









Bruno Latour, Simon Schaffer, Pasquale Gagliardi  
Editors

# A Book of the Body Politic

## Connecting Biology, Politics and Social Theory



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Photo on front cover: Zodiac Man. Joannes de Ketham, *Fasciculus medicinae*, Venice: Giovanni e Gregorio de' Gregori, 1491 (Venice, Fondazione Giorgio Cini).

*A Book of the Body Politic: Connecting Biology, Politics and Social Theory*  
Edited by Bruno Latour, Simon Schaffer, Pasquale Gagliardi  
San Giorgio Dialogue 2017

“Do you remember the Aesopian Fable of the Belly and the Members, or the letter of Paul to the Corinthians about the Body and the Church, or *The Fable of the Bees* by Mandeville, or the somewhat dangerous association of pests and foreigners, or the more recent attempts to think of the Earth as a giant organism? None of these stories stops shifting metaphors between one domain—that of the body—and another—that of politics. The result has been the creation of that most important concept of Western philosophy, *corpus politicum*, the Body Politic. One interesting aspect of this most famous topic is that every domain borrows from each other the certainty associated with the other’s authority, so that political science ends up borrowing from biology what biologists borrow from political theory.

This constant commerce of concepts and metaphors, unfortunately, has never guaranteed the quality of what has been ceaselessly transported from one domain to another. The result is that we remain deprived of a coherent definition of collective bodies. Hence the idea of attempting to re-open the question in a Dialogue of San Giorgio by bringing the different domains together and examine what each has really to offer to the others that is genuinely proper to the phenomena it studies.

This book is the outcome of three days of intense confrontation among experts of various disciplines (biology, philosophy, ecology, social theory, anthropology, history of science, political science) aimed at finding a new body’s description for the Body Politic.”

VIII-310 pages; 27 illustrations

# ACKNOWLEDGMENTS

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## PREFACE

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# Origin and context

*Bruno Latour, Simon Schaffer, Pasquale Gagliardi*

In the last two decades, it has become the good and generous custom of the Giorgio Cini Foundation to host regular meetings in Venice under the name of ‘Dialoghi di San Giorgio.’ These dialogues ingeniously and hospitably assemble participants from a range of different fields and with very different kinds of experience and expertise to debate issues of pressing urgency in contemporary culture and society. One goal of the Dialoghi has therefore always been deliberately to form a productive collective by the careful assemblage of a set of selected individuals. It seemed apt to make this goal itself the focus of the 2017 meeting. No topic, of course, could be more challenging and more significant to the current crises of political order and of ecological catastrophe, both dominated in connected ways by the obvious weakness and indeed delusion of the terms in which political groups and natural systems are characterized. Hence arises the pressing need to create constructive communities out of their components and at the same time to protect particulars and persons in a potent public polity.

Plans and conversations for the Dialogo were developed by Bruno Latour, Pasquale Gagliardi and Simon Schaffer from the autumn of 2016, to define more precisely the political and scientific issues which must be addressed to make sense of how better to understand the relation between collective and individual agency across the wider range of knowledge. In turn, these plans were also focused on the selection of those who would be well-placed to reflect on how models of community and of agency have been used, and then revised, in specific sciences. Indeed, this was a key part of the shared initial intuition of the dialogo’s organizers: questions

such as the puzzle of those telling shifts between imagery of social collectives so often used in the explanatory techniques of biosciences, or the imagery of animal communities relentlessly exploited in sciences of economy and society are not merely ubiquitous in the politics of knowledge, but very often explicitly recognized by the practitioners themselves. The wager of the Dialogo was thus to assemble a group of peculiarly careful and reflective practitioners of the natural and the social sciences, working with full awareness of this epoch's dramatic challenges of the new climatic regime and the crises of political legitimacy, and to invite reflexion from them, individually and collectively, on better ways of dealing with such tricky, shifty and barely satisfactory images of order in life and in labor.

