De-escalation, Reserve and Invention: Michel Serres on the Natural Contract and Law

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The Natural Contract

In *The Natural Contract*, Michel Serres argues that as the founding act of a political order, the social contract excludes nature and by this exclusion has exposed it to violent exploitation. Serres calls on us to realise our connectedness to the nonhuman world and to devise a new politics consistent with this. In concrete terms, he proposes that the social contract be revised to give nature rights and democratic representation through a transnational institution to advocate on behalf of Water, Air, Fire, Earth and Life (*Times of Crisis* 51). In this paper I propose that the natural contract as an initiative in law can be supplemented by drawing on Serres' characterisation of processes that lead to and sustain states of near equilibrium, and on the account of 'contract' developed through his reading of Lucretius in *The Birth of Physics*. The possibility of translating between the formation of order in nature and politics and ethics relies on Serres formalism according to which a structural invariance can be realised in a series of different models. In de-escalation, reserve and invention, I identify three such invariances or principles that can guide an understanding of the natural contract and its translation into political practice.[1]

In *The Natural Contract* Serres traces the long and convoluted history by which law in a juridical sense has been implicated in science and in turn knowledge of the laws of nature has informed our conception of justice. The connection intimates that somehow law might be put to work in both settings to bring knowledge and justice closer together, but there is no quick fix. One of the founding assumptions of modernity is that human society and culture stand apart from nature, and the division cannot be overcome just like that. By the same token, simply reverting to a pre-modern position is unrealistic and in any case ultimately undesirable. Nonetheless, there are straightforward pragmatic reasons to focus on law: the language of law and rights is widely recognised and is supported by existing institutions, which should in theory make it easier to implement reforms that are urgently needed. The Rights of Nature movement has grown rapidly in recent years, and legislation to give legal protection to rivers, lakes, and the Earth itself have been introduced in many countries, including

1. Timothy Howles' recent and valuable paper 'The Concept of Equilibrium in the Work of Michel Serres: from philosophy of nature to human social order' takes a similar approach to the one I propose here and shows that Serres' understanding of equilibrium and disequilibrium in a dynamic setting can be translated into initiatives in politics and ethics, thereby extending the idea of contract beyond its strictly legalistic sense. I agree with his analysis, including his account of homeostasis and homeorhesis, and in this paper I try to carry it further by identifying three principles that characterise the processes involved.

Ecuador, Bolivia, New Zealand, India, and the United States of America.[2] But again, the approach is not without its problems.[3] The focus on rights appears to enshrine individualism and seems to be at odds with Serres' views on the co-implication of the human and the nonhuman, mingled bodies, and complex and convoluted forms of order. Moreover, the social contract relies on a conception of law that is formally and historically connected to the modern idea that knowledge is a condition for mastery. From this perspective, which can be called naturalism, nature is other to human culture. Where human society is historical, nature is governed by laws that are universal and timeless and which therefore do not themselves arise from or belong within nature. Unless there is a change to this perspective, an extension of the social contract to include nature will risk reproducing both the good (legal protection against harm) and the bad (a condition for inflicting harm) in the conception of law on which the social contract depends. However valuable it may be today, there is a danger that an appeal to law and rights may achieve short-term gains at the expense of more far-reaching change over the longer term. It is therefore worth reconsidering the relation between law and the natural contract, the presentation of which passes by way of law, without being restricted to law in either its scientific or legal sense. Going back to Serres' account of the idea of contract in Lucretius may helpfully modify our approach to law and inform its use in relation to the world, both human and nonhuman.

