DELEUZE, GUATTARI AND EMERGENCE

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OVERVIEW. The concept of emergence – which I define as the (diachronic) construction of functional structures in complex systems that achieve a (synchronic) focus of systematic behaviour as they constrain the behaviour of individual components – plays a crucial role in debates in philosophical reflection on science as a whole (the question of reductionism) as well as in the fields of biology (the status of the organism), social science (the practical subject), and cognitive science (the cognitive subject).[1] In this essay I examine how the philosophy of Deleuze and that of Deleuze and Guattari[2] can help us see some of the most important implications of the debate on the status of the organism, as well as prepare the ground for a discussion of the practical and cognitive subject.

All of what follows depends on accepting the strong case put forth in DeLanda 2002 that Deleuze's project in *Difference and Repetition* (Deleuze 1968) and *The Logic of Sense* (1969) – continued in the collaborative works of DG – establishes the ontology of a world able to yield the results forthcoming in complexity theory.[3] In terms I will explain further below, complexity theory models material systems using the techniques of nonlinear dynamics, which, by means of showing the topological features of manifolds

(the distribution of 'singularities') affecting a series of trajectories in a phase space, reveals the patterns (shown by 'attractors' in the models), thresholds ('bifurcators' in the models), and the necessary intensity of triggers (events that move systems to a threshold activating a pattern) of these systems.[4] By showing the spontaneous appearance of indicators of patterns and thresholds in the models of the behaviour of complex systems, complexity theory enables us to think material systems in terms of their powers of immanent self-organization.

There are four main benefits here. (1) The first is the critique of hylomorphism, that is, the notion that matter is chaotic or passive and so in need of rescue (by means of the laws of God, or a transcendental subject, or the scientific project) to provide it with order or novelty.[5] (2) We can thus avoid the issue of reduction to physics, the science whose laws predict the behaviour of 'matter' at its simplest.[6] (3) Furthermore, by modelling the negative and positive feedback mechanisms characteristic of complex systems, complexity theory thereby enables us to ground the concept of emergence in the effects of such mechanisms (Silberstein and McGeever 1999: 197). (4) And as a last benefit, complexity theory enables us to dispense with the false problem of 'downward causation' by showing that the constraints of a pattern, described by an attractor, are not a case of efficient causality, but instead need to be thought of as a 'quasi-cause' (DeLanda 2002: 80, 110, 126 [where quasi-causes are said to replace final causes]) or a reformed formal and final cause (Juarrero 1999: 127, 143).

Difference and Repetition will thus enable us to talk about synchronic emergence (order) and diachronic emergence (novelty), but it's the collaborative works of the emergent unity, DG, which enable us to talk about a third kind of emergence by letting us

situate the organism or subject as one emergent unity in a field of such unities. Such a field is not a simple hierarchy of levels, for besides allowing us to move ‘below’ to modules or agents from which the organism or subject emerges and ‘above’ to social machines in which the organism or subject is a component of an emergent unity, DG also enable us to move ‘transversally’ to assemblages formed from biological, social and technical components. This third form of emergence, transverse emergence in assemblages, is what I call ‘political physiology’.

COMPLEXITY THEORY. A first distinction: complexity theory is not chaos theory. Chaos theory treats the growth of unpredictable behaviour from simple rules in deterministic nonlinear dynamical systems, while complexity theory treats the emergence of relatively simple functional structures from complex interchanges of the component parts of a system. Chaos theory moves from simple to complex while complexity theory moves from complex to simple.

To explain how complexity theory studies the emergence of functional structures we need to understand three sets of linked concepts: (1) in the system being modelled: range of behaviour, fluctuation, patterns and thresholds; (2) in the dynamical model: phase space, trajectory, attractors and bifurcators; (3) in the mathematics used to construct the model: manifold, function and singularity. A phase space is an imaginary space with as many dimensions as ‘interesting’ variables of a system; the choice of variables obviously depends on the interests of the modeller. The phase space model is constructed using a manifold, an n-dimensional mathematical object. The manifold qua phase space represents the range of behaviour open to the system: ‘what a body can do’.

The global condition of a system at any one point can be represented by a point in phase space with as many values as dimensions or ‘degrees of freedom’, to use complexity theory jargon. If you track the system across time, you can see the point trace a trajectory through the manifold / phase space, a trajectory representing the behaviour of the system. For some systems you can solve the equation that governs the function represented by that trajectory; for other systems you must simply run a computer simulation of the model and see what happens. Often these simulations will show the trajectories following a particular configuration. These shapes of trajectories are called ‘attractors’ and represent patterns of behaviour of the real system. There are various kinds of attractors: point (stable or steady-state systems), loop (oscillating systems), and ‘strange’ or ‘fractal’ (turbulent or ‘chaotic’ systems). Here we must make an important distinction: chaos in the sense of chaos theory is not the ancient cosmogony sense of chaos, which is now called a ‘random’ system, one whose model produces no attractors. On the contrary, the models of what are now called chaotic systems do have attractors, albeit fractal ones. Although the behaviour of chaotic systems is unpredictable in quantitative detail it is sometimes predictable in the long run or ‘qualitatively’.

