Affirmative analyses of science as constructed

— resources of radical constructivism in Hegel and Deleuze.

Bergen, Sunday 21st May, 9:15-10:30 a.m.

Niels Viggo Hansen, Dept. of Philosophy, Univ. of Aarhus, Denmark.

[One or two generations ago, giving a talk on unholy matters at this point of time, during church hours, on a Sunday morning, would constitute something close to a violation of the world order. This kind of world order is still intact to some degree in rural areas like the place I live — so I am glad none of my neighbours can see me now. But...]

It has become ever more difficult to circumnavigate the critical insight that many authoritative features of our world are very much *constructed*. A classical modern critical point is that the old religious structures of authority were *mere constructions*, and hence only *seemed* to be a given and norm-setting cosmic structure installed by higher powers — now these structures are unveiled and exposed as produced by something or somebody like ourselves, for earthly purposes. This turns such structures into the kind of thing that something or somebody like ourselves are free to overturn for purposes now claimed as higher or more genuine: rationality, progress, science, humanity. Once this critical move of self-consciousness is initiated it is, however, very difficult to stop again. The inherent dynamism of self-consciousness is — as Hegel famously showed — to assert itself through the negation of everything merely positive that falls into its view. In any case, at this late hour in the history of modernity, the critical light of self-consciousness is pointed more and more frequently at even that which used to be the platform of criticism: the scientific, the rational, humanity, progress. Even these modern anchor points are now well known traditional authorities, criticised to an increasing extent as *constructions*. But does this really destroy their power? Does this late modern extension of the modern criticism of traditional authority mean, for example, that the sciences' claim of finding truth, and of contributing something important and good to the world by expanding the possibilities of human existence, is now simply unmasked as empty? And does it mean, on the other hand, that the true patriots of progress and humanity must now turn around and fight with all means the terrible critical powers that their grandfathers set loose? That they have to claim the monstrousity and heresy of

discourse that sees constructedness in progress, machines in humanity, aesthetics in science and interests in rationality — the same kind of indignant defensive claims as those made in the name of the retreating positions of religion during the first triumphant offensives of modernity[1]?

I do not think progress and science need that kind of defence. Or, even, that real living religion ever did. They do not, because critical insights into their constructedness do not really negate them in a way or sense that poses any threat to their liveliness and health. The same Hegel who pointed out the negating and self-negating dynamics of self-consciousness also pointed out that the Holy which is expressed in religion is very much a historical construct living by virtue of a social and historical medium, the Spirit. But the idea that the pre-moderns had *beliefs* about these holy matters — that it was just a question of an inner, cognitive states representing something external — is, in Hegel's view, very much a modern representation of religion, suited to filter out that dimension of religion in which the truth of the Holy is alive: the life form's collective and practical self-organization, self-understanding and self-transcendence. Now, it is well known that according to Hegel science has indeed taken over the torch of Spirit and superseded religion as the most complete expression of truth — but it could not do so if it was restricted to a life in the dimension in which religion was never really confined: representations. In this sense too I suggest we try to see what happens if we take Hegel's analyses very seriously and in a form as least as radical as his own.

The trajectory of science through design space

How can we best imagine the striving of the sciences towards truth, if indeed they have such a tendency? Like a light ray cutting through open space by the shortest route to the destination, or like a river meandering through a landscape full of local maxima and minima, sometimes blocked by a barrier beyond which it plunges down again with new power? Like a goal seeking missile or well optimized search algorithm iteratively using the magnitude and direction of the error of previous guesses to produce one of greater precision — or rather like those sleepwalkers who are famous for their automatic performance of acts indistinguishable from waking goal-directed behaviour, but who also often perform strange modifications of such behaviour on other objects: the refrigerator instead of the TV set, the cupboard or dresser instead of the water closet, etc.

---

[1] As expressions of such noble but quixotic patriotism see P. Gross & N. Levitt: *Higher Superstition : The Academic Left and Its Quarrels With Science*, 1997. A. Sokal & J. Bricmont: *Fashionable Nonsense: Postmodern Intellectuals' Abuse of Science*, 1998

If we do not completely renounce on truth as an illusory dream, or claim to own it already — that is, if we take it as a reasonable hope and goal for scientific processes — then there is a family of metaphors that lie so close at hand that it takes some effort to avoid them. They have been discussed and criticized in more or less succesful philosophical attempts to overcome their naivity. It is the family of spatial metaphors like the ones just mentioned, all of them sharing the basic intuition that one is situated somewhere in a space or landscape and that truth is at some other point in it, so that the progress of science is like a route through this space, more or less continuous or broken, more or less teleological or shaped by swerge and randomness.