In spite of his focus on the problem of law in *The Natural Contract*, Serres came to be equivocal on its importance to our relation to nature. In an interview given in 2008, he underlines that only law can protect the environment against exploitation by the free market ('Le droit peut sauver' 9), and in the same interview he underlines that law can not only help to save nature, it may be the primary means of doing so ('Le droit peut sauver' 8). Yet his endorsement of law is not unequivocal and he concedes that law may be "a bad solution for saving the environment" but one that in the absence of others we have have no choice but to adopt: "The economy and politics are not enough" ('Le droit peut sauver' 11). His reservations are voiced more strongly again in an essay published in the same year in which he questions his own proposal for a legal contract between human society and nature. The idea of a new contract, he writes, assumes a basic division between nature and culture and as such it adheres to a naturalism that has largely been taken for granted in science and in thinking aligned with science. Referring to the work of Phillipe Descola, Serres acknowledges the limitations of naturalism and the damaging consequences it has brought in its train, not least by impoverishing the resources at our

2. Examples of such protection include New Zealand recognising the Whanganui River as a living entity with rights, the state of Uttarakhand in India according rights to the Ganges and Yamuna rivers, and the constitutions of Ecuador and Bolivia giving nature positive rights to regeneration and respect..

3. Calls for a transition from environmental law to more radical notions of ecological law and Earth Governance are growing louder. See Anker et al, *From Environmental to Ecological Law*. Also, the Oslo Manifesto produced by the Ecological Law and Governance Association. https://elgaworld.org/oslo-manifesto, accessed 22.11.23.

disposal to understand the world (Descola, *Par-delà nature et culture* 674-676). While naturalism has been a defining characteristic of Western modernity, it is not universal and there is no reason to accept it as a default position. Alongside naturalism, Descola identifies three alternative ontologies in animism, analogism and totemism, each of which stands as a different way of inhabiting the world and making sense of it (*Par-delà nature et culture* 666). On his part, Serres supplements his naturalism with animism, insofar as all things participate in the same play of relations (e.g., receiving, processing, storing and emitting information), while refusing to remain bound by any one set of ontological commitments: "Neither a sectarian nor a sectator, I now need an animism for help in understanding science, work, and the contemporary world. I turn to it for help, shamelessly ('Feux et signaux' 130).[4] This is by no means an eccentric position to take up since, as Serres points out, naturalism has been superseded by changes in the sciences themselves. What Serres has in mind here is that the sciences, and especially the climate sciences, have moved away from the insularity of different disciplines and have begun to speak "together, more concretely, … about the world as a global partner" (*Times of Crisis* 40), and as a consequence "our knowledge disciplines, albeit unwittingly, have abandoned naturalism" ('Feux et signaux' 127). In view of this he no longer believes that we have to sign a natural contract, the idea of which has come to seem "extremely insufficient" to him (126). But if Serres steps back from the legal interpretation of 'contract' according to which two previously unrelated parties enter into a formal agreement, a view consistent with naturalism, he does not abandon the idea of contract altogether. For a contract does not have to be a written document at all. As Serres writes, "a set of cords is enough" (*Natural Contract* 107); that is, a system of relations and exchanges. Importantly, such a variation on the idea of contract does not simply replace the legal interpretation, which continues to play its part, only now without being taken as primary. One is therefore led to ask: how else can contract be understood, how does such an understanding break with naturalism, and how can it inform an interpretation of the natural contract in terms of law?

Drawing on Leibniz and mathematical formalism, Serres developed the idea that a structure can be realised in models that are formally invariant but which vary in their content.[5] While certain relational characteristics in the models remain invariant, because different terms are involved the relations themselves are not perfectly identical and need to be worked out in the vernacular of each model.

4. "Oh, that I might one day discover the ground on which these four ontologies rest, or better yet, the blank space, the virgin island, the dead center, motor, energy, exchanger, the point of departure from which I could direct my thinking life in new directions" ('Feux et signaux' 130).

5. "Formal laws are valid whatever the object may be, i.e., for any object. This is the precise meaning of the term *structure*; it is an ensemble of undefined significations, grouping together any number of elements (elements whose content is not specified) and a finite number of relations, whose nature is not defined, but whose function with respect to the elements is defined. We obtain a *model* (a paradigm) of this structure if we specify the content of the elements and the nature of the relations. What the whole of these paradigms have in common, analogically, is the structure in question" (*Le système de Leibniz* 4).