Now the areas of phase space surrounding attractors – representing normal behaviour of the system in one or another of its behaviour patterns – are called ‘basins of attraction’. The behaviour patterns described by attractors are formed by the action of negative feedback mechanisms. The layout of attractors in the phase space, which describes the layout of the patterns of behaviour of the system, is defined by the layout of singularities, which are mathematical objects that define the topological structure of the manifold; a singularity is a point where the graph of the function changes direction as it

reaches local minima or maxima, or more dramatically, where the slope of the tangent to the graph of the function becomes zero or infinite. A singularity in the manifold indicates a bifurcator in the phase space model which in turn represents a threshold where the real system changes qualitatively. A singularity is not an attractor, but it defines where attractors are found by indicating the limits of basins of attraction. Some bifurcators are 'thick' so that inside a zone of sensitivity we find that minimal fluctuations – those that would be otherwise be swallowed up by the negative feedback loops whose operation define normal functioning of a system following one of its patterns of behaviour – can now push the system to a new pattern. In model terms, in zones of sensitivity or crisis situations we find fractal borders between basins of attraction, so that any move, no matter how small and in no matter what any direction, might – or might not – trigger the move to another basin of attraction. Here we have an irreducible element of 'chance' even though the system is thoroughly deterministic.

As we have said, what keeps a system inside a behaviour pattern – represented by the trajectories inhabiting a basin of attraction – is the operation of negative feedback loops that respond to system fluctuations below a certain threshold of recuperation by quickly returning to the system to its pattern. (These fluctuations can be either endogenously generated or responses to external events.) These quickly recuperating systems are called 'stable'. With regard to normal functioning, fluctuations are mere 'perturbations' to be corrected for in a stable system. Since internal system resources translate the sense of events into terms significant to that system, external events are merely 'triggers': they trigger a pre-patterned response.[7] Such changes in environment relevant to the system's 'interests' are called 'signs'. (From this perspective, which

Deleuze and Guattari buy into, signs are thus far beyond human language and meaning is the probability of triggering a response in a system. Thus Deleuze and Guattari are not 'postmodernist' if by that you mean they are exclusively or even primarily concerned with meaning as produced in chains of signifiers, because for them, 'signs' are not restricted to 'signifiers'.)[8]

Now fluctuations of a certain magnitude – beyond the recuperative power of the negative feedback loops or homeostatic mechanisms – will push the system past a threshold, perhaps to another pattern in its fixed repertoire, or perhaps into a 'death zone' where there are no patterns but only static or chaos. Thus some stable systems are 'brittle': they can be broken and die. Some systems are 'resilient' however: a sign or trigger that provokes a response that overwhelms its stereotyped defensive patterns and pushes the system beyond the thresholds of its comfort zones will not result in death but in the creation of new attractors representing new behaviours. We call this 'learning'. (Although of course there is a sense in which the old system has died and the new one is 'born again'. All sorts of question of personal identity could be raised here.) Sometimes this learning, this creation of new patterns for a particular system, repeats patterns typical of systems of its kind; we call this 'development'. Sometimes however this learning is truly creation: we call this 'evolution', or as we will see, 'diachronic emergence'.

Diachronic emergence, or creativity in the production of new patterns and thresholds of behaviour, is what Deleuze will call an 'event', which is not to be confused with a mere switch between already established patterns or with the trigger or 'external event' that pushes the system past a threshold and produces the switch. The Deleuzean event repatterns a system. The key to the interpretation of Deleuze in DeLanda 2002 is

that the virtual is the realm of patterns and thresholds, that is, those multiplicities, Ideas, or abstract machines that structure the intensive morphogenetic processes that produce actual systems and their behaviours. A behaviour pattern, or a threshold at which a behaviour pattern is triggered, needs to be ontologically distinguished (or 'modally' distinguished) from behaviour, just as singularities are distinguished from ordinary points on the graph of the function.[9] Thus patterns and thresholds are virtual, while behaviour is actual. An event, in creating new patterns and thresholds, restructures the virtual.

Let me concretize the discussion so far with the example of weather. Weather is a classic chaotic system: Lorenz and the butterfly effect and all that.[10] But as Waldner 2002 explains, you have to remember that while weather is chaotic, there are definite long-term patterns; weather is unpredictable, but climate is not. So while the butterfly's flap might move a developing weather system to another point in its sensitive zone (represented by a move to a point on its chaotic attractor minimally close by on a fractal border), and while this fluctuation might perhaps even switch that particular weather system to a hurricane pattern, it will not budge the global climate system out of its pattern, for there are a predictable number of hurricanes per season – on average, over the long haul – and butterflies have no effects here. The nightmare scenario of nuclear winter of course is that the effects of large-scale thermonuclear explosions will flip the global climatic system into its other big pattern: the ice age. Has global warming pushed us already into a crisis, modelled by a zone of sensitivity in which a minor fluctuation that otherwise would not have budged us off our attractor, but merely moved us to another point on that attractor, will now push us into another attractor, the ice age attractor, that is, into a new climate pattern? Or will the global system create a new pattern, neither temperate nor ice age, but

something different? The global climate system might be creative and resilient, but there's no guarantee the new pattern will provide a viable environment for human beings!

SYNCHRONIC EMERGENCE. Now that we have discussed the basics of complexity theory, which will provide the basis for the rest of our discussion, let's discuss synchronic emergence. Diachronic emergence, as we have intimated, is the creation of new patterns and thresholds in a system. Synchronic emergence has however dominated discussion so far. Unfortunately. First, the definition: a synchronically emergent structure is that which enables focused systematic behaviour through constraining the action of component parts. This definition encapsulates what Thompson and Varela 2001 call 'reciprocal causality': the mutual constitution of local-to-global or 'upward' causality that produces focused systematic behaviour and the global-to-local or 'downward' causality that constrains the local interactions of components. Synchronic emergence is the emergence of 'order out of chaos' as the popular formula has it.[11]

The focus on the part / whole relation of synchronic emergence has caused a lot of mischief in social science with the structure / agency dilemma, and in philosophy of mind with the entire range of problems surrounding the issues of physicalism, eliminative materialism, reductionism, supervenience, and so forth.[12] We see a curious chiasmatic relation here. In consciousness issues, researchers operating without a notion of complex systems struggle to relate the global level of freedom (the mental whole) to the local determinism of physical parts, while in social science they struggle to relate the local freedom of individual agents (parts) to the global determinism of social structure (the whole). The relation of methodological individualism in social science to genetic

reductionism in biology is not chiasmatic however, but analogic. Genetic reductionism is analogous to methodological individualism in that all living or social phenomena are considered mere epi-phenomena of fundamental units (genes or agents); in other words, these stances accept only 'upward causality'.[13]

