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DELEUZE AND THE OPEN-ENDED BECOMING OF THE WORLD

With the final mathematization of classical physics in the nineteenth century, a certain picture of the world emerged dominant, one in which clockwork determinism reigned supreme and time played no creative role, so that the future was effectively closed, completely given in the past. Although the set of equations with which Hamilton was able to unify all the different fields of classical physics (mechanics, optics, and the elementary theory of electromagnetism) did contain a variable for time, this variable played only an extrinsic role: once the equations were defined for a specific instant, both the past and the future were completely determined, and could be obtained mechanically by simply integrating the equations. To be sure, this static, timeless picture of reality did not go unchallenged within science, since thermodynamics had already introduced an arrow of time which conflicted with the symmetric conception of classical mechanics, where the past and the future were interchangeable. Nevertheless, as the history of statistical mechanics makes it clear, much scientific effort has been spent in our century to reconcile time asymmetry at the level of large aggregates with the still accepted time symmetry at the level of individual interactions.

Thus, it would become the task of philosophers and social scientists to attempt to reconceptualize the world in order to give time and history a creative role, with the vision of an open future that this implies. Although there have been a variety of strategies to achieve this open future, here I would like to concentrate on two contrasting approaches. The first is perhaps best illustrated by the intellectual movement that is today known as "social constructivism", but which roots lie in linguistic and anthropological theories which go back to the turn of the century. At the risk of oversimplifying, we may say that the core of this approach is a neo-Kantian theory of perception, in which individual experience is completely structured by the interplay of concepts and representations, but one in which Kant's transcendental concepts (of space and time) have been replaced by the conventional concepts of a given culture. The guiding image of this strategy may be said to be "each culture lives in its own world", an image central to many theoretical approaches

in this century, from the cultural relativism of Margaret Mead and Franz Boas, to the linguistic relativism of Edward Sapir and Benjamin Worf, to the epistemological relativism of Thomas Khun's theory of scientific paradigms. Again, oversimplifying somewhat, the key idea in all these theories is one of "incommensurability" across worlds, each conceptual scheme constructing its own reality so that bridges between worlds are hard, if not impossible, to build.

Although these influential schools of thought deserve a more careful characterization, this few remarks will suffice for my purpose here. If indeed every culture and subculture inhabits its own conceptually constructed reality, then the world and the future become open again. Far from being completely given in the past, the future is now unbound, the world itself becoming a text open to innumerable interpretations. The problem is now, of course, that we have made the world open at the expense of giving up its objectivity, in other words, the world becomes open only through human intervention. For some this relativism may not seem like a problem, particularly when the only alternative is believed to be a realism based on a correspondence theory of truth, a realism deeply committed to essentialism and rationalism. Clearly, if the idea of material objects independent of human experience is based on a conception of their genesis in terms of preexisting essences, then we are back in a closed world where all possibilities have been defined in advance by those essences. Similarly, if the world is pictured as a fixed set of beings to which our theories correspond like a reflection or a snapshot, then that world would be hardly capable of an open becoming.

Yet, the work of philosopher Gilles Deleuze makes it clear that a belief in the autonomous existence of the world does not have to based on essentialist or rationalist views. It will be the task of this essay to make a case for what we may call Deleuze's "neo-realist" approach, an approach involving a theory of the genesis of form that does away with essences, as well as a theory of epistemology that does not rely on a view of truth as a faithful reflection of a static world of beings. I would like to begin with a quote from what is, in my view, Deleuze's most important work, Difference and Repetition. It is traditional since Kant to distinguish between the world as it appears to us humans, that is, the world of

phenomena or appearances, and those aspects of the world existing by themselves and referred to as "nuomena". Deleuze writes:

> Difference is not diversity. Diversity is given, but difference is that by which the given is given...Difference is not phenomenon but the nuomenon closest to the phenomenon...Every phenomenon refers to an inequality by which it is conditioned...Everything which happens and everything which appears is correlated with orders of differences: differences of level, temperature, pressure, tension, potential, difference of intensity.[1]