There are not many enthusiastic supporters of the simplest, one-dimensional version of such a spatial imagination of the sciences' approach to truth, but do we have a real alternative? Do we have anything but a sligthly decorated version in which one dimensional cumulative progress is expanded into a multidimensional idea of a spatial trajectory? Perhaps branching and "punctuated" or even with dead ends, perhaps in a space representing possible modifications of not only theories but of practices too — but still the intuition is basically that of a movement striving towards the point of truth in the space which is, in a neo-darwinist metaphor, "design space" for a given science.

What I propose to consider is that there is no design space to move in. Or perhaps better, that the space of possible designs is a construction spanned by a real concrete form of life in and with technology and science — by the negative experience that something is missing, and by the resulting attempts to imagine variations of different components of the real. My point is that the calm space of possible states and positions does not exist independently of local, concrete and creative processes inhabiting it, and that no constructed space of variations is large enough to contain the profound emergence and transformation of real interesting developments in science. In other words I think there is something seriously misleading in the imagination that the principles of the digital computer existed in some kind of background structure of the world before the 20th century. The — admittedly very objective — existence of such principles comes about through a certain kind of problems in a certain kind of life form, through the kind of late modern entangled objects, groups and projects well described I think in Pickering's "Post WWI regime". The idea of the nonexistence of design space is the insistence upon a very strong moment of *emergence* in the process of science, not just in the sense of creative minds of scientists but also in the sense that concrete historical situations may have a moment of emergence beyond the consciousness of researchers — in fact part of the point I will try to make is that consciousness is always too conservative, never constructive enough.

A nicer and more positive formulation of the same proposal is that we consider the possibility that scientific realities are more than just constructions, they are constructions in a particularly strong and interesting sense. Not just assembled out of elements already at hand[2], elements which could have been combined in a number of other ways, they are processes in which the elements — elements of theory, objects, practices — are themselves in the historical process of becoming. The elements take shape through the developing network of relations they take part in, they cannot stand calmly and quietly at the side line as requisites, background, border conditions. In short, in a sufficiently strong constructivism elements are at least as constructed as assemblages. As a simple but powerful model of this kind of relation-dependent elements, remember the Leibnizian relationist analysis of the points in physical space.

[It is difficult to avoid using the imagery of science as moving in a field of preexisting options and elements. Even those who have made important contributions to a more relational and processual analysis sometimes use this kind of imagery, presumeably as a kind of first approximation. This seems to be happening, for example, in Pickering's drawings of the combined spaces expressing the possible future combinations of agents and objects, or in Latour's list of theoretical, experimental, economic and political elements at hand for a game in which techno-scientific programmes compete by seizing and fixing as many as possible in their network.]

Sustainable constructivism

Authors like Latour and Pickering are proponents of a constructivism which gains much in sturdy realism by being sufficiently radical (in contrast to a more "conservative" social constructivism which becomes anti-realist because of its eagernes to keep a realist anchor point). The weaknesses of constructivism, in my view, tend to appear where proponents are reluctant to take constructivism to its fullest consequence. My concern here is not to pick on a few places in Pickering and Latour which may be (mis)read as less than totally constructivist but to try to use some

[2]This is not a denounciation of the point (Pickering, Latour, and others) that developments in science and technology have the character of "tinkering" in a histocial situation, in all its contingency and locality, with methods just as local and contingent. What is denounced however is the metaphysical assumption that the historical, local, contingent situation consists of a collection of elements which have a character which is independent of the way they are digested by further processes. The historical process in which steam engines are being "tinkered", for example, does not only presuppose the existence of "fuel" as an element in the situation, it gives a new, determinate sense and role in which certain things can exist, from now on, as "fuel".

philosophical resources to characterize a radical project which is, as far as I can see, very much theirs. I hope the use of these resources may help showing that the reactionary antiscientism that some have thought to see in constructivism is a consequence of not thinking constructivism radically enough.