How is one to demonstrate the existence of a synchronic emergent functional structure rather than just asserting its presence? A negative demonstration would be pointing out any systematic behaviour that cannot be accounted for by analysis of the system into its components and then explaining the behaviour of the whole on the basis of the properties of the parts. But this explanatory failure might simply be epistemic (due to sensitivity to initial conditions and so on) and so we have here merely 'epistemological emergence'; we are not any closer to being able to claim 'ontological emergence' or emergence as a real feature of the world. Thus we see that a key arena for emergence questions is the unity of the sciences issue. Emergentists will propose level-specific laws, while reductionists will claim them to be merely 'epistemological emergence' or simply markers of our (temporary) ignorance. Kant struggled with this problem in the *Critique of Judgment* when he relegated teleological judgments to the realm of regulative principles.

Now what used to be called ontological emergence can sometimes be shown to have been merely epistemological emergence due to the immaturity of science at the time. For instance, Mill proposed water as emergent: H_2O does not act like the 'combination' of hydrogen and oxygen. But quantum mechanics has shown ways to explain water's properties on the basis of the properties of hydrogen and oxygen (Schröder 2000; Sawyer 2001: 560). Note also that systemic focus as the criterion for

emergence is not the same as what some people call the ‘emergence’ displayed by thermodynamic properties. A single molecule does not have a temperature but temperature only ‘emerges’ at the level of the whole, as average kinetic energy. But there’s nothing systemic here: there’s no notion of ‘normal function’ or ‘breakdown’ applicable to thermodynamic phenomena (Sawyer 2001: 560).

This brings us to the notion of arguing for ontological emergence by demonstrating the formation of attractors in computer modelling of systems, since such attractors represent the functioning of nonlinear feedback loops (Silberstein and McGeever 1999). Such attractors would entail a reduction in the amount of the state space available to the system, and hence indicate the possibility of focused behaviour achieved through the constraint of components. We would dispense thereby with the problem of ‘downward causation’ when that is thought of as efficient causation issuing from a reified totality, as in the controversies surrounding ‘mental causation’ and sociological realism (Sawyer 2001).

Part of the difficulty in these controversies is a widespread misunderstanding of efficient and final causes in Aristotle *Physics* 2.3, where, notoriously, Aristotle uses the poietic model of statue construction to explain the biological phenomenon of development. What we have come to call the efficient cause is that ‘from which’ the development occurs: the commanding origin of motion / development, the sculptor or father. It is not the hammer blows or the immediate action of the spermatic fluid; it is not billiard ball causality. The final cause is the perfect state of development or end state of motion. While the sculptor might have something in mind to guide his work, we need not impute purpose or intention to biological development. The final cause or end state

channels development; the infant does not intend to grow into an adult. It's this notion of channelling which is the key to understanding systematic constraint and focused behaviour in synchronic emergent functional structures. In other words, synchronic emergence is a misnomer; there's always a coming into being of functional structures which needs to be conceptualized.

Synchronic emergence works on one level by means of negative feedback mechanisms. Now a negative feedback mechanism is just that, a mechanism. It can be made sense of on the billiard ball model of efficient causality. These actions produce constraints on behaviour, producing patterns of behaviour modelled by basins of attraction, and these constraints produce focused system-wide behaviour. The problem is how to conceptualize the onset of such focused behaviour, modelled by the funnelling of trajectories in a basin of attraction. One place where the study of focus is quite advanced concerns entrainment or synchronization (Strogatz 2003 has a very good popular survey of the field). The tendency of systems to move to an entrainment pattern once past a threshold is described by Deleuze as a 'quasi-cause' (see DeLanda 2002: 78-80). The question is why this tendency should be granted an ontologically distinct status from the action of the negative feedback mechanisms. One of the key issues here is multiple realizability, the way patterns which are modelled by identical singularity layouts in manifolds can appear in widely different instanciations. Following Lautman's ontological distinction between singularities and the trajectories which are shaped by them, Deleuze says yes, here we need an ontological difference: the patterns defined by a layout of singularities in a manifold should be called virtual multiplicities, because they structure many spatio-temporally distinct intensive morphogenetic processes that result in widely

different actual products. It's the quasi-causal action of these multiply realizable (in Deleuze's terms, differencially actualisable) patterns, patterns which channel behaviour and which are modelled in basins of attraction, which must be distinguished from the efficient, billiard ball, causality of negative feedback loops operating in intensive states of actual systems. And this is the reformed notion of final causality to which DeLanda and Juarrero refer (DeLanda 2002: 80, 110, 126; Juarrero 1999: 127, 143) and by means of which we can avoid the false problem of downward causation, when that is conceived as efficient causality emanating from a reified totality. But only when we study the onset of synchronic emergence does the notion of quasi-cause make sense; hence we need to think diachronic emergence.

DIACHRONIC EMERGENCE, TRANSVERSAL EMERGENCE, AND POLITICAL PHYSIOLOGY. If one were to stay with the perspective of synchronic emergence, one would indeed find a hierarchy of material systems, so that individuals on one level are components of emergent unities on the next level: cell, organ, somatic body, social body.[14] The organism or subject is one level of this hierarchy, though we can go below the subject to a multiplicity of agents or independent behaviour patterns that when triggered are run on the system's organic hardware, to indulge a little computer jargon that is actually out of place for technical reasons we can't get into at this point but have to do with the presuppositions of the computationalist versus embodied mind paradigms. In any event, for DG the multiplicity of agents as component parts of a subject is not simply equivalent to the 'society of mind' thesis, which deals only with the composition of a cognitive architecture of abstract functions (Varela, Thompson and Rosch 1991: 106).