There are several things to notice in this quote. First of all, it is clear that for Deleuze nuomena are not (as they were for Kant) beyond human knowledge. On the other hand, that which is beyond what is given to us in experience is not a being but a becoming, a difference-driven process by which the given is given. Let me illustrate this idea with a familiar example from thermodynamics. If one creates a container separated into two compartments, and one fills one compartment with cold air and the other with hot air, one thereby creates a system embodying a difference in intensity, the intensity in this case being temperature. If one then opens a small hole in the wall dividing the compartments, the intensity difference causes the onset of a spontaneous flow of air from one side to the other. It is in this sense that intensity differences are morphogenetic, giving rise to the phenomena of experience, even if in this case the phenomenon that emerges is too simple. The main idea, however, is much more general: many phenomena, in geology, meteorology, biology and even economics and sociology, emerge spontaneously from the interplay of intensity differences. Indeed, one can build an entire theory of the genesis of form (of geological, biological or cultural forms) on the basis of processes of becoming driven by intensity differences. Unlike essentialism, where matter is viewed as an inert receptacle for forms that come from the outside (transcendental essences), here matter is seen as possessing its own immanent, intensive resources for the generation of form from

1 Gilles Deleuze, *Difference and Repetition* (Columbia University Press, New York, 1994), page 222.

within. (Deleuze refers to the essentialist model of morphogenesis as the "hylomorphic schema").

However, in the page following the quote above, Deleuze argues that, despite this important insight, nineteenth century thermodynamics cannot provide the foundation he needs for a philosophy of form. Why? Because that branch of physics became obsessed with the final equilibrium forms, at the expense of the difference-driven morphogenetic process which gives rise to those forms. In other words, intensive differences are subordinated to the extensive structures (structures extended in space-time) they give rise to. But as Deleuze argues, most of the important philosophical insights can only be grasped during the process of morphogenesis, that is, before the final form is actualized, before the difference disappears. This shortcoming of nineteenth century thermodynamics, to overlook the role of the intensive and stress only the extensive, to concentrate on the equilibrium form that emerges only once the original difference has been canceled, has today been repaired in the latest version of this branch of physics, appropriately labeled "far-from-equilibrium thermodynamics". Although Deleuze does not explicitly refer to this new branch of science, it is clear that far-from-equilibrium thermodynamics meets all the objections which he raises against its nineteenth century counterpart. In particular, the systems studied in this new discipline are continuously traversed by a strong flow of energy and matter, a flow that maintains these differences and keeps them from canceling themselves, that is, a flow which does not allow the intensive process to become hidden underneath the extensive results. It is only in these far-from-equilibrium conditions, only in this singular zone of intensity, that difference-driven morphogenesis comes into its own, and that matter becomes an active material agent, one which does not need form to come and impose itself from the outside.[2]

Even at this early stage of my analysis, the contrast with constructivist philosophies should be clear. Although many constructivists declare themselves "anti-essentialist", they share with essentialism a view of matter as an inert material, except that they do not view the form of material entities as coming from a Platonic heaven, or from the mind of God,

2 Gregoire Nicolis and Ilya Prigogine, *Exploring Complexity, (W*.H. Freeman, New York 1989).

but from the minds of humans (or from cultural conventions expressed linguistically). The world is amorphous, and we cut it out into forms using language. Nothing could be further from Deleuzian thought than this linguistic relativism which does not break with the hylomorphic schema. For him, the extensive boundaries of individual entities do not exist only in human experience, drawn by the interplay of concepts, but are real, the product of definite, objective processes of individuation. Thus, the extensive boundaries that define living creatures (their skin, but also the folds the define their internal tissues and organs) are the result of complex processes of individuation (or actualization) during embryogenesis. As Deleuze writes:

> "How does actualization ocurr in things themselves?...Beneath the actual qualities and extensities [of things themselves] there are spatio-temporal dynamisms. They must be surveyed in every domain, even though they are ordinarily hidden by the constituted qualities and extensities. Embryology shows that the division of the egg is secondary in relation to more significant morphogenetic movements: the augmentation of free surfaces, stretching of cellular layers, invagination by folding, regional displacement of groups. A whole kinematics of the egg appears which implies a dynamic."[3]

So far I have made a case for a non-essentialist realism, but this by itself does not address the question of an open future. There are at least two lines of argument used by Deleuze to defend the idea that the future is not given in the past. The first one is directly related to his theory of individuation or actualization just mentioned, that is, a theory of intensive processes of becoming involving spontaneous spatio-temporal dynamisms, or as I refer to them, processes of self-organization. The simplest self-organizing processes seems to be those involving "endogenously-generated stable states", such as states of minimal energy acting as 'attractors' for a process. The spherical form of a soap bubble, for instance, emerges out of the interactions among its constituent molecules as these are

3 Gilles Deleuze. Op. Cit. page 214.

constrained energetically to "seek" the point at which surface tension is minimized. In this case, there is no question of an essence of "soap-bubbleness" somehow imposing itself from the outside (hylomorphic schema), an ideal geometric form (a sphere) shaping an inert collection of molecules. Rather, an endogenous topological form (a point in the space of energetic possibilities for this molecular assemblage) governs the collective behavior of the individual soap molecules, and results in the emergence of a spherical shape.