Moving from one model, or instance of order, to another is a work of translation by which one both elaborates something new and refines an invariance that never appears as such. Importantly, no original version provides the key to all the rest. As Serres puts it, a theme composed as the point of departure for a series of variations may itself be heard as one variation among others.[6] Relations of priority between different instances of order are therefore evened out, or rather alternative orders of priority are possible, depending on one's starting point or chosen perspective. The formal invariance of 'law' is what allows Serres to outline the history of the relations between scientific and juridical law without settling on one final correct version. It is also means that juridical law and the human world for which it legislates can be approached as variations within a series that includes scientific law and the natural world. The idea of 'contract' itself is no different, in the sense that no one variation has priority over all others. Since it features in his reading of Lucretius in *The Birth of Physics*, we can reasonably turn to this text to enrich our understanding of the natural contract as Serres presents it in the book of that name. In doing so, the point is not to make 'contract' as it appears in *The Birth of Physics* the source from which its political and juridical sense is to be derived directly, any more than it is simply to extend human law to the 'persons' of nature. In short, Serres is not proposing to cross the border just once, either from politics to nature or from nature to politics, as if one could tell us how the other must be ordered, but rather to move back and forth in a series of translations. The idea of contract as it appears in *The Birth of Physics* and the natural contract as a legal, political and ethical initiative are variations on each other through which runs a formal invariance, and it is for this reason that the conception of contract that Serres finds in Lucretius may tell us something about the natural contract and its relation to law without imposing a solution to be replicated exactly.

The *foedera natura*

The Birth of Physics (*La naissance de la physique dans le texte de Lucrèce: fleuves et turbulences*), published in French in 1977, thirteen years before *The Natural Contract*, puts front and centre a vision of our relation to the material world that has been eclipsed in much of modern philosophy and science. In a reading of *De rerum natura*, written in first century BCE Rome by Titus Lucretius Carus, Serres laments the fact that Lucretius has mostly been treated as a poet rather than a scientist and elicits from his work a rigorous account of the material world that is, for us, strikingly contemporary in prefiguring non-linear dynamics (the physics of turbulence) and the thermodynamic concept of entropy. Crucially, the physics Lucretius proposes is expressly opposed to violence: it is a

6. 'When you hear or compose variations on a given theme, don't you sometimes ask yourself if the theme itself doesn't develop like one variation among others, simpler, doubtless, purer, shorter, certainly, but why separate it from them? … Yes, the theme is nothing but one of the variations.' (*Troubadour* 149).

physics of Venus, not Mars, of love not war. For Serres, it demonstrates an alternative to the classical science of modernity and to the philosophy of Francis Bacon and René Descartes, for whom knowledge made possible our mastery of nature. Instead, a different physics emerges based on a conception of law not as universal and necessary but as the outcome of local combinations and regularities. As Serres puts it, at the foundation of objective knowledge lie "a series of decisions or preliminary choices that often pass unnoticed. Here is one of them: either the contractual pact or military strategy" (*The Birth of Physics* 139).