Rather they would look at brain-level cognitive multiplicity by recourse to neurological findings and to the notion of the modularity of subsystems, or as they would call them in *Anti-Oedipus*, 'desiring machines'. An example of such a modular agent would be rage, a primitive mammalian inheritance.[15] In *A Thousand Plateaus* they describe it this way: 'schizoanalysis … treats the unconscious as an acentered system … as a machinic network of finite automata' (DG 1980: 18).

But the perspective of diachronic emergence shows that time scales of each level are staggered, so that what appears as a systematic unity on a specific level is an event, a process, from the perspective of another level with a longer time scale. We can call this heterochrony: cells come and go but the organ stays (relatively) the same; people die but the social body lives on, and so on. Now we must also remember that 'above' the subject dimension there are intermediate scales: it's not just 'individual and society' but lots of not always harmoniously competing institutions, groups, bands, networks, nations, families, dysfunctional couples, you name it. DeLanda's social ontology work in *A Thousand Years of Nonlinear History* (1997) here is indispensable: hierarchies and meshworks (strata and consistencies, to use DG's terms), but also meshworks of hierarchies and hierarchies of meshworks.

Finally, we need to think how DG enable us to think emergence 'transversally' in their concept of assemblages. The key addition of DG is the focus on transversality, the thought of assemblages, which renders more complex the already complex notion of a heterochronous hierarchy sketched above. For example, the eukaryotic cell, which one might propose as the base level in a synchronic reading of the human organism, is itself already an organic assemblage according to the symbiogenesis theory of Lynn Margulis,

who proposes, across evolutionary time scales, the incorporation of mitochondria – previously independent bacteria – into the emergent unity of the eukaryotic cell (Margulis and Sagan 1986: 128-33). In *A Thousand Plateaus* DG show how social machines intersect technological lineages in producing 'machinic phyla', or groups of assemblages defined by their affects: what they can do and what they can undergo. Thus the horse – man – stirrup assemblage of the steppe nomads also produces a bio-social-technical functional unit that is no simple aggregate. These assemblages are territorialized: the triggers of self-organizing behaviour are embedded systematically in a territory. The territorial assemblage interweaves a machinic assemblage of bodies and a collective assemblage of enunciation so that behaviour patterns are reliably triggered given the utterance of 'order words' (DG 1980: 88). A territorial assemblage produces emergent unities 'tranversally' among organisms, subjects and technological apparatuses.

As the above examples indicate, our three forms of emergence admit of some further nuances, as transverse emergence can be either homeostratic or heterostratic as well as synchronic or diachronic. To be precise, the isolation of an assemblage as containing only entities of the same stratum is an artificial selection: all organic entities have close ties to their inorganic milieus, while all social assemblages are technical and organic at the same time. Nonetheless, let us present them in outline form, with apologies for the rather barbaric terminology.

1. Homeostratic synchronic transversal emergence

    a. organic (symbiosis among organisms; ecosystems among groups of organisms)

    b. social (institutions forming a larger entity: colleges forming a university)

    c. technical (e.g., computers and routers forming the Internet).

2. Homeostratic diachronic transversal emergence

a. organic (symbiogenesis: Margulis' theory of the origin of the eukaryotic cell)

b. social (system change: change of the university from education of elite into a centre for mass vocational training / military-industrial research)

c. technical (system change: from ARPANET to Internet to world wide web)

3. Heterostratic synchronic transversal emergence (a bio-social-technical assemblage)

4. Heterostratic diachronic transversal emergence (mutation and co-evolution of such assemblages in 'machinic phyla').[16]

Moving us above, below, and diagonal to the organism or subject, DG thus enable us to construct a concept of 'political physiology' which studies the way interlocking intensive processes articulate the patterns, thresholds, and triggers of emergent bodies, forming assemblages linking the social and the somatic, with sometimes – but not always – the organic or subjective as intermediary. Sometimes we have direct links of the social and the sub-organismic or sub-subjective, as when, for example, American military training embeds 'shoot to kill' reflexes in the spinal cords of GIs, reflexes triggered by the presentation of human-shaped targets in the appropriate 'free fire zone'.[17]

THE ORGANISM AND EMERGENCE. Let us see how all these notions of emergence intersect the question of the organism as conceived by DG. As a fruitful contrast to DG, let us think of the work of Francisco Varela, both in his early work with Humberto Maturana ('autopoiesis') and later in his contribution to the 'embodied mind' school of cognitive science ('enaction').[18] Briefly put, DG will completely agree with the autopoietic notion of the organism as an instance of synchronic emergence dedicated to

homeostatic stability, but they want also to think the relation of the (actual) organism to life, which for them is a virtual multiplicity which is actualized in differenciating bursts of diachronic emergence – a notion which it turns out is quite close to the 'natural drift' argument of the later Varela. In addition, they also have a notion of 'non-organic life', which would be their way of talking not simply of inorganic self-organization (that is, homeostratic synchronic emergence below the organic level[19]), but also heterostratic transversal emergence. There are thus two critiques of the 'organism' we need to distinguish. The first simply points out the difference between having an identitarian or differential horizon for thinking change. The second is not so much a complaint about homeostasis in individual somatic bodies as it is a critique of what they call Oedipus, a particular way in which human organisms have come to be knit into the bio-social-technical assemblages of capitalist society. In other words, the second critique of the organism is also a call to think heterostratic transversal emergent assemblages, or political physiology.