Moreover, the one and the same topological form, the same minimal point, can guide the processes that generates many other geometrical forms. For example, if instead of molecules of soap we have the atomic components of an ordinary salt crystal, the form that emerges from minimizing energy (bonding energy in this case) is a cube. In other words, one and the same topological form can guide the morphogenesis of a variety of geometrical forms. A similar point applies to other topological forms which inhabit these spaces of energetic possibilities. For example, these spaces may contain closed loops (technically called "limit cycles" or "periodic attractors"). In this case the several possible physical instantiations of this space will all display isomorphic behavior: an endogenously generated tendency to oscillate in a stable way. Whether one is dealing with a socio-technological structure (such as a radio transmitter or a radar machine), a biological one (a cyclic metabolism), or a physical one (a convection cell in the atmosphere), it is one and the same immanent resource that is involved in their different oscillating behavior.

Deleuze calls this ability of topological forms to give rise to many different physical instantiations, a process of "divergent actualization", taking the idea from French philosopher Henri Bergson who, at the turn of the century, wrote a series of texts where he criticized the inability of the science of his time to think the new, the truly novel. The first obstacle was, according to Bergson, a mechanical and linear view of causality and the rigid determinism that it implied. Clearly, if all the future is already given in the past, if the future is merely that modality of time where previously determined possibilities become realized, then true innovation is impossible. To avoid this mistake, he thought, we must struggle to model the future as truly open ended, and the past and the present as pregnant not only with possibilities which become real, but with virtualities which become actual.

The distinction between the possible and the real assumes a set of predefined forms (or essences) which acquire physical reality as material forms that resemble them. From the morphogenetic point of view, realizing a possibility does not add anything to a predefined form, except reality. The distinction between the virtual and the actual, on the other hand, does not involve resemblance of any kind (e.g. our example above, in which a topological point becomes a geometrical sphere) and far from constituting the essential identity of a form, intensive processes subvert identity, since now forms as different as spheres and cubes emerge from the same topological point. As Deleuze writes, "Actualization breaks with resemblance as a process no less than it does with identity as a principle. In this sense, actualization or differenciation is always a genuine creation."[4]

Deleuze criticism of nineteenth century thermodynamics should be understood in this context. By concentrating on the final, extensive form achieved once the intensive process is finished, thermodynamics failed to see that, before the differences in intensity are canceled, the final form (or more exactly, its topological counterpart) is already there, guiding (or acting as an attractor for) the morphogenetic process. In other words, topological attractors have a perfectly real existence, as virtual entities, even before a given geometrical form becomes actual. And this simply emphasizes Deleuze ontological attitude towards the world: he is not only a realist regarding the actual, but also a realist towards the virtual.

This realm of virtual entities capable of divergent actualization are only one of the several immanent resources which insure the openness of the future. I will discuss in a moment other forms of material creativity behind the open-ended evolution of the world, but before doing that I would like to address one aspect of virtual forms of the attractor type that may seem paradoxical in the context of this discussion. One would think that open-endedness is a concept intrinsically opposed to determinism, and hence that the creative potential of matter derives from a connection with chance. And yet the processes involved in spatio-temporal dynamisms governed by attractors are completely deterministic. Hence, we may have to go beyond the simple dichotomy between complete

4 ibid. page 212.

determinism and complete indeterminism, and introduce (in Deleuze and Guattari's words) "reverse causalities or advanced determinisms" between these two extremes.[5]

These intermediate forms of determinism, laying between the two extremes of a complete fatalism, based on simple and linear causal relations, and a complete indeterminism, in which causality plays no role, arise in physical interactions involving nonlinear causal relations. The most familiar examples of nonlinear causality are those causal loops known as "feedback loops", which may involve mutually stabilizing causes, as in the negative feedback process exemplified by the thermostat, or mutually intensifying causes, as in the positive feedback process illustrated by explosions or spiraling arms races. These forms of circular causality, in which the effects react back on their causes, in turn, are one condition for the existence of forms of determinism (attractors) which are local and multiple, instead of global and unique. (The other condition is a flow of matter-energy moving in and out of the physical process in question). These "advanced" determinisms may be static (yet multiple and hence local, since a system can switch between alternative destinies) but also dynamic, allowing for simple stable cycles or for complex forms of quasi-periodic behavior, as in deterministic chaos.[6] Thus, the fact that attractors come in several types, that they ocurr in groups, and that each group is capable of divergent actualization, explains away the apparent paradox between some degree of determinism and an essentially open future. On the other hand, it is important to emphasize that these deterministic processes are only one resource matter and energy have at their disposal.