Lucretius imagines a state in which across the universe atoms rained down in parallel lines. This represents a state of perfect equilibrium in which there could be no change, no combinations of matter, and nothing could exist. However, spontaneously and without cause, here and there an atom swerves just slightly from its path and collides with other atoms. The swerve, or clinamen, sets off a chain reaction of collisions, creating turbulence. Atoms begin to combine, and in the turbulence vortices form as the combinations create constraints that lead to settled patterns of movement. Dynamic quasi-stable forms of order emerge contingently, survive for a time, and eventually break down to release their atoms back into the wider flow. Although the tendency is towards dissolution, the path that any local instance of order follows, and therefore how long it takes to reach equilibrium, will vary. Serres' example of eddies in flowing river water suggests two ways to think about the conditions that determine how long a local instance of order will survive, how quickly or slowly it will breakdown. Up to a point, the regularity of the vortical flow depends on the strength of the bonds between its elements: in Lucretius's terms, atoms that link tightly will stay bound together longer. But the path that any flow takes on its way to maximal equilibrium (dissolution) also depends on how it is bounded. Serres reminds us that there are no fixed borders and that "the stream is its own dyke, the river its own wharves" (*The Birth of Physics* 69), which is to say not only that a flow is constrained by other flows (as Serres notes, "*the vessel itself is a flow*, but thicker and more complex" (*The Birth of Physics* 91), but also that the regularity, and therefore survival, of a local instance of order will depend on its interaction with the flows by which it is bounded and with which it interacts. To exist at all is to be in disequilibrium, and a local instance of order exists by virtue of being sustained in disequilibrium by regularities that comprise both its 'own' movement and its relations with the flows that run around it and through it.[7] In fact, the two are so closely related as to be inextricable from one another: the survival of a system depends on a degree of internal consistency that requires an engagement with the mix of order and disorder flowing around it and through it. As Serres often notes, to achieve this calls for variation and invention.

7. Timothy Howles describes this as a state of 'differentiated equilibrium' ('The Concept of Equilibrium' 17), which captures its complex character very well. I address the concept of equilibrium in my paper 'Michel Serres: the natural contract, narrative and law', where I link Serres' view of the world in terms of multiple dynamic equilibria to his interpretation of the principle of sufficient reason and his use of the cybernetic notion of 'steering'.

Lucretius borrows the term '*foedus'* from Roman law. Although its meaning is associated with contract and treaty, it is often translated as 'law', yet this can be misleading for us today because the modern conception of law does not align well with what Lucretius calls the *foedera naturae*. Although the laws of nature are said to be binding, Lucretius states that those of fate (*fati*) are broken by the clinamen, and therefore the *foedera naturae* that structure the universe are indeed more akin to contracts or political treaties that set constraints for what exists without determining movement or behaviour in every respect. The distinction is clearly there in Lucretius, but Serres turns it into the thread that connects each element of *De rerum natura*. It's only fair, then, to ask whether the appeal to a notion of 'contract' projects a language of politics and human society onto nature where it does not really 'belong'. Is the idea of the *foedera naturae* just a figure of speech? Serres broaches the question and concludes that "Far from a political convention being projected upon nature, it is on the contrary the natural constitution that, in the final instance, accounts for every other federation" (*The Birth of Physics* 146). On the face of it, this appears to contradict Serres' view of structure, models and variation outlined above, where no one instance of order takes priority. However, he is simply recognising that Lucretius's account begins with a description of the movement and conjunction of atoms, without making this account foundational in the sense that it determines everything that follows.

In most science and philosophy of science it is assumed that law precedes causality, which is to say that every event (of a given kind) is determined by the same laws; the collision of A with B leads to Y happening because the laws governing this situation dictate that it must happen that way. Following Lucretius, Serres reverses this reasoning to say that causality precedes law:

> In a sense, the pre-model of the fundamental physics has no laws. … As soon as a phenomenon appears, as soon as a body is formed, a law can be expressed. The laws of nature are those of conjugation, there is only the nature of composites. (*The Birth of Physics* 147)

As combinations form, regularities emerge and only where they remain especially stable can we perhaps then speak of laws. Therefore, laws do not precede the system they describe or govern. Initially, there are no laws that determine how an atom *must* move and how it *will* combine with others. When laws do appear, they are not imposed on the nascent order from outside, as are the fixed laws that Lucretius calls the *foedera fati*, the "laws of destiny" in which "Cause repeats cause *ad infinitum*" and "Chains of reason pour down like rain" (*The Birth of Physics* 136). Serres associates the *foedera fati* not only with the conception of laws as universal that we find in modern science, but also with the cycles of violent sacrifice by which cultures throughout history have sought to impose order on the world. When the world tips out of kilter and events do not run their 'true' course, a sacrifice to the gods restores order for a period of time, but the solution does not last and soon the violence must be repeated (*The Birth of Physics* 142-3). Adherence to the *foedera fati* and the practice of sacrifice both involve a belief that the world is fundamentally in equilibrium, either as determined