In *A Thousand Plateaus*, the organism is a centralized, hierarchized, self-directed body, the 'judgment of God' (He who provides the model of such self-sufficiency), a molarized and stratified life form.[20] The organism is a synchronic emergent effect of organizing organs in a particular way, a 'One' added to the multiplicity of organs in a 'supplementary dimension' (DG 1980: 21; 265). The organism is the unifying emergent effect of interlocking homeostatic mechanisms that quickly compensate for any non-average fluctuations (below certain thresholds, of course) to return a body to its 'normal' condition (as measured by species-wide norms). As a stratum, we can use DG's specialized terminology for the organism. Skipping over several scales (cell, tissue,

organ) for simplicity's sake, we arrive at the level of organic systems (e.g., the nervous, endocrine, and digestive systems), where the substance of content is composed of organs and the form of content is coding or regulation of flows within the body and between the body and the outside. The form of expression at this level is homeostatic regulation (overcoding of the regulation of flows provided by organs), while the substance of expression, the highest level emergent unifying effect, is the organism, conceived as a process binding the functions of a body into a whole through co-ordination of multiple systems of homeostatic regulation.

DG's reading matches the autopoietic conception of the organism. Autopoietic theory distinguishes between the (virtual) organization and the (actual) structure of organisms. Organization is the set of all possible relationships of the autopoietic processes of an organism; it is hence equivalent to a virtual field or the Body without Organs of that organism (Maturana and Varela 1980: 88 mentions autopoietic 'space' [scare quotes in original]). Structure is that selection from the organizational set that is actually at work at any one moment (Maturana and Varela 1980: xx, 77, 137-38; see also Hayles 1999: 138 and Rudrauf et al, 2003: 31). Perturbation from the environment in 'structural coupling' leads to structural changes which either re-establish homeostasis or result in the destruction of the system qua living (Maturana and Varela 1980: 81). Homeostatic restoration thus results in conservation of autopoietic organization.

The difficulty here is that the assumption of organization as a fixed transcendental identity horizon prevents us from thinking life as the virtual conditions for creative novelty or diachronic emergence. Life for autopoiesis is restricted to maintenance of homeostasis; creative evolutionary change is relegated to structural change under a

horizon of conserved organization. If virtual organization is conserved for each organism, no matter the changes in its actual structure – one of the prime tenets or autopoietic theory – then on an evolutionary time scale, all life has the same organization, which means belongs to the same class, and has only different structure. As Hayles put it: 'either organization is conserved and evolutionary change is effaced, or organization changes and autopoiesis is effaced' (Hayles 1999: 152). Autopoietic theory gladly admits all this. 'Reproduction and evolution do not enter into the characterization of the living organization' (Maturana and Varela 1980: 96); evolution is the 'production of a historical network in which the unities successively produced embody an invariant organization in a changing structure' (104).

Although autopoietic theory, developed in the 1970s at the height of the molecular revolution in biology, performed an admirable service in reasserting the need to think at the level of the organism, it is clear that autopoiesis is locked into a framework which posits an identity-horizon (organizational conservation) for (structural) change. The critique of identity-based thinking developed in Deleuze 1968 posits life as virtually creative, that is, posits pure difference or differentiation / differenciation as the horizon for change. For autopoietic theory, living systems conserve their organization, which means their functioning always restores homeostasis; evolution is merely structural change against this identity horizon. For Deleuze, life is virtual differentiation ceaselessly differenciating in divergent actualization; the self-identity of the organism, preserved by homeostasis, is just an expression of the necessity of dipping into actuality in order to provoke the next burst of virtual creativity. (There is a parallel argument about species and organic form, developed in Ansell Pearson 1999 and responded to by Hansen 2000,

which we treat below.)

The concept of the organism as enactive in Varela's later work (Varela 1991; Varela, Thompson and Rosch 1991) is much closer to DG's interests in describing diachronic transversal emergence, as here we loop into the environment. Perception is no longer simply triggering of response, but comes from action in the environment, from movement. Cognitive structures emerge from recurrent sensory-motor patterns (Varela, Thompson and Rosch 1991: 173-79; see also Lakoff and Johnson 1999). Cognition, perception, and moving action are all intertwined in 'structural coupling' with the world and are all needed for development. Each organism enacts a world for itself in bringing forth what is significant to it, what has 'surplus signification' (Varela 1991: 96).

On the macro-evolutionary time-scale, natural drift, which encompasses self-organization, structural coupling and bricolage of modules (Varela, Thompson and Rosch 1991: 197), is the analogue of cognition as embodied action (188). In natural drift, diversity of organic form shapes and is shaped by coupling with environment; it is an 'emergent property' (195). Here survival and reproduction are only global constraints, for natural selection only rejects what doesn't meet these criteria, instead of selecting for an optimal fit of organism and environment. Thus in the concept of natural drift there is still a lot of room for what Deleuze 1968 would call differenciation. The evolutionary problem is not finding optimality but pruning away diversity to allow substrata for satisficing solutions rather than optimizing what fits a pregiven external standard (196). The problem posed to natural drift in *The Embodied Mind*: 'how to prune the multiplicity of viable trajectories' (196) thus comes much closer to Deleuze's notion of differenciation as diachronic emergence than was ever possible with autopoietic theory.

Things are not so simple however when we concentrate more closely on questions of transversal emergence and organic form. In dialogue with Ansell Pearson 1999, Hansen 2000 points to the need to distinguish time scales; he claims DG conflate the macro-evolution time scale of symbiogenesis with the time scale of ontogeny or individual development. At stake is the relation of the virtual field (THE BwO) of life as self-ordering and creative to the portion of the virtual field relevant to an organism (A BwO, the BwO of the organism, as what this particular body 'can do'). Hansen claims DG neglect the constraints of the viability of organic form in favour of what he calls their 'cosmic expressionism'. That is, Hansen believes DG postulate a completely open 'molecular' field for any possible combination of organic forms, without regard to the conservation of viable organic form in species-wide norms. Thus even organic form is a haecceity, or arbitrary selection from an open and heterogenous virtual field. The key complaint is that DG consider individuation as (synchronic) haecceity while neglecting diachronic emergence from a morphogenetic field, which needs the constraint of natural kinds channelling development.