There is another, less deterministic, process which is even more intimately connected with the emergence of novelty keeping the world from closing: the spontaneous formation of "machinic assemblages" of diverse elements. Deleuze and Guattari introduce the notion of "consistency" (or "self-consistency") to designate this morphogenetic process which generates new structures without homogenizing the components and without submitting them to hierarchical control, or in other words, without imposing on them a hylomorphic model. As they write:

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5 Gilles Deleuze and Felix Guattari, *A Thousand Plateaus*, (University of Minnesota Press, Minneapolis, 1987), page 336.

6 Ian Stewart, *Does God Play Dice: The Mathematics of Chaos*, (Basil Blackwell, Oxford, 1989), chapter 6.

> "Consistency necessarily ocurrs between heterogeneities, not because it is the birth of a differentiation, but because heterogeneities that were formerly content to coexist or succeed one another become bound up with one another through the 'consolidation' of their coexistence or succession...What we term machinic is precisely this synthesis of heterogeneities as such."[7]

Although this remark ocurrs as part of a discussion of the self-assembly of animal territories, it would be a mistake to think that machinic assemblages (or "meshworks" as I call them) ocurr only in animals whose behavior is highly "decoded", that is, not rigidly programmed by their genes. To be sure, a flexible behavioral repertoire does increase the ability of particular creatures to enter into complex combinations with heterogeneous elements in their environment (life does involve a gain in consistency, or a "surplus value of destratification"[8]) but meshworks can be formed at all levels of reality, including inorganic materials, as the following quote illustrates:

> ". . . what metal and metallurgy bring to light is a life proper to matter, a vital state of matter as such, a material vitalism that doubtless exists everywhere but is ordinarily hidden or covered, rendered unrecognizable, dissociated by the hylomorphic model. Metallurgy is the consciousness or thought of the matter-flow, and metal the correlate of this consciousness. As expressed in panmetallism, metal is coextensive to the whole of matter, and the whole of matter to metallurgy. Even the waters, the grasses and varieties of wood, the animals are populated by salts or mineral elements. Not everything is metal, but metal is everywhere. . . The machinic phylum is

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7 Gilles Deleuze and Felix Guattari. Op. Cit. page 330.
8 ibid. page 336.

> metallurgical, or at least has a metallic head, as its itinerant probe-head or guidance device."[9]

Deleuze and Guattari argue that the hylomorphic model is totally alien to the history of technology up to the 19th. century, particularly to that ancient branch known as "metallurgy". For the blacksmith "it is not a question of imposing a form upon matter but of elaborating an increasingly rich and consistent material, the better to tap increasingly intense forces."[10] In other words, the blacksmith treats metals as active materials, pregnant with morphogenetic capabilities, and his role is that of teasing a form out of them, of guiding, through a series of processes (heating, annealing, quenching, hammering), the emergence of a form, a form in which the materials themselves have a say. His task is less that of realizing previously defined possibilities than actualizing virtualities along divergent lines. But, again, it would be a mistake to think that the relevance of metals for the question of innovation is solely due to human intervention.

To see this we need to explain an obscure phrase in the quote above. What does it mean to say that "the machinic phylum has a metallic probe-head"? The key idea here is to think of metals as being the most powerful catalysts in the planet. (The only exception being organic enzymes, but these have been evolved to achieve that potency). A catalyst is a substance capable of accelerating or decelerating a chemical reaction, without itself being changed in the process. That is, a catalyst intervenes in reality, recognizes specific targets, triggers effects, causes encounters that would not have taken place without it, and yet it is not consumed or permanently changed in these interactions, so that it can go on triggering effects elsewhere. We can imagine our planet, before living creatures appeared on its surface, as populated by metallic particles which catalyzed reactions as they flowed through the Earth, in a sense allowing the planet to "explore" a space of possible chemical combinations, that is, allowing the planet to blindly grope its way around this space,

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9 ibid. page 411.