The plan was straightforward: participants were each provided with a 'Manifesto'—see next section—setting out the challenges of political and natural imagery, and invited first to offer all the other members of the group one or two of their own writings that would provide a shared group of reference works for the conversation. Before the Dialogo itself, in September 2017, these participants also prepared their own brief statements, organised in a pairwise manner as conversations between the members of the collective. And during the three days of the meeting at San Giorgio most of the time was thus devoted to brief initial presentations by participants, followed by much lengthier exchanges between all members of the Dialogo. The focus on imagery in politics and the sciences, and on the forms of expertise which seem relevant to making sense of collective and of group action, proved a fascinating and rebarbative theme. The results, and the process, are evident in the volume that follows.

### THE 'MANIFESTO'

The 'Introductory Note' (or the 'Manifesto') which was sent to all the experts invited to the 2017 Dialogue, was written by the planning team, composed of Bruno Latour, Simon Schaffer and Pasquale Gagliardi. It ran as follows:

«Do you remember the Aesopian Fable of the Belly and the Members, or the letter of Paul to the Corinthians about the Body and the Church, or *The Fable of the Bees* by Mandeville, or the somewhat dangerous association of pests and foreigners, or the more recent attempts to think of the Earth as a giant organism? None of these stories stops shifting metaphors between one domain—that of the body—and another—that of politics. The result has been the creation of that most important concept of Western philosophy, *corpus politicum*, the Body Politic. One

interesting aspect of this most famous topic is that every domain borrows from each other the certainty associated with the other's authority, so that political science ends up borrowing from biology what biologists borrow from political theory. This constant commerce of concepts and metaphors, unfortunately, has never guaranteed the quality of what has been ceaselessly transported from one domain to another. The result is that we remain deprived of a coherent definition of collective bodies. Hence the idea of attempting to re-open the question in this Dialogue by bringing the different domains together and examine what each has really to offer to the others that is genuinely proper to the phenomena it studies.

Just at the moment when the idea of sovereignty has become obsolete through the intensification of globalization, planetary changes and migrations, the new political mood is to withdraw behind the borders that Nation States invented in previous centuries. In spite of the vast transformations that the new climatic regime requires, it is today a politics of identity, nationalism and borders that seems the most attractive to voters. Everywhere the choice is either to prolong the extension of globalization or else return to the older ideas of strictly enforced sovereignty. There seems to be no other alternative. In this Dialog we wish to open the way for another political orientation, one that relies neither on the idea of globalization nor on those of sovereignty, identity and individuality. Our assumption is that most of the ideas about the Body Politic come from ideas about the biological body, *and vice versa*. There has always been a two-way stream of exchanges between biology, law, religion and social theory to the point that it is very difficult when people talk about ecosystems, identity, genetics, organism or globalization to decide if they speak about human or non-human entities. Biologists don't seem to worry that they import social theory to talk about organs and tissues, sociologists don't hesitate to use a legal conception coming from Church history to define the individual, while economists happily mobilize what they take as a "naturalistic" notion of competition to render the optimum calculable, while organization theorists borrow offhandedly the DNA metaphor of cell organization, and so on. *Metaphors travel freely, transporting the same unexamined perplexities from field to field.*

This confusion has become even more complete, at the time of the Anthropocene, when politics has to be expanded to the former objects of nature. The solution is certainly not to add to the confusion by treating humans and non-humans as if they were the same, either by treating all of them as being equally "social," or all of them as equally "natural." When selfish genes look suspiciously like Wall Street executives, when the planet Earth is treated as a goddess, when organisms themselves are treated like corporations, when anthills are treated as macro-organisms, cells as if they were cybernetic machines, States as if they had natural boundaries, it is extremely difficult to specify the differences between collective forms. It is at

this point that we wish to intervene. The newly emerging Body Politic requires a careful examination of what is meant by body, organism, individual, identity and collective.

Immense advances have been made in the study of collective behavior at many different scales—markets, cells, social animals, nation states, corporate bodies, human interactions as well as ecosystems. And yet a difficulty remains that scholars and scientists tend simultaneously to solve practically and to dismiss intellectually: the notion of an individual agent that *then* enters into some sort of *relations* within a *collective* is not a notion that seems to work. First, because every time a study is carefully made, the individual does not seem to have clear-cut *boundaries*; and second, because the collective of which it is supposed to be a part does not seem to be really *more* than its components. The difficulty is constantly papered over by vague concepts such as organism, emerging properties, systems, totalities.