Hansen is onto something here, which we can see when we consider the following lines from *A Thousand Plateaus*: 'The BwO howls: "They've made me an organism! They've wrongfully folded me! They've stolen my body!" ' (DG 1980: 159). As a fixed habitual pattern locked onto normal functioning as determined by species-wide average values, the organism deadens the creativity of life, the possibilities of diachronic emergence; it is 'that which life sets against itself in order to limit itself' (503). The organism is a construction, a certain selection from the virtual multiplicity of what a body can be, and hence a constraint imposed on the BwO (the virtual realm of life, the set of all

possible organic forms). Like all stratification, however, the organism has a certain value: 'staying stratified – organized, signified, subjected – is not the worst that can happen' (161), although this utility is primarily as a resting point for further experimentation, the search for conditions that will trigger diachronic emergence. Hansen is correct here: DG's insistence on caution in experimentation only recognizes individual organism survival as a negative condition for further experiment without giving any positive role to the organism-level self-organizing properties of the morphogenetic field.

The only thing to say on behalf of DG is that Hansen's analysis is organic, all too organic: it is homeostratic. While the statement 'staying stratified is not the worst thing' is negative, we also have to remember that all the strata intermingle (69), that the body is a body politic, that in the context of heterostratic transversal emergence, 'organism' is a political term. 'Organism' refers to body patterns being centralized so that 'useful labour is extracted from the BwO' (159). We see that 'organism' is a term of political physiology when we realize that for DG the opposite of the organism is not death, but 'depravity': 'You will be an organism … otherwise you're just depraved' (159). That is, being an organism means that your organs are Oedipally patterned for hetero-marriage and work. Getting outside the organism doesn't mean getting outside homeostasis guaranteed by a certain organic form so much as getting outside Oedipus into what Oedipal society calls 'depravity'. Furthermore, political physiology or the thought of the body politic means we have to think *le corps* as social in the context of heterostratic transversal emergence: we are all a Corps of Engineers. When a body links with others in a bio-social-technical assemblage it is the complex, transversally emergent body that increases ITS virtual realm, that is, it is the BwO of the bio-social-technical body that is

at stake, not that of each individual organism or somatic body. So the experimentation DG call for is not so much with somatic body limits (although that is part of it) but with bio-social-technical body relations in heterostratic diachronic transversally emergent assemblages, what DG will call a 'consistency' or a 'war machine'.

CONCLUSION: TOWARD A DISCUSSION OF THE SUBJECT AND EMERGENCE.

Using this article as a basis, in another context I hope to discuss the way DG's notions of emergence can help us to see that a discussion of the genesis of agents, rational and otherwise, can help in many of the debates in social science on methodological individualism, sociological realism, Rational Choice Theory, the structure / agency dilemma, and other problematic areas. In doing so we will have to take account of the difference between the synchronic emergence of stable systems, with their equilibrium focus, and the ability to sustain creativity in what DG call consistencies or war machines ('the nomad reterritorializes on deterritorialization itself' (DG 1980: 381). Such absolutely deterritorializing assemblages are not simply resilient and creative, but are so precisely in ways that maintain the conditions for future creativity; they find ways to stay in their crisis zones, they feel at home while on the move – even if they don't move relative to their position in a GPS system. In other words, their pattern allows them to change their pattern. We can thereby dissolve the false dichotomy between social holism (oriented to homeostatic stability) and methodological individualism (which denies ontological emergence), as well as evade the antinomies of the structure / agency debate, by showing that agency, when conceived as creativity in changing the patterns and thresholds of social systems, can only appear in far-from-equilibrium crisis situations.[21]

WORKS CITED

Abrahamson, Warren and Arthur Weis (1997). *Evolutionary Ecology across Three Trophic Levels*. Princeton: Princeton University Press.

Ansell Pearson, Keith (1999). *Germinal Life*. London: Routledge.

Bonta, Mark and John Protevi (2004). *Deleuze and Geophilosophy: A Guide and Glossary*. Edinburgh: Edinburgh University Press.

Clark, Andy (2003). *Natural Born Cyborgs*. Oxford: Oxford University Press.

DeLanda, Manuel (1997). *A Thousand Years of Nonlinear History*. New York: Zone Books.

DeLanda, Manuel (2002). *Intensive Science and Virtual Philosophy*. London: Continuum Press.

Deleuze, Gilles (1968). *Différence et Répétition*. Paris: PUF. Translated as *Difference and Repetition* by Paul Patton. New York: Columbia University Press, 1994.

Delueze, Gilles. (1969). *Logique du Sens*. Paris: Minuit. Translated as *The Logic of Sense* by Mark Lester with Charles Stivale. New York: Columbia University Press, 1990.

Deleuze, Gilles and Félix Guattari (1972). *L'Anti-Oedipe*. Paris: Minuit. Translated as *Anti-Oedipus* by Robert Hurley, Mark Seem and Helen R. Lane. London: Athlone, 1984.

Deleuze, Gilles and Félix Guattari (1975). *Kafka: Pour une littérature mineure*. Paris : Minuit. Translated as *Kafka : Toward a Minor Literature* by Dana Polan. Minneapolis : University of Minnesota Press, 1986.

Deleuze, Gilles and Félix Guattari (1980). *Mille Plateaux*. Paris: Minuit. Translated as *A Thousand Plateaus*, by Brian Massumi. Minneapolis: University of Minnesota Press, 1987.