10 ibid. page 329.

eventually stumbling upon proto-living creatures, which as many scientists now agree, were probably autocatalytic loops of materials, that is, proto-metabolisms.[11]

A crucial question regarding open-ended evolution is the nature of these "spaces of chemical (or biological, or social) combinations". It is becoming increasingly clear that a crucial ingredient for the emergence of innovation at any level of reality is the "combinatorial productivity" of the elements at the respective sub-level, that is, at the level of the components of the structures in question. Not all components have the same "productivity". For example, elementary particles have a relatively low productivity, yielding only 92 possible atoms in this planet, although we can artificially stabilize a few more trans-uranic elements, beginning with Plutonium in World War II. However, when we move to the next higher level, the assembly of molecules out of atoms, the number of combinations becomes immense, essentially unsurveyable. Similarly, the number of cell types on Earth (nerve, muscle, bone etc.) is relatively small, a couple of hundred types, but the number of organisms that may be built combinatorially out of these elements is, again, immense. As physicist George Kampis has remarked, "the notion of immensity translates as irreducible variety of the component-types... This kind of immensity is an immediately complexity-related property, for it is about variety and heterogeneity, and not simply as numerousness."[12]

The point here is that a key ingredient for combinatorial richness, and hence, for an essentially open future, is heterogeneity of components. Another key element are processes which allow heterogeneous elements to come together, that is, processes which allow the articulation of the diverse as such. Here we can take a clue from another passage in Deleuze and Guattari's A Thousand Plateaus:

> "It is no longer a question of imposing a form upon a matter but of elaborating an increasingly rich and consistent material, the better to tap increasingly intense forces. What makes a material increasingly rich is the

11 Stuart Kauffman, *The Origins of Order. Self-Organization and Selection in Evolution*, (Oxford University Press, New York 1993), ch. 3.

> same as what holds heterogeneities together without their ceasing to be heterogeneous. What holds them together in this way are intercallary oscillations, synthesizers with at least two heads."[13]

Meshworks combine heterogeneous elements by meshing them using their functional complementarities. For example, an ecosystem brings together a large variety of distinct species interlocking them into food webs via alimentary complementarities: parasite-host, predator-prey, and others. But often these heterogeneities do not mesh well and special intercallary elements are needed to effect the link, such as symbiotic micro-organisms lining the gut of animals, allowing them to digest their food. Or to take a different example, pre-capitalist marketplaces were meshworks which interconnected buyers and sellers through complementary demands. Barter could indeed effect this meshing, but the chance encounter between two people with exactly matching demands was very rare. In this circumstances money (even primitive money such as cowry shells or salt blocks) could act as an intercallary element allowing complementary demands to find each other at a distance, so to speak.

Thus, there are two questions that connect the theory of meshworks or machinic assemblages to the theme of an open-ended future: one is the existence of special combinatorial spaces that are more open than others (for example, the space defined by carbon, an element which thanks to its ability to bond in several ways with itself, has a much higher combinatorial productivity than any other element) and the existence of special intercallary entities that open up possibilities by allowing heterogeneities to mesh with each other (for example, metallic catalysts which insert themselves in between two poorly-meshing chemical substances, recognizing them via a lock-and-key mechanism, to facilitate their interaction.) Philosophically, these two questions boil down to one, the singular nature of either carbon or metallic catalysts (to stick to examples from chemistry). Deleuze tackles this issue in a way that parallels his approach to attractors. As I said above,

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12 George Kampis, *Self-Modifying Systems in Biology and Cognitive Science. A New Framework for Dynamics, Information and Complexity*, (Pergamon Press, Oxford, England, 1991), p. 235

13 Gilles Deleuze. Op. Cit. page 189.

he proposes to get rid of the distinction between the possible and the real, keeping only the latter but distinguishing in the real between the virtual and the actual. Similarly, he suggests we get rid of the dichotomy between the essential and the accidental, affirming that everything is accidental, but distinguishing in the latter between the ordinary and the singular (or the special, the remarkable, the important.) As he writes:

> "It will be said that the essence is by nature the most 'important' thing. This, however, is precisely what is at issue: whether notions of importance and non-importance are not precisely notions which concern events or accidents, and are much more 'important' within accidents than the crude opposition between essence and accident itself. The problem of thought is tied not to essences but to the evaluation of what is important and what is not, to the distribution of the singular and regular, distinctive and ordinary points, which takes place entirely within the unessential or within the description of a multiplicity, in relation to the ideal events that constitute the conditions of a problem."[14]

