues of non-technological, non-scientific existence, it can be shown that science and technology enable a more radical and more concrete understanding of just those classical metaphysical structures that seemed to conflict with them — such as *becoming*.

The Bergsonian requirement of creativity does not translate into a formal algorithm which will secure that speculation proceeds without errors, transgressions, contradictions and revisions. But less will do. What the standard does secure is that occasional failures will be grand, but also that more of life's actual potentials and material forms will be grasped. The requirement is *hard working, systematic creativity* in Bergsonian terms. With a strong sense of this requirement of creativity, the project of an intuitive philosophy of nature becomes indistinguishable from the Whiteheadian requirement of a speculative scheme always itself in process under the

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double requirement of coherence and careful mindfulness of "overseen halves". Settling on notions and roles of ultimate stuff without taking this risk will not take us beyond the politics of ultimate stuff but it will be the even more dangerous strategy of making such decisions *without due process*.