First, I would like to point out that strong constructivism sees in the scientific process a kind of autonomy which does not appear to the eyes of a more moderate, compromise-seeking constructivism. The practical and theoretical work of building techno-scientific "assemblages" cannot be understood as simply conditioned by external factors such as social relations — in other words it cannot be understood as a subject similar to the sleepwalker I mentioned in the beginning, stumbling around in a furniture shaped for other purposes or by other powers and guided by misrepresentations, in a false consciousness, of the real furniture. It cannot, because it is its own work that shapes the furniture. In this view the process of science has a quite strong kind of autonomy in the power of creatively transforming the world, not just moving around externally related elements in a way which may or may not suit a given purpose. It is not in spite of this autonomy, but by virtue of it, that constructivist expressions of the claims of truth and rationality of science can be given. As you may know this is very much Hegel's project, and I will return to it later.

Let me try to make the proposed idea of construction a bit more workable through an example. Michel Callon points, in a recent work, to a peculiar relation of "embeddedness" between concrete economical reality and economical theory, a relation of embeddedness of a completely different character, in an important sense exactly the reverse, of the one that most of us will be constructivist enough to accept. Of course, we would say, economics (the theory) lies in a bed of economy (the market transactions), and most of us may also find it obvious that it lies there in such a way that not all moments of real transactions can be reached by the limbs of the theory, and that even some of the real transactions condition the theory in a way that is systematically overlooked in the picture the theory draws. If, for example, more internal and so-called "personal" interactions such as gifts, theft and ordinary helpfulness — and perhaps more generally the ways of life in families, classes and local traditions — are things which underlie the possibility for some individuals to sometimes act in a market in the form of "calculative agents" whose behaviour is described by a certain kind of economical theory, then it is trivial that this theory can only be true under a number of border conditions and ceteri paribus clauses. If it is the case, furthermore, that a certain bourgeois economical theory of the market is systematically filtering out other economical interactions even while these interactions have the form of interests which motivate, consciously or unconsciously, certain groups, classes and institutions to disseminate this theory, then we have a case of the classical criticism of the theory's constructedness: the theory of the market activities

of the calculative agents is then socially constructed in a seriously problematic sense. This is a criticism whose seriousness and relevance I do not question at all.

But Callon takes constructivism one step further, a third and very important step, beyond the talk of "embeddedness" in this double critical sense, that 1) calculative market activity is embedded in a much greater field of human/natural non-calculative activity of more or less economical character and 2) that the theories themselves are essentially conditioned by this background in a way that they are incapable or unwilling to make explicit. This final step is 3) that the economical theory is a way of "formatting the agencies" so that it is an efficient link in a widely distributed process of channeling and education which brings it about that institutions, individuals and perhaps other agents *become* in such a way that the market structure assumes a main role. A further interesting aspect of Callon's diagnosis is that this main role which involves the "*disentanglement*" from traditional non-calculative involvements which has often been pointed out by critics of economical theories and realities — but according to Callon it involves at the same time the production of new forms of "*entanglement*", new forms of agents' stronger and more internal involvement in one another, or to put it more simply, new forms of life and community.

This third step gives Callon's constructivist analysis an essential affirmative point. Radical constructivism expands the question of scientific truth and objectivity in such a way that *representation* of elements of the given situation becomes unimportant compared to the process of *bringing about* elements for a situation to be given. Classical economical theories, such as Adam Smith's, are not completely or partially true as a picture of an independent economical reality, but as something much stronger, namely as a mobilizing, channeling power aimed at a market agency which is constructed rather than represented. Perhaps something similar should be said of Marx's theories, but in relation to a different set of economic institutions and subjects. In some of my own previous work I have attempted to interpret Newton's absolute concept of time as an effective power in the formatting of a set of physical events as manageable and exchangeable within a universal system of transportation to be extended beyond contingent local limits and privileges. In this way, constructivism — which appears in its first fearful utterances to be destructive of positive interest in science, under the "disclosure" of its autonomy and objectivity as "false" — can become much more enthusiastic about the sciences' grasp of the real world and much more interested in its technicalities.

Hegel's philosophy of science and nature

A sufficiently strong constructivism completely collapses the difference between construction and reality. In philosophy, this kind of thought is traditionally known as idealism. I don't really think idealism is as bad as its reputation, and perhaps it is not

avoidable at all, but embracing it with open eyes has the advantage that we may combine it with some mature form of "materialism" in order to avoid a fatal restriction of the understanding of the process of construction, the restriction which takes for granted that the source of the process lies in etheral matters like consciousness or cognitive structures. Although it has become almost mandatory to denounce idealism and associate it with solipsism, a narcissistic withdrawal to the self sufficiency of subjectivity or the uncritical affirmation of its autonomous expressions, many still remember that the work of unfolding idealism once resulted in a system of useful models and approaches to complex, reflexive, historical phenomena. Hegel's system is, above all, a thinking through of construction and constructedness, of construction processes from within and below so to speak. Applying this system to science, Hegel is led to a double conclusion: to a strong affirmation of science as the most complete medium of the spiritual process, but also to a sharp criticism of many forms of science and particularly understandings of science, for not reflecting the dynamic and the concrete.