It hardly needs to be added that, as a realist philosopher, Deleuze sees the distributions of the singular and the ordinary as perfectly objective, the world itself exhibiting traits that are more or less important or remarkable regardless of whether there is a human being to carry on these evaluations. Carbon and metallic catalysts are objectively unique in this sense. And so are the topological forms we discussed above, and which Deleuze refers to as "singularities". Attractors are indeed remarkable (states which minimize free energy, for instance, are rare and unique) as are the bifurcations that change one set of attractors into another, such as the special points in intensity (temperature) at which water changes from liquid to solid or from liquid to gas. Yet, as the quote above illustrates, there is a close relation between these objective distributions and the nature of human knowledge ("the problem of thought"). I would like to conclude this essay with a few remarks on Deleuze's

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14 ibid. page 169.

special approach to epistemology (an epistemology of problems), an approach that further distinguishes him from older forms of realism that are too closely linked to rationalism.

Instead of rejecting the dichotomy between true and false, thus plunging into a form of relativism, Deleuze extends it so that it not only applies to the answers to questions, but to the questions themselves. That is, he makes "truth" a predicate that applies primarily to problems, and only derivatively to their solutions. Yet, problems for him are not a human creation (and problem-solving a human activity) but possess their own objective reality. As he puts it, the concept of the "problematic" "does not mean only a particularly important species of subjective acts, but a dimension of objectivity as such that is occupied by these acts." Problems exist in reality defined by singularities, hence problem-solving is an activity in which all kinds of material assemblages may engage. To illustrate with examples we have already used, a population of interacting physical entities, such as the molecules in a thin layer of soap, may be constrained energetically to adopt a form which minimizes free energy. Here the "problem" (for the population of molecules) is to find this minimal point of energy, a problem solved differently by the molecules in soap bubbles (which collectively minimize surface tension) and by the molecules in crystalline structures (which collectively minimize bonding energy).

Given this objectivity of problems and their conditions, what may be peculiarly human is not problem-solving, but problem-posing, an activity that involves distinguishing in reality the distributions of the special and the ordinary, and grasping the objective problems that these distributions condition. Chapter Four of Difference and Repetition is a philosophical meditation on the differential and integral calculus (a mathematical tool at the heart of all modern physics) viewed precisely as a "technology" for the framing of true problems. But as the above remarks on metallurgy suggest, Deleuze does not think of representations (even mathematical ones) as the only, or even the most important, means to pose problems. Any kind of learning, even physical, sensual learning, involves an engagement with material assemblages which embody problems and their defining singularities. As he writes:

> "For learning evolves entirely in the comprehension of problems as such, in the apprehension and condensation of singularities, and in the composition of ideal events and bodies. Learning to swim or learning a foreign language means composing the singular points of one's own body or one's own language with those of another shape or element which tears us apart but also propels us into a hitherto unknown and unheard-of world of problems."[15]

Clearly, these few remarks cannot do justice to Deleuze complex theory of the problematic. I introduce them here simply to draw one connection between human knowledge and the open-ended evolution of the world. The latter depends, as I said, on divergent actualization, combinatorial productivity, and the synthesis of novel structures out of heterogeneous components. These define the essentially problematic structure of the world. It follows that truth cannot be a correspondence relation between representations and a static, fixed set of beings, but an open-ended relation of isomorphism between problems as actualized in reality and problems as actualized in our bodies and minds.

To conclude, unlike social constructivism, which achieves openness by making the world depend on human interpretation, Deleuze achieves it by making the world into a creative, complexifying and problematizing cauldron of becoming. Because of their anthropocentrism, constructivist philosophies remain prisoners of what Foucault called "the episteme of man", while Deleuze plunges ahead into a post-humanist future, in which the world has been enriched by a multiplicity of non-human agencies, of which metallic catalysts, and their acts of recognition and intervention, are only one example. And, in contrast with other realist or materialist philosophies of the past (such as Engel's dialectics of nature), the key non-human agency in Deleuzian philosophy has nothing to do with the negative, with oppositions or contradictions, but with pure, productive, positive difference. It is ultimately this positive difference, and its affirmation in thought, that insures the openness of the world.

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15 ibid. page 192.