by fixed laws or by virtue of winning favour through sacrifice. Yet as Serres points out often, a steady state is in reality a state of decline, moving inevitably towards its dissolution (death), a descent interrupted by the clinamen: "the angle interrupts the stoic chain; it breaks the *foedera fati*" (*The Birth of Physics* 109). What were regarded as fixed laws of nature no longer hold, and in their place arise *foedera naturae*, the regularities in conjunction and movement that codify local, temporary, and scale-specific conditions of existence. Moreover, unlike the *foedera fati*, the *foedera naturae* are not imposed on states of perceived disorder, and do not aim to restore equilibrium. As Serres underlines, disequilibrium is necessary for anything to exist at all, and the *foedera naturae* arise with, or more precisely as, the order that constitutes things and their relations. Disequilibrium is therefore the condition for the *foedera naturae*, and in this sense the contract is struck not to eradicate disequilibrium but to regulate it, to keep it from spiralling too quickly into disorder, and to preserve the conditions from which pockets of order can arise. In thermodynamic terms, it makes possible negentropic variations. Without reducing other forms of order to physics, Serres sees in this an example from which it is possible to translate political and juridical versions of contract. However, this is only possible at all because *De rerum natura* itself models a formal structure that recurs in multiple variations, each of which can be seen as a translation of others. In looking to atomism for inspiration, the aim is not to translate it into human law *per se* but to see in atomism formal characteristics that recur in multiple instances and which might be elaborated also in the way law is framed with respect to nature.

The imitation of initial conditions

If we wish to deepen our understanding of the entanglement of the human and nonhuman worlds with one another and to revise our laws explicitly to include the nonhuman world, then we can do worse than to return to the contracts that matter strikes with matter and to think again about the emergence of order. In itself, this can now be done quite easily, as a great deal has been written about the emergence of order from chaos and complexity. The challenge is to work out what we can take from this in terms that speak to the nature and scale of events that concern us. What lessons are we to learn, and how? Serres is absolutely clear that no direct translation is possible between the behaviour of matter and our history, law and political institutions, which are not coded for us in advance. There is no straight line from nature to human society, and therefore no way to re-make law on the basis of a determination of nature, even if this were thought to be a desirable thing to do. Yet it's also the case that in his reading of Lucretius Serres states that we make and remake our history, laws, and institutions we 'imitate' nature.

> The laws of nature are not federal as imitations of our own laws, but the reverse. Our writings, our memory, our histories and our times are negentropic; they go back to the initial conditions, preserve them and maintain them, *as* nature has shown them to us. (*The Birth of Physics* 179)

The passage introduces three striking ideas: our laws, or contracts, 'imitate' those of nature; our writings, our memory, our histories, our times, and let us say also our laws, can be negentropic; and to be negentropic they must return to 'initial conditions' as we find them in nature.[8] But what are these initial conditions, how are they imitated, and what can we expect to follow from this?

One way to understand how our laws may imitate those of nature without returning to a version of natural law is consider Serres' account of the code inscribed in all order. He takes information theory as a modern day translation of the Lucretian idea that atoms are letters, and therefore "Language is born with things, and by the same process" (*The Birth of Physics* 148). Through a composition that is at once material and linguistic: "things appear bearing their language" (*The Birth of Physics* 149). For Serres, this means that our written history, laws, and culture are late and brief additions to a much longer history coded in things that stretches beyond the human to paleontological, geological and cosmological time. These "pre-texts" constitute what Serres calls "prescription" and in a passage reminiscent of the account of the *foedera natura*, he concludes: "always anterior, this prescription founds law and founds it in nature; if peace prevails over war, it owes it to this natural code" (*The Incandescent* 111). One might therefore say that law is founded in the prescription that can be discerned in things, for example by the sciences working in collaboration. Law would then be an institutional translation of the code written in nature itself, or at least, as a first attempt or iteration, within those things to which the law is intended to apply. This seems to be a good fit with the Rights of Nature: for example, the transnational organisation Rights for Rivers declares that rivers should have the rights to flow, to feed and be fed by sustainable aquifers, and to perform essential functions within their ecosystems – all of which describe processes we take to be constitutive of what a river is.[9] Yet this may place too much emphasis on single instances of code or prescription at the expense of many other variations that extend beyond river systems to countless other possible examples, from scales of time and space, to geology, the formation of the earth, and cosmology. The invariance to look for in such a mass of examples lies the process by which they came to take on a form sufficiently stable for us to find them at all. At least as important as what is prescribed (e.g. what it is to be a river) are the conditions of prescription, which is to say the features of the dynamic processes by which order arises and persists in states of disequilibrium. Such features will be repeated not only across different instances of a particular kind of order, or of order on a particular scale, but also across