As the most complete medium of Spirit's — the entire life form's — self-expression, science is capable of producing truth in a very complete sense: speaking from the depths of the nature of things, as if it had participated in their making. Of course strong constructivism implies that it does indeed participate in their making. However, the story is a bit more complex than that, fortunately, because there is no such thing as a preexisting cosmic subject who has already made everything — rather subjectivities are themselves shaped by the processes of expressing and digesting other things. Therefore, science is not just a substitute for an original wisdom which might have been found within.

And therefore, science can only work in complete immanence, within the structures of the total life form as given so far. It cannot reach beyond them — or it can only do so because they are unstable and incomplete in a way that is already in the process of forcing them beyond themselves. For example, Hegel analyzes Newtonian mechanics as an expression of a particular historical form of consciousness, "understanding", and its *interest*edness. This interest takes the form of a self-satisfaction of a dry, empty, ahistorical character. Hegel points out, as Kuhn and many others have later done, that the fundamental laws of mechanics are so abstract that they are very close to explaining nothing at all — as Hegel says, on their own abstract conditions they may always just as well explain the opposite. An immanent critique of abstract mechanical explanation, in other words, leads to the discovery of implicit, local, and in the light of the "understanding" completely arbitrary border conditions. However, for Hegel the immanent critique does not just end with this negative result but continues into the realization of the more complete and concrete framework which was implicitly depended on in order to save the phenomena — or

rather the power of explanation. In fact, this implicit dependence as well as the *interest* in explaining the phenomena are themselves the beginning breakthrough of a more complete subjectivity, which is in Hegels words the *truth* of the previous one (in the way Hegel claims it to be generally the case in the transitions brought about by immanent critique). For the mere understanding, the source of the interest is not yet visible. Its own driving force, the satisfaction of the interest, can hardly be expressed at all[3], and it only becomes visible as the "understanding" subjectivity gives way to some of the stuff it is "embedded" in. Hence, in the *Phenomenology of Spirit*, the main chapter on *understanding* (where knowledge is the main issue and newtonian science is the paradigmatic character) culminates in the transition from consciousness to self-consciousness (where the fight of dominance and recognition is the main issue and the master and the slave are the paradigmatic characters). In short, dominance is the hidden truth of the mechanical understanding of natural (or other) phenomena: mechanics is the paradigm for a particular kind of construction of objects, and according to Hegel it is also, underneath that which is still the surface, a corresponding construction of subjects, both of the polarities shaped by an axis determined by the relation of dominance.

This diagnosis of the scientific adventures of an "understanding" type of subjectivity does not sound very much like the kind of affirmation that would flatter many physicists, in fact it sounds pretty much like something well captured by our metaphorical image of the sleepwalker. The scientific structure that used to be the very idea of scientific achievement and the great example to follow, is depicted as depending on a kind of ignorance on another level, a picture rather akin to Goethe's characterization of the reductionist chemistry which believes itself to be able to understand chemical processes and process patterns on the basis of an alphabet of corpuscular, elementary parts:

> *Encheiresin Naturae nennt's die Chemie,*
> *Spottet ihrer Selbst und weisst nicht wie.*
> *Hat die Teile in ihrer Hand,*

[3]But see Moritz Schlick *The Foundation of Knowledge**** for an admirably thorough analysis of the process of science viewed as proceeding in a space of abstract representations and explanations. Schlick's radical and explicit adherence to the principles of the classical programme of logical positivism allows him to make his analysis so accurate that it ends up identifying with great certainty the only possible driving force of such an abstract process: satisfaction as an inner state of consciousness achieved in the retrospective contemplation of an accordance between memories of theory-derived predictions and representations of elemental observations.

Fehlt leider nur das geistige Band.[4]

However, this short and famous Goethean diagnosis of the science of the "understanding" consciousness also contains, in a seed form, the other moment which makes Hegel able to radicalize constructivism to the point where it turns into new affirmativity. If reductionist science — or science understood as reductionist — was ultimately outside the living or "spiritual" connectedness referred to, then perhaps it might be wrong, and it might perhaps be in a sad, deplorable state of delusion, but it could not, as the poem says, "mock itself". The reason it can do so is that its own nature *is* that spiritual connectedness.