This conundrum is well known. Everyone recognizes that the two notions of individual and collectives are fraught and then tries to find some way to avoid the difficulty. This creates a strange situation for ethics, law and politics as well as for science: the most important features of our orientation in the world (who are we as individuals? What is the shape of the larger ensemble inside which we are supposed to live? What are the boundaries that define our collective existence?) are based on a series of concepts *wholly unfit to capture the nature of individuality and of collective*. Strangely enough, even though scholars, scientists, educators and moralists all recognize the fragility of this model, there has been no systematic way to find an alternative model to redefine part/whole relations and rework the odd notion of organism that is then used as a blueprint for our ideas of sovereignty. Social theory and biology seem to go their own ways even though they keep exchanging concepts and metaphors without examining carefully what is thus exchanged.

We think that there is an opportunity to advance the search for a critical examination of such commerce by using *to our benefit* the very fact that it travels freely through so many domains at once. The problem of defining organism and identity has exactly *the same form* if you study cell development, the behavior of ant colony, of a baboon group, the growth of geopolitical coalitions, corporate bodies, ecosystems, markets or human interactions in societies. Naturally, the empirical material differs, but *not the concepts* in which such material is then formatted. It is this very problem that could offer the best opportunity to solve it. Our idea is very simple: to compare and exchange the solutions each of us in our own discipline had to develop to renew our definition of collectives and individuals. Since the same conundrum is impeding all our various disciplines, let's render the *common problem* visible by assembling around one table several specialists of various disciplines (biology, philosophy, ecology, social theory, anthropology, history of science, political

science) who have, each in their own way, courageously raised the same question against the paradigms of their own disciplines. We will not solve the problem in three or four days; but the two-way commerce between biology, politics and social theory will be at least clear to all.

Although we will speak about totally different entities—bacteria, cells, ants, corporations, clans or bands—, we will force ourselves to be uniquely attentive to the origin, nature, quality, impact, undertone of the metaphors and concepts we borrow from other disciplines when we frame the problem of what is a collective in our own disciplines. It is risky, but every one of us has had to develop some aspect of such an enterprise against the powerful paradigms we had to dispute. As political ecology is clearly and urgently paralyzed by the inability to develop a clear conception of what could compose a Body Politic, it would be heartening to feel that we are not isolated, but—much more important—we might come up with a much better way to phrase the problem.

San Giorgio, a secluded island, is an ideal venue for the dialogue, in that it differs from some other utopias. Instead of dogmatically assuming the answer has already been reached, the Cini Foundation offers the chance for collaborative search for better questions.»

The participants to this edition of the ‘Dialogo di San Giorgio’ are Deborah Gordon, Shirley Strum, Scott F. Gilbert, Isabelle Stengers, Didier Debaise, Mike Lynch, Kyle McGee, Timothy Mitchell, Tim Lenton, David Western, Bruno Latour and Simon Schaffer.

### THE OPENING EVENT<sup>1</sup>

Following an established tradition of the Dialogues, on the late afternoon before the first day of the seminar there was a formal opening event, aimed at promoting the Dialogue to the public opinion and the press, and introducing the intellectual experience with an aesthetic experience able to convey our emotions alongside our thoughts. For the 2017 Dialogue we proposed two events intertwined: a performance of Stockhausen’s *Tierkreis*, and the reading of some excerpts from an ancient literary tradition that brings together celestial bodies, human bodies, and political bodies. These three worlds spoke to us through unexpected affinities and, with the power of spoken words and music, prefigured the ideas that were dealt with over the next few days.