8. The term 'negentropy' was coined by Léon Brillouin following Erwin Schrödinger's use of 'negative entropy' to describe the local emergence of order from disorder and in Serres' writing it is associated with creativity, invention, and work, and with the third of the three orders of time (*Hermès V* 78-82).

9. https://www.rightsofrivers.org/#declaration. Accessed 30.03.24.

different kinds of order at different scales. This recalls Serres' adoption of the Leibnizian notion of structural invariance across a variety of models, but it's there, too, in *De rerum natura*, where Lucretius describes the emergence of order in the material world in terms of the clinamen, disequilibrium, and flow before going on to use the same terms to account for the emergence of life, of society, and even of laws and morals. In Serres' words:

> Whether we look at atoms, at species and, later, at society, the same model is always at work. That is, first an equilibrium and, here, there, tomorrow or yesterday, a deviation. Here is isonomy; here is the *clinamen*, differential deviation, flow and fluctuation, which initiates the slope. (*The Birth of Physics* 208-9)

This is why the *foedera fati* cannot hold always and everywhere: different scales and localities of order exhibit their own regularities, which is to say that they have their own laws that are irreducible to any single foundational law or body of laws from which they are derived. Yet there is still a consistency between them. The cosmologist Lee Smolin argues for a similar arrangement:

> Our universe should not be seen as a vast collection of elementary events, each simple and identical to all the others, but the opposite, a vast set of elementary processes, no two of which are alike in all details. At this level fundamental principles may be discerned but there are no general laws in the usual sense. (*The Singular Universe* 371)

There are no general laws because no two elementary processes are exactly alike, but dispensing with general laws does not mean embracing a chaotic free for all because certain fundamental principles are repeated through the variations in law. For Smolin and his co-author Roberto Mangabeira Unger, these fundamental principles include the idea that laws change along with the phenomena they describe and that there is an inevitably historical and narrative character to explanations of the universe. For Serres, following Lucretius, the principles, or initial conditions, are those which enable the formation of the *foedera naturae* through conjugation, and the emergence of regularities in vortical movement; namely, the conditions of laminar flow becoming turbulent and then vortical, each flow being bounded by other flows. In short, the initial conditions to which Serres proposes we return are those implicit within the processes by which order emerges and lasts through a play of repetition and deviation. As such, they also provide the principles by which variations from the present order can be made without triggering catastrophic change.

What Serres would have us imitate are the codes 'prescribed' in things, but also the principles that set the boundaries for the emergence of these codes, and for any future variation from them. Serres notes that Lucretius was marginalised not for being a materialist but because "his physics was a complex evaluation of open models" and that for this reason it was "unthinkable" (*The Birth of Physics* 93). The physics of closed systems was, Serres writes, reflected in institutions that were similarly closed. While Serres may have been thinking above all of academia, the open systems to which he refers

already cross the boundaries between nature and culture or society, and therefore our understanding of them might one day be reflected in novel institutions of other kinds, including political institutions. To connect the idea of the *foedera natura* to the legal interpretation of the natural contract is to call into play the invariant features that recur as systems move through varying states of near equilibrium. It follows that a consideration of the natural contract in terms of law should acknowledge this by aiming to imitate how order emerges and persists at multiple levels and scales, in addition to the human. To put this another way, treating the earth, life, and humanity as iterations of connected and formally similar processes is a pathway to thinking about the entanglement of the human and nonhuman worlds, which is ultimately what is at stake in the idea of a natural contract.