However, it is important for Hegel that we do not just lean back now and openly enjoy the previously secret and forbidden idealist self-satisfaction which lies in the simple being-at-home — i.e. in simply recognizing the footprint of our own essence in the wonderful shapes and movements of nature, or for that matter, the footprints of nature in our own cognitive apparatus. Even if there is indeed such deep and significant connection of the essences, this kind of naive idealism comes about by overlooking the dynamics which is the core of the blood relation which is simply claimed or felt in naive idealism. And it is this dynamism — the dependent co-origination, to use a Buddhist phrase for what I think is very much the same kind of subject-object constructing dynamics[5] — it is this dynamics that Hegel wants us to become awake and lively participants in.

The Hegelian vision of the dependent co-origination of forms of nature, science and spirit is that spirit is neither at home or a stranger in nature, but that spirit and nature are rather two sides of an interaction which has the shape of a violent drama: love, death, lostness, salvation through self-sacrifice and transformation. Homeliness and strangeness are moments set by this process, not fixed characteristics of any object or subject but rather stages in the subproces defining temporal subject-like and object-like poles.

---

[4]Goethe: *Faust*, 1. Teil, Studierzimmer, v. 1937-1940 — lines quoted by Hegel at several occasions.

[5]The point that subjects and objects are "dependently co-originated" in a construction process without any substantial basis is made with particular philosophical depth and thoroughness in the influential Madhyamaka ("Middle Way") school of Mahayana Buddhism. The famous thesis of Shunyata, "voidness", concerns this active groundlessness and not a nihilistic claim of changelessness or the like. The central philosophical expression is the *Mulamadhyamikakarika* by Nagarjuna (approx. 150 C.E.), a recent philosophically oriented translation and commentary is J.L. Garfield: *The Fundamental Wisdom of the Middle Way*, Oxford U.P. 1998.

(To the kind of subjectivity Hegel calls "Reason" self-recognition is still only this incomplete form that makes the process of co-construction implicit. This is the background of Hegel's famous claim of the cunning reason which guides the intellect in the understanding of nature, leading the interest on to ever more adequate forms of nature — that is, from simple mechanical ones to rich, organic ones in which constructive activity becomes visible)

Hegel who just seemed to deny all autonomy and reasonableness in a science following the externalizing pattern of Newtonian mechanics, can now seriously praise this science as an important link in a great system of scientific truth. Mechanics can be situated within a context that gives it a depth and sense to which Newton and other mechanicists have, in Hegel's view, been blind — even if it is part of our implicit common experience. To give scientific truths such a sense is to show them as organs, as it were, in a systematic construction which will make explicit this great context. This is philosophy of nature.

Hegel's philosophy of nature is a "system of levels" — one "implying" the other — from the simplest to the most complex forms culminating, ultimately, with the historical form of life, Spirit itself, at the point in Hegel's overall system's structure where the *Encyclopedia's* second book, on nature, passes into the third book, on religion, culture, legitimacy and politicial structures.

Many have read the philosophy of nature as an attempt — and hence necessarily as a failed attempt — to derive the entireity of nature from first principles, known from intuition. Something like the way geometry is a sequence of deductions from a set of axioms whose truth should, in the classical view, be available and unavoidable for all rational beings. A construction following with necessity from an unconstructed beginning, so to speak. But it will be clear to anyone who reads more than a few excerpts of Hegel's philosophy of nature, that this is not at all what Hegel is doing. In contrast to Schelling who did indeed ground his philosophy of nature in an unconstructed beginning, the intuition of pure processuality, Hegel is constructing the system of nature without a basis. I will try to explain how this can be done.

Schelling's philosophy of nature, in many ways closely related to Hegel's, is litterally described by Schelling as Spirit's "construction of nature". First, of course it is necessary to note that construction is used in another sense here than that of present day discussions of social constructivism etc. At least it takes a few considerations to see that there is a deep familiarity between the two kinds of constructedness — metaphysical and social — which I think there is indeed. Schelling's use of the term "construction" is a metaphor whose source is the way that geometrical proofs and figures are put together out of the "Elements". Schelling's own project of a "rational

physics" is designed to show all the findings of the sciences to possess a deep inner coherence transcending what is available to the more narrow local abstractions. As we break through to a fully rational way of knowing we can reconnect with sensibility and intuition in order to see, again, the processuality and productivity which is the unitary ground in which all of nature's layers and details are constructed by inner necessity. At the same time, the sharp distinction between empirical knowledge and aprioristic construction is seen to be due to a restricted understanding of both — speculation is said to be one with "the spirit of true experiment", because in the experiment the natural phenomenon — the magnet, the light ray, etc. — is not just represented as found, it is produced by and with the subject, and as Schelling says: the only way we can fully know something is by doing it ourselves. [This is also the refrain of an old boy scouts' song.]
As in the geometrical constructions. However, Schelling's philosophy of nature is the intellectual process of finding everything to be an agency which is also ours.