Some metaphors run through history like underground rivers, surfacing again in distant times and places: the metaphor of the body (the human body, the celestial

body, and the political body) belongs to this category. One of the earliest known attempts to establish correspondences between the signs of the Zodiac and the members of the human body was made in *Astronomica*, a work written by the Roman poet and astrologer Marcus Manilius in the first century A.D.. For an early image of this human body-Zodiac relationship, we can turn to a woodcut illustrating Johannes de Ketham's *Fasciculus medicinae*, published in Venice in 1491 and kept in Cini Foundation's library. The image depicts so-called *Homo zodiacalis* or *signorum*: a human figure in which every part of the body is associated with an astrological sign. So, it begins with Aries on his head and ends with Pisces at his feet, following the circular order of the twelve signs. This is one of the many illustrations, often found in the Middle Ages and early Renaissance, of a man-microcosm, a body reflecting nature and the whole structure of the Universe. Images of *Homo zodiacalis*, mostly in treatises of medicine, also attest to a belief in the stars' influence over the human body and, directly or indirectly, depending on the various authors, over the body of the State. At the height of Renaissance, Marsilio Ficino took up and developed this idea in his commentary on Plato's *Laws*: just like the body's members—he explains—the twelve parts of the city are also under the signs of the Zodiac.

Everybody knows the fable of the belly and the members, attributed to Aesop, which was read in Giulio Landi's sixteenth-century translation. But what is generally not known is that there is a very similar story told in an Egyptian tablet from the XXth dynasty, that is, around 1000 B.C., in which the belly decides to pursue legal action against the head. Unfortunately, this fascinating text has only survived in fragmentary form. Many centuries later, Shakespeare was to return to this esoteric fable, but in Latin guise: in a memorable page in Act One of *Coriolanus*, Menenius Agrippa retells the famous story. And, in the *First Letter to the Corinthians*, St. Paul compares the church to a body made up of members of equal dignity and importance.

That evening we also heard the reflections of Christine di Pizan, a remarkable writer and feminist *ante litteram*, born in Venice in 1365. She wrote a treatise of political ethics entitled *Libro del corpo politico* (The Book of the Political Body), in which the state is seen as a single body, whose functions are guaranteed by the harmony between the parts and by the correct movement of the individual components. Further food for thought was provided by John of Salisbury, the author of *Policraticus*, written around 1159, probably one of the first books of political science in the Middle Ages.

This garland of readings, ranging from ancient Egypt to Shakespeare, was interwoven with Karlheinz Stockhausen's *Tierkreis*, a composition inspired by and shaped in the image of the Zodiac. *Tierkreis* (it literally means "animal circle") is

the German word for the Zodiac. Stockhausen's composition is a cycle of twelve short pieces, which reproduces the structure of the Zodiac according to precise correspondences. Each of the twelve pieces is centered on a different note, establishing a parallel between the twelve signs and the chromatic scale. Scorpio is C, Sagittarius C sharp, Capricorn D, and so on. Around the twelve notes, and using the same number of various mathematical structures (arithmetical series, Fibonacci numbers etc.), Stockhausen constructed twelve strikingly simple pieces, each with its own specific melody and rhythm. The characteristic melody of each piece was repeated three or four times, as was taken up in turns by the various instruments in the ensemble: flute, clarinet, trumpet, and piano. At the end of the twelve pieces, the first piece was repeated, thus closing the circle of the work.

Stockhausen's *Tierkreis* was performed by the MDI ensemble, and the texts were read in Italian by Alberto Onofrietti. What follows is an English version of the same texts, freely chosen from classic and modern editions.

### ***Ancient Egyptian Writing Board, Museo Egizio, Turin (c. 1250 B.C.)***

Trial of Belly v. Head—wherein are published the pleadings made before the supreme judges—while their President watched to unmask the liar—his eye never ceased to watch. The due rites having been done—in honour of the god who detests iniquity—after the Belly had spoken his plea—the Head began a long harangue:—

“’Tis I, ’tis I, the rafter of the whole house—whence the beams issue and where they join together—all the members ... on me and rejoice. My forehead is joyous—my members are vigorous—the neck stands firm beneath the head—my eye sees afar off—the nostril expands and breathes the air—the ear opens and hears—the mouth sends forth sound and talks—the two arms are vigorous—and cause a man to be respected—he marches with head erect—looks the great in the face as well as the lowly...’Tis I that am their queen—’tis I the head of my companions... Who would play a trick—or is there any would say—‘Is it not false?’ Let them call me the head—’tis I that cause to live.”