Deleuze, Gilles and Félix Guattari (1991). *Qu'est-ce que la philosophie?*. Paris: Minuit. Translated as *What is Philosophy?* by Hugh Tomlinson and Graham Burchell. New York: Columbia University Press, 1994.

Dyke, Chuck (1988). Cities as Dissipative Systems. In Smith, Weber, and Depew, eds., *Entropy, Information and Evolution.* Cambridge, MA: MIT, 355-367.

Dyke, Chuck (1989). *The Evolutionary Dynamics of Complex Systems: A Study in Biosocial Complexity*. Oxford: Oxford University Press.

Dyke, Chuck (1990). Strange Attraction, Curious Liaison: Clio Meets Chaos. *The Philosophical Forum*, 21.4 (Summer), 369-392

Goldstein, Jeffrey (1999). Emergence as a Construct: History and Issues. *Emergence* 1.1, 49-72.

Griffiths, Paul (1997). *What Emotions Really Are: The Problem of Psychological Categories*. Chicago: University of Chicago Press.

Griffiths, Paul and R. Gray (1994). Developmental Systems and Evolutionary Explanation. *Journal of Philosophy* 91.6, 277-305.

Griffiths, Paul and R. Gray (2001). Darwinism and Developmental Systems. In Oyama,

Susan, P. Griffiths and R. Gray, eds. *Cycles of Contingency: Developmental Systems and Evolution*. Cambridge MA: MIT Press.

Grossman, David (1996). *On Killing*. Boston: Little, Brown.

Hayles, N. Katherine (1999). *How We Became Posthuman*. Chicago: University of Chicago Press.

Hüttemann, Andreas and Orestis Terzidis (2000). Emergence in Physics. *International Studies in the Philosophy of Science* 14.3, 267-81.

Juarrero, Alicia (1999). *Dynamics in Action: Intentional Behavior as a Complex System*. Cambridge MA: MIT Press.

Klee, Robert (1984). Micro-Determinism and Concepts of Emergence. *Philosophy of Science* 51.1 (March), 44-63.

Lakoff, George, and Mark Johnson. 1999. *Philosophy in the Flesh*. New York: Basic Books.

Luigi-Luis, Peter (2002). Emergence in Chemistry: Chemistry as the Embodiment of Emergence. *Foundations of Chemistry* 4.3, 183-200.

Margulis, Lynn and Dorion Sagan (1986). *Microcosmos: Four Billion Years of Microbial Evolution*. Berkeley: University of California Press.

Massumi, Brian (1992). *A User's Guide to Capitalism and Schizophrenia: Deviations from Deleuze and Guattari*. Cambridge MA: MIT Press.

Maturana, Humberto and Franciso Varela (1980). *Autopoiesis and Cognition*. Boston: Reidel. Boston Studies in the Philosophy of Science, volume 42.

McDonough, Richard (2002). Emergence and Creativity: Five Degrees of Freedom. In

Terry Dartnell, ed. *Creativity, Cognition and Knowledge: An Interaction*. Westport CT: Praeger, 283-320.

Pihlstrom, Sami (1999). What shall we do with emergence? A survey of a fundamental issue in the metaphysics and epistemology of science. *South African Journal of Philosophy* 18.2 (May), 192-211.

Prigogine, Ilya and Isabelle Stengers (1984). *Order Out of Chaos*. New York: Bantam Books.

Protevi, John (2001a). *Political Physics: Deleuze, Derrida and the Body Politic*. London: Athlone Press.

Protevi, John (2001b). The Organism as the Judgment of God: Aristotle, Kant and Deleuze on Nature (that is, on Biology, Theology and Politics). In Mary Bryden, ed., *Deleuze and Religion*. London: Routledge.

Protevi, John (2005). Political Physiology in High School: On Columbine. In Adrian Parr and Ian Buchanan, eds., *Deleuze and the Contemporary World*. Edinburgh: Edinburgh University Press.

Rudrauf, David, Antoine Lutz, Diego Cosmelli, Jean-Philippe Lachaux and Michel Le Van Quyen (2003). From Autopoiesis to neurophenomenology: Francisco Varela's exploration of the biophysics of being. *Biological Research* 36.1: 27-65.

Sarkar, Sahotra (1998). *Genetics and Reductionism*. Cambridge: Cambridge University Press.

Sawyer, R. Keith (2001). Emergence in Sociology: Contemporary Philosophy of Mind and Some Implications for Sociological Theory. *American*

Journal of Sociology 107.3 (Nov), 551-85.

Schröder, Jürgen (1998). Emergence: Non-Deducibility or Downwards Causation? *The Philosophical Quarterly* 48.193 (Oct), 433-52.

Silberstein, Michael and John McGeever (1999). The Search for Ontological Emergence. *The Philosophical Quarterly* 49.195 (April), 182-200.

Spurett, David (2000). Bhaskar on Open and Closed Systems. *South African Journal of Philosophy* 19.3, 188-209.

Strogatz, Steven (2003). *Sync: How Order Emerges From Chaos in the Universe, Nature, and Everyday Life*. New York: Hyperion.

Thompson, Evan, and Francisco Varela (2001). Radical Embodiment: Neuronal Dynamics and Consciousness. *Trends in Cognitive Science* 5: 418-425.

Varela, Francisco (1991). Organism: A Meshwork of Selfless Selves. In Alfred I. Tauber, ed., *Organism and the Origins of Self*. The Hague: Kluwer, 79-107.

Varela, Francisco, Evan Thompson and Elizabeth Rosch (1991). *The Embodied Mind*. Cambridge MA: MIT Press.