The interesting thing to be learned from a comparison with this Schellingian programme is that if you take a closer look at Hegel's philosophy of nature the systematic construction is turned "upside down" in an important sense. Schelling grounds the construction in that which is for him the most concrete and most certain, the pure process or productivity, the pure light, the first source of the cascade of "products which are themselves productive" that constitute living nature — and whose last and lowest step is pure externality, the pure product: extension, mechanics, dead matter.
In Hegel, on the other hand, the entire construction is hovering in the thin air of abstractions. At least in the following important sense. Rather than beginning with a postulate of a safe, available and unconstructed basis, Hegel begins with that which is to turn out to be the most constructed and abstract: pure extendedness, space. Then follows, only slightly more concrete, time, then kinematics, and then as the most concrete in the very abstract mechanical world, forces. Just as in Schelling's case this whole level of mechanics is the most externally related and dead, furthest away from concrete participatory life. But by making this the beginning, Hegel emphasises that natural philosophy is groundless, that is does not have and does not need a basis outside of the concrete historical process of science. It is in the scientific and technical approaches to nature, not outside of it or in spite of them, that philosophical appropriation of nature is possible. This is, at the same time, a point about what metaphysics is and should be: it is homeless, it does not have its own domain anywhere in the world but always works immanently in the forms that the spirit of the time has at its disposal — and one of the most important places that these are forged is in science and technology.

There is a great and important task in finding out how much of the philosophy of nature that can and should be transformed in the light of the radically transformed stock of scientific facts that is available today, and how deep into the carrying philosophical structure such a transformation should be allowed. We cannot really take up this task now and here, but according to the programme of metaphysics as itself immanent and constructive, it seems that the transformation should be allowed to go very deep. Deleuze's radical criticisms and extensions of Hegel's thought seem to me one of the boldest and most interesting attempts at doing so in towards the end of the 20th century. Whitehead did something similar in the beginning of the 20th century. Maybe the present heirs of the Hegelian programme are people like Andy Pickering (I say this slightly to tease Andy who will be unfomfortable, I know, by the weight of the old master thinker on his shoulders...)

There are three Hegelian points I think it will be useful to make before I close these considerations with some radicalizing moves due to Deleuze.

First, I would like to point out that Hegel's affirmative-constructivist analyses of science are not an inessential side theme or illustration for his general philosophical system. In fact such points are explicitly used as carrying structures everywhere in the system — not only in the Philosophy of Nature but also in the Logic and particularly in the Phenomenology of Spirit. This is a feature which makes the relation of hegelian thought to its time radically different from that of Heidegger, for example. In Heidegger's writings there are hardly any references to contemporary science and technology, hardly any trace of the 20th century at all, whereas Hegel's writings readily betray their time of writing this way — a feature very much shared with Deleuze.

Secondly: when such structures of science are treated philosophically, there is a systematic pattern in Hegel's treatment. It is never a question a "hard naturalism" in the sense of simply repeating a set of scientific abstractions with a certain emphasis to the effect that this is rock bottom reality. Just as little as they are declared to be in conflict with rock bottom reality. Instead it is a question of making available another way of interpreting them as an installation of a subject-object relationship, that is, a dynamic relationship shaping polarities of subject-like and object-like character. The availability of this alternative interpretation shows, for example, that the success of mechanical science does not necessarily imply a (Locke-style) metaphysics of corpuscular substances, it may just as well or even better support a (Leibniz-style) picture of the world and of science as full of concrete processuality in all cracks and corners.