(Cited in *The Fables of Aesop, as first printed by William Caxton in 1484 with those of Avian, Alfonso and Poggio now again edited and introduced by Joseph Jacobs*, London, 1889)

### ***Aesop, The Belly and the Members (VI c. B.C.)***

One fine day it occurred to the Members of the Body that they were doing all the work and the Belly was having all the food. So they held a meeting, and after

a long discussion, decided to strike work till the Belly consented to take its proper share of the work. So for a day or two, the Hands refused to take the food, the Mouth refused to receive it, and the Teeth had no work to do. But after a day or two the Members began to find that they themselves were not in a very active condition: the Hands could hardly move, and the Mouth was all parched and dry, while the Legs were unable to support the rest. So thus they found that even the Belly in its dull quiet way was doing necessary work for the Body, and that all must work together or the Body will go to pieces.

(Trans. by Joseph Jacobs, 1894)

### **Manilius, *Astronomica*, 2, vv. 453-465**

Now learn how the parts of the human frame are distributed among the constellations, and how the limbs are subject each to a particular authority: over these limbs, out of all the parts of the body, the signs exercise special influence. The Ram as chieftain of them all is allotted the head, and the Bull receives as of his estate the handsome neck; evenly bestowed, the arms to shoulders joined are accounted to the Twins; the breast is put down to the Crab, the realm of the sides and the shoulderblades are the Lion's, the belly comes down to the Maid as her rightful lot; the Balance governs the loins, and Scorpion takes pleasure in the groin; the thighs hie to the Centaur, Capricorn is tyrant of both knees, whilst the pouring Waterman has the lordship of the shanks, and over the feet the Fishes claim jurisdiction.

(Manilius, *Astronomica*, ed. and trans. by G. P. Goold, Harvard University Press, Cambridge, MA, 1977)

### **First Letter of St. Paul to the Corinthians (1 Corinthians 12:1-26)**

Now concerning spiritual gifts, brethren, I do not want you to be unaware. You know that when you were pagans, you were led astray to the mute idols, however you were led. Therefore I make known to you that no one speaking by the Spirit of God says, 'Jesus is accursed'; and no one can say, 'Jesus is Lord,' except by the Holy Spirit. Now there are varieties of gifts, but the same Spirit. And there are varieties of ministries, and the same Lord. There are varieties of effects, but the same God who works all things in all persons. But to each one is given the manifestation of the Spirit for the common good. For to one is given the word of wisdom through the Spirit, and to another the word of knowledge according to the same Spirit; to

another faith by the same Spirit, and to another gifts of healing by the one Spirit, and to another the effecting of miracles, and to another prophecy, and to another the distinguishing of spirits, to another various kinds of tongues, and to another the interpretation of tongues. But one and the same Spirit works all these things, distributing to each one individually just as He wills. For even as the body is one and yet has many members, and all the members of the body, though they are many, are one body, so also is Christ. For by one Spirit we were all baptized into one body, whether Jews or Greeks, whether slaves or free, and we were all made to drink of one Spirit. For the body is not one member, but many. If the foot says, 'Because I am not a hand, I am not a part of the body,' it is not for this reason any the less a part of the body. And if the ear says, 'Because I am not an eye, I am not a part of the body,' it is not for this reason any the less a part of the body. If the whole body were an eye, where would the hearing be? If the whole were hearing, where would the sense of smell be? But now God has placed the members, each one of them, in the body, just as He desired. If they were all one member, where would the body be? But now there are many members, but one body. And the eye cannot say to the hand, 'I have no need of you'; or again the head to the feet, 'I have no need of you.' On the contrary, it is much truer that the members of the body which seem to be weaker are necessary; and those members of the body which we deem less honorable, on these we bestow more abundant honor, and our less presentable members become much more presentable, whereas our more presentable members have no need of it. But God has so composed the body, giving more abundant honor to that member which lacked, so that there may be no division in the body, but that the members may have the same care for one another. And if one member suffers, all the members suffer with it; if one member is honored, all the members rejoice with it. Now you are Christ's body, and individually members of it.