However, it's one thing to say that law can be regarded as a variation on the emergence of order at a material level, but quite another to know what we are to do with this insight to 'improve' our political engagements, laws and institutions. An understanding of this will call for a translation from one instance to the other, from the formal characteristics that can be read off from the Lucretian account to the framing of law. To make a start, it's helpful to consider whether the *foedera naturae* exhibit features that we can imitate by translating them, and more specifically their relation to the conditions from which they arise. Translating such features of the *foedera naturae* into terms that we can incorporate into politics and law will show that the natural contract and the institutions that come with it can usefully be supplemented by an understanding of the formation of order in different localities and scales.

Order emerges first through a minimal deviation and then later it will break down unless something happens to reverse this. For states of near equilibrium to arise the conditions must be there for the deviation to lead to new combinations and for these combinations to settle into a regular pattern. This means achieving a state of near equilibrium strong enough to survive but supple enough to vary without always returning to the exact same state as before: connections need to be resistant but mutable. In Serres' work, one can find three such features characteristic of systems capable of sustaining themselves in states of near equilibrium: de-escalation, reserve, and invention.[10]

De-escalation

De-escalation is related to the Epicurean principle that one should avoid appetites that feed on themselves and only increase as they are satisfied. It's a familiar story, most usually told with regard to rich food, wine, or power, but the ethical model can be generalised to other forms of dynamic

process: or rather, the management of our appetites models a more general structure.[11] As such, an insatiable appetite really describes any system that in order to survive must acquire or consume ever increasing amounts. In the end, it will tear itself apart or use up all the resources available to it; either way, it cannot last. Like the boat that Serres describes bobbing on the water, near stability is achieved by moving around within a range without ever being in perfect equilibrium (*The Birth of Physics* 42). Exceed the range and the slope to dissolution (equilibrium) steepens: the boat overturns. The principle here is that each movement beyond a point of equilibrium must be compensated or countered by another. It is an image of dynamic equilibrium that Serres associates with justice (*The Natural Contract* 87-8), and the first step toward achieving it is to identify the variables at play. A feature of systems that tend toward continual escalation is their narrow focus on one or two such variables; e.g. quantity of food or economic growth. This leads to the second principle. In *De rerum natura* Lucretius criticises those who endlessly pursue new pleasures and distractions (III 1076-1094) and in a discussion of virtue and vice Serres follows suit, pointing out, for example, that a personality dominated by vanity seeks compliments everywhere, and the individual consumed by anger 'asks every situation for reasons to rage'. Such people, he concludes, 'all suffer from a single ill: growth' (*Variations* 47). Here we see that escalation is damaging for a different reason, as it elevates a certain kind of relation to the world over others; e.g., economic growth is more important than measures of human well-being or capacity, or creativity, or shared collective activity. Escalation crowds out plurality and restricts the range within which the world 'makes sense'. It makes the world less nuanced, less complex and reduces the scope for invention. If, as Serres writes, our humanity depends on our capacity to disobey and to diverge from the norm, we are therefore diminished not only by escalation, but also by any response to it that aims simply for a reduction according to the same metric, since that, too, limits plurality and reduces the scope for invention.