Thirdly: A main example of such a Hegelian use is the concept of the organism. To Hegel it is of great philosophical significance that mechanical concepts had been developed and tried out in different fields with greatly different success, and particularly that they had the well known difficulties capturing and describing organic life, even if living organisms are a large part of experienced reality and even if they do exist in the dimension of spatial, physical things. Of even greater significance to Hegel was the unfinished scientific project of building a systematic concept of organisms, especially because it required dynamic concepts, concepts suited to handle processes without a fixed boundary, without any stable inside and outside. The contrast between inorganic and organic is really what delivers, I dare to claim, the carrying conceptual structure for the central transition, in the Phenomenology, between the abstract, mere consciousness and more concrete form of self-consciousness. For while consciousness is the form of subjectivity which is broadly understandable as an inner with a stable and unproblematic relationship to an outer — in short, *representation* — self-consciousness is the form which can handle, or at least tries explicitly to handle, in a long sequence of more or less disastrous ways, the condition that inner and outer are unstable, mutually shaping, interdependent polarities — in short, *construction*. It is important to emphasize a main feature which makes the organism well suited as a model for self-consciousness: it is not only a bunch of processes shaping and reshaping something or other, it shapes a *self*. What that means is that at some level this bunch is able to distinguish something to be produced and reproduced from other parts of the situation which will be thereby *non-self*, that which can be destroyed or repressed or digested in the process of making and continuing the self. It is in close connection with the concept of life as such a digesting, negating, self-producing process that Hegel develops the famous dialectics of recognition, showing how self-consciousnesses as well as organisms, when they strive to produce and claim their own particularity, always end up producing and amplifying, in effect, *another* self-consciousness. In other words, part of the cost of being alive is that there is always, so to speak, another life sprouting from beneath, from the hidden cracks and corners in the control of the situation that one life form attempts to have, maybe even sometimes thinks that it has. If you have children you will know what I am talking about.
(I am quite aware, as you may have noticed, that I have let the metaphor get somewhat out of control too: life is not *as if* it was self-conscious, and Hegel's central notion of self-consciousness is in fact not only *metaphorically* organic, it is much rather that whatever is alive is already — even if perhaps only implicitly — self-conscious. Therefore Hegel can point out that every consciousness, by virtue of its material life, is much wiser than it wants to be: it knows that ultimately it cannot stand at a distance of reality and represent it — it is dependent on devouring it, shaping it and fighting it.)

Now, the concept of organism is a good place to see how Deleuze tries to radicalize rather than — as most of Hegel's critics — moderating that which is to my eyes central in Hegel: the vision of strong constructivism and the violent philosophical use of elements from all aspects of contemporary culture and not least science, in a way which is more than metaphorical. Philosophical violence, I believe, is not so much excercised upon scientific concepts as with them, at least this is what ought to be happening: showing the concepts to have enormous consequences when taken beyond ordinary moderate use, when taken as Deleuze says "to their limit". In short, what Hegel and Deleuze have in common is that they are not content with thinking about, they want to think within science — insisting that science is already full of thought and metaphysical insights into the depths of life and subjectivity — and that philosophy should open eyes, language, musicality for those depths of science.

For Deleuze too, the living, participatory and processual has a strong kind of priority over the inorganic, extended and substantial. Following Bergson he readily characterizes his own thought as *vitalist*. However he is emphatically not an *organicist* for reasons we shall look at shortly. And, like Hegel, Deleuze interprets concepts, practices and instruments related to extended spaces and mechanical parts as something shaped by interests in fixing a dominant order through standardizing formatting — and again, just as in Hegel, such attempts at control have implications all way down to the roots of who the controlling subject is, and implications which are often different, in weird, disastrous or beautiful ways, from the intentions. However, Deleuze sees something more in concepts and practices to do with space than mere extendedness and externality which is where Hegel seems to be a bit in a hurry to leave it. There is also a moment of spatiality which is intimate to the living and processual and which is just the kind of thing that Hegel, according to Deleuze, is unreasonably reductive to. This moment is the multiple, the parallel, the condition that life, process and history are never captured in just one centre. Rather than just indentifying space with one homogenous topological-metrical structure adapted to the needs of mechanical physics, Deleuze has the historical advantage of being able to make philosophical use of the much richer theories of different geometries which have emerged in the meantime, to speak of not one but several kinds of spatiality which can be overlapping or enfolding one another. Some of them corresponding to a life form's grasp of some field under homogenization and control, as in the development of navigation tools and practices of seafarers, others corresponding to a hilly landscape seen in the eyes of a small nomad or even seen from a point down in its cracks and furrows where other life forms grow. Just as Deleuze is not willing to reduce space to externalization and control, he also insists on seeing mechanics and mechanisms as something more ambiguous. Machines should not just be depreciated as lifeless, frozen, externalized projects whose true nature only comes to light in the kind of concrete totality Hegel always seems to point to in the last

analysis: that of the entireity of a life form which is ours. It is becoming ever more important to grasp the uncentered and parallel life forms sprouting not in spite of and between machines, for example, but *in* them. In my view this is really not so much of a contradiction of Hegel as it is taking the full consequence of the master-slave dialectics.