### **John of Salisbury, *Policraticus* (c. 1159)**

A commonwealth, according to Plutarch, is a certain body [...] The place of the head in the body of the commonwealth is filled by the prince, who is subject only to God and to those who exercise His office and represent Him on earth, even as in the human body the head is quickened and governed by the soul. The place of the heart is filled by the Senate, from which proceeds the initiation of good works and ill. The duties of eyes, ears, and tongue are claimed by the judges and the governors of provinces. Officials and soldiers correspond to the hands. Those who always attend upon the prince are likened to the sides. Financial officers and keepers (I speak now not of those who are in charge of the prisons, but of those who are keepers

of the privy chest) may be compared with the stomach and intestines, which, if they become congested through excessive avidity, and retain too tenaciously their accumulations, generate innumerable and incurable diseases, so that through their ailment the whole body is threatened with destruction. The husbandmen correspond to the feet, which always cleave to the soil, and need the more especially the care and foresight of the head, since while they walk upon the earth doing service with their bodies, they meet the more often with stones of stumbling, and therefore deserve aid and protection all the more justly since it is they who raise, sustain, and move forward the weight of the entire body. Take away the support of the feet from the strongest body, and it cannot move forward by its own power, but must creep painfully and shamefully on its hands, or else be moved by means of brute animals.

(*The Statesman's Book of John of Salisbury*, trans. by John Dickinson, New York, 1927)

### **Henri de Mondeville, *Chirurgie de Maître Henri de Mondeville* (c. 1306-1320)**

The heart is the principal organ par excellence [...] which gives vital blood, heat and spirit to all other members of the entire body. It is located in the very middle of the chest, as befits its role as the king in the midst of his kingdom.

(Cited in Jacques Le Goff, 'Head or Heart. The Political Use of Body Metaphors in the Middle Ages,' in *Fragments for a History of the Human Body*, pt. 3, ed. Michel Feher, Ramona Naddaff, and Nadia Tazi, New York, 1989)

### **Christine de Pizan, *The Book of the Body Politic* (1407)**

Here begins the Book of the Body Politic which speaks of virtue and manners and is divided into three parts. The first part is addressed to princes, the second to knights and nobles, and the third to the universal people. [...]

These three types of estate ought to be one polity like a living body according to the words of Plutarch who in a letter which he sent to the Emperor Trajan compared the polity to a body having life. There the prince and princes hold the place of the head in as much as they are or should be sovereign and from them ought to come particular institutions just as from the mind of a person springs forth the external deeds that the limbs achieve. The knights and nobles take the place of the hands and arms. Just as a person's arms have to be strong in order to endure labor, so they have the burden of defending the lay of the prince and the polity. They are also the hands because just as the hands push aside harmful things, so they ought push hall harmful and useless things aside. The other kinds of people are like the

belly, the feet, and the legs. Just as the belly receives all that the head and the limbs prepare for it, so, too, the activity of the prince and nobles ought to return to the public good, as will be better explained later. Just as the legs and feet sustain the human body, so, too, the laborers sustain all the other estates.

(Christine de Pizan, *The Book of the Body Politic*, ed. by Kate Langdon Forhan, Cambridge, 1994)

### **Marsilio Ficino, *Commentary on Plato's Laws* (1484)**

Plato's ideal city, along with its surrounding countryside, is divided into twelve parts. But why in twelve parts? It's important for you to understand that a city ought to be administered like the celestial kingdom. The celestial city is distributed into twelve signs, as it were twelve tribes. Nor is it in vain that he dedicates his city to the Twelve Gods, since indeed the twelve Gods are said to rule the twelve signs. Furthermore, they are six gods and six goddesses: Juno, Vesta, Minerva, Ceres, Diana, and Venus; Mars, Mercury, Jupiter, Neptune, Vulcan