Reserve

If escalation leads to narrowing the terms in which the world makes sense, reserve denotes the inverse tendency to allow a plurality of relations co-exist. In *The Troubadour of Knowledge*, Serres presents several examples of what happens in the absence of such reserve: an excess of heat reduces a landscape to desert and an excess of cold leads to a frozen wasteland; rising waters flood, swallowing "every detail beneath the flat level of the silky waters" (*Troubadour* 116); a single species proliferates to the point where no other form of life is possible; humans "arrange the world for ourselves alone" (*Troubadour* 116). The common feature is the imposition of a single universal law, the consequence

11. Commenting on Lucretius, Serres notes that the soul follows general dynamic principles that it shares with everything else: "At its root, at its birth, the movement of the soul is differential: it is a flow, a fluctuation, the same deviation in equilibrium as that which locally changes the cataract of the atoms" (*The Birth of Physics* 216).

of which is a uniformity equivalent to death. Reserve avoids this fate by allowing for plural relations and processes to arise and to persist. And because laws then do not hold always and everywhere, reserve is the condition both for history (*Troubadour* 116) and for life. As Serres writes:

> We … owe life to all the gaps left by the other living things, the Earth, the atmosphere, the waters, and the flames that, in return, owe their existence to the marginal reserves that we leave them (*Troubadour* 119).

In thermodynamic terms, to exercise reserve by leaving gaps is to contravene the second law that states all systems will move towards equilibrium. It is a negentropic tendency characteristic of living systems, taken not in isolation but in their multiple relations to one another.

Invention

Invention is a theme that features throughout Serres' work, for example in the account of a 'negentropic' time in *Hermes V*, in his encouragement in *Variations of the Body* to leave the safe haven of a settled life, in the many variations of 'casting off' that we find in *The Natural Contract* and other works, and in the idea that humanity is 'hominescent', on a trajectory of exo-Darwinian evolution.[12] Invention is required in order, in Serres' terms, to branch off, to communicate, to link one locality to another, and so to establish new instances of order. Importantly, it is not a uniquely human characteristic. No example of order remains the same forever and while changes lead in general towards dissolution, or equilibrium, at times they may also give rise to new pockets of order that are not a simple continuation of what came before. In this way, the general drift towards higher entropy can be slowed. New contracts are possible codifying new relations, new tendencies or patterns, that may contain old forms of violence in new ways or even moderate new forms of violence. To invent, here is less to dream up the wholly unexpected through the power of imagination than to experience the world as composed of endless variations and, which is almost the same thing, to compose further variations, or at least to encourage them.

Coda

Wisdom, Serres writes, belongs to those who cultivate life in the smallest deviation, the angle between equilibrium and declination, a place 'of the necessary and the natural' where everything comes down to 'an evaluation of limits' (*The Birth of Physics* 216). If Serres' notion of a natural contract calls for an extension of social and political ideas and their institutional counterparts to the nonhuman world, far from crossing a boundary between society and nature it invites us to

12. *Hermés V* 78-82; *Variations* 46-52; *The Natural Contract* 97-124; *Hominescence* 27, 39.

acknowledge that any such notion of a clear boundary is a reductive imposition on the series of variations, and the multiplicity of series of variations, that make up both the world and its sense. Serres freely admits that there is a difference between the energy and matter of the world on the one hand and the sense we make of it and feelings we have about it on the other, between the hard and the soft, but the two sides are not separate: the hard and the soft mingle with one another everywhere.[13] At the beginning of this paper I noted a concern that for all the pragmatic appeal of extending rights and legal protections to nature it may not be sufficient to meet the scale of the emergency that is rapidly overtaking the world. Serres' work shows how the conception of law on which such an appeal depends serves to promote states of ongoing dynamic near-equilibrium. To achieve this, legislation may be guided by the regularities, the codes, written into the constitution of things – what things are – but it should also follow the principles of de-escalation, reserve, and invention that characterise complex processes which avoid the extremes of stasis and rapid dissolution.

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13 "I see lakes of the soft in the hard and continents of the hard in the soft; yes, we scholars and thinkers are coming to discover a world that is hard, certainly, but also dense with codes and decoding, which practices, in its own way, writing, reading, memory, remembrance, and is endowed therefore with negentropy – yes, with thought, with soul, if you wish. Today our sciences unceasingly describe vaporous regions of the soft in the hard kernel of things" ('Feux et signaux' 126).

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