A complete treatment of the degrees to which there are breaks and continuations in the relation between these two speculative constructivists is of course beyond this paper. But there is one point regarding the concept of organism which beautifully captures the shared project as well as the tension. Scientific concepts of organic life have developed radically since the time of Hegel, and Deleuze makes use of some of these new structures to further push the point that an organism is far from representing a stable and unitary string of processuality — rather it is a bunch of histories, systems and selves, and not so much in a stable balance as in a cadence of violent metamorphoses. It is important to Deleuze that we do not attenuate this insight into the multiplicity and emergence of life, therefore he may well speak of organisms, selves and even Spirit — but always under the condition of multiplicity, of another, of an omnipresent drive for not only emergence, but also transcendence and overturning of the selves. The famous postulate of one spirit which is the sense of everything, even if not there at the beginning but at the end of history, is hence a very serious treason on Hegel's part. Having shown how science, religion, art etc. live and live well by virtue of construvtive processes, an unconstructed ground seems to be brought in as the real power beind this goodness. The famous Hegelian picture of the truth as the "Bacchantische Taumel", the orgy in which no member is not intoxicated, but whose circular dance shows a final, appollonian clarity. This is where Hegel turns things upside down after having got it almost right.

So, for Deleuze at least, rather than accepting the dionysian whirls because they finally find their place in an overall circle with an appollonian unitary centre, we can affirm all the Appollo-style truths of science and technology once we learn to see how they are embedded in and shot through with dionysian life.

I cannot end this without returning to the introductory question of how to imagine the science's road to truth. Science moves closer to the truth about the world, or better, becomes more true, when it becomes a more alive participant in the construction of the world. I would like to finish with pointing to an important requirement that scientific activity must meet in order to grow in respect to this more participatory than representational form of truth. Science must risk itself, set itself and its object at risk, it must let the object be so much of a fellow that its own being is set in movement, is transformed. The formulation of this Deleuze-inspired norm for a good and lively scientific activity is due to Isabelle Stengers. In showing how the

constructivist-affirmative analyses of science can have a normative dimension she also shows that it can be truly affirmative — in contrast to some all embracing claim that science is allright because it reflects a true life on another level. This requirement is not about scientists explicitly subscribing to a programme of their science as an organic, relational process of metamorphosis with the object, that they describe their own activity in terms like Pickering's "alchemy" or Stengers' "joyful science". It is quite possible to hold an official understanding of science in classical terms of externality and representation even while engaging much more seriously and joyously with the matters. Unfortunately it is also possible for engagement and adventure to be attenuated into what Stengers calls "sad science", within the practices of research and training in techno-scientific institutions as well as in the understandings of these activities by outsiders. Perhaps "sad science" is what makes a generation of young people flee from everything to do with technology and science, because they cannot see any relevance for the great risky project of finding something deep and genuine in human life. Then they come to us and want to study only Heidegger.

Stengers' criterion can also be found as sketched in Hegel's *Phenomenology*, I think, in the description of an implicit drive in scientific inquiry through its fields in search for an object which would correspond to the self-consciousness as a counterpart it can fully recognize as worthy. But again, the sense we can make of this hegelian drive may depend whether or not all multiplicity is thought to be sublated in the process. Without true and truly recognized multiplicities and sproutings, the Hegelian version of such a criterion will have to lead us ever upwards until it finally lands us with a fully expressed and unified Spirit as the only fully acceptable object of science.

For the subjects of science it is a question of having the objects *make a difference*. Therefore, bad or sad science is just like the sleepwalker we discussed, for whom it makes no difference whether the frozen, sleeping programme is performed on one piece of furniture or another.

- - -

I do not pretend to have given inescapeable arguments that you must from now on regard science as thoroughly constructed. But I have tried to show that if we go along with the spirit of the time in its ever broader criticism of everything as constructed, rather than fearing and fighting that spirit or attempting to fence it in, what we face is not really so terrifying at all. It is not the death and destruction of truth, reason, science and progress, it may just as well be turned into an opening of richer and more sturdy notions of these ideal realities.