Waldner, David (2002). Anti Anti-determinism: or what happens when Schrodinger's Cat and Lorenz's Butterly meet Laplace's Demon in the Study of Political and Economic Devlopment. Paper presented at the annual meeting of the American Political Science Association, August 29 – September 1, 2002. Available online at: http://www.people.virginia.edu/~daw4h/Anti-Anti-

Determinism.pdf

Williams, James (2003). *Gilles Deleuze's* Difference and Repetition: *A Critical Introduction and Guide*. Edinburgh: Edinburgh University Press.

NOTES

[1] In recent and noteworthy attempts, McDonough 2002 provides a taxonomy of 27 (!) concepts of emergence, Pihlstrom 1999 provides an excellent overview of the field and a pragmatist defence of emergence, while Schröder 1998 will confine emergence to an epistemic category and Spurrett 2000 will claim Bhaskar fails in his case for 'strong emergence'. Specialized studies for emergence in specific scientific fields are Hütteman and Terzidis 2000 for physics, Luigi-Luis 2002 for chemistry, and Sawyer 2001 for sociology. We should note that worrying about the concept of emergence is something of a philosopher's obsession; many scientists just get down to the practice of studying cases of emergence without worrying about precisely defining its concept. Chuck Dyke, who is a philosophical expert on complexity theory and emergence (Dyke 1988, 1989, 1990), put it like this in a personal correspondence with me: 'The trick is to know where to look and what to look for [in searching for scientific work on emergence]. You don't look for cases that make a big deal about "emergence" with fanfares and flags, but cases where emergence is taken for granted and used without fuss'. Dyke goes on to recommend Abrahamson and Weis 1997 as an example of such low-key work with emergence.

[2] Their teamwork in producing *Anti-Oedipus* (1972), *Kafka* (1975), *A Thousand Plateaus* (1980) and *What is Philosophy?* (1991) is itself an example of emergence. I will call the emergent unity 'DG'. One of the things the contemporary philosophy field most needs is a discussion of the relations among Deleuze's work, Guattari's work, and the work of DG.

[3] See also Massumi 1992 in this regard, though he focuses on DG. The question of Deleuze's materialism and / or realism – or in other words, the relation of philosophy and

science in his thought (Queen, handmaiden, or something else entirely) – is extremely complex. As the better part of valour I will defer this issue to another context, though the confrontation with the position established in Williams 2003 – namely that mathematics and science are for Deleuze mere illustrations of a fundamentally philosophic stance – will be essential to that endeavour.

[4] Mark Bonta and I provide an overview of complexity theory and Deleuze in our *Deleuze and Geophilosophy* (2004), with extensive references.

[5] See Silberstein and McGeever 1999 and Thompson and Varela 2001 for a discussion of how thinking in terms of complex systems studied by means of non-linear dynamics changes the terms of the classic debate summarized by McDonough 2002, which remains burdened with an impoverished view of matter. Goldstein 1999 also provides a sympathetic account of emergence in terms of complexity theory. I deal with hylomorphism extensively in Protevi 2001a.

[6] DeLanda 2002 attempts to outflank the entire reductionism question by proposing a Deleuzean epistemology that redefines science from the search for laws in nature to the search for topological regularities in scientific fields, or as he puts it, the distribution of singular and ordinary points in a problem (1999: 127-28).

[7] Here we adapt terms from autopoietic theory, which we discuss below.

[8] Mark Bonta and I treat this theme at length in our *Deleuze and Geophilosophy* (2004). See also Varela 1991: 96.

[9] DeLanda (2002: 31) points out the importance for Deleuze of the work of Albert Lautman concerning this point.

[10] As Silberstein and McGeever note, the most conservative commentators will insist that

chaos is a property of the model and 'one cannot in general prove that a real physical system is chaotic in the rigorous sense in which a mathematical model is chaotic' (1999: 195). This sort of extreme caution seems a holdover from positivist allergy to ontological commitment; it would take us too far afield to deal more with this question of realism and anti-realism, but we will note the strong realism of DeLanda 2002.

[11] The same phrase appears as title of Prigogine and Stengers 1984 and the subtitle of Strogatz 2003.

[12] McDonough 2002 usefully engages Klee 1984 as a classic case of anti-emergentism in philosophy of mind.

[13] For a critique of genetic determinism from an analytic philosopher, see Sarkar 1998. For the anti-genetic determinism of the Developmental Systems Theory (DST) school, see Griffiths and Gray 1994 and 2001.

[14] By 'social body' I mean that human groups – institutions, teams, corporations, families, and so on – can be seen as emergent unities, with a focused systematic behaviour whose powers extend beyond that expected by simply adding up the power of members acting alone. This is of course the thesis denied by methodological individualism in social science, which is treated in Bonta and Protevi 2004.

[15] Griffiths 1997 calls rage – along with other primitive emotions – an 'affect program'.

[16] On bio-social-technical assemblages or 'cyborgs' in the context of cognitive science and philosophy of mind, see Clark 2003. On the notion of machinic phyla, see DG 1987: 404-10.

[17] Grossman 1996 has details of such reflex training, which was first implemented in the Vietnam era to increase firing rates of infantrymen, which were found to be unacceptably

low in post-WWII studies. I have treated the issue at length in Protevi 2005.

[18] Maturana and Varela 1980 is the classic statement of autopoietic theory. For the embodied mind, see the book of the same name: Varela, Thompson and Rosch 1991. For an overview of Varela's career, see Rudrauf et al. 2003.

[19] As in the self-organization of lipids to form membranes, a common concept in theories of the origin of life.

[20] I detail DG's notion of the organism in relation to Aristotle and Kant in Protevi 2001b.

[21] Of course it's never easy identifying the criteria by which one can recognize a crisis. See Waldner 2002 for a treatment of the political science literature on 'regime change' with regard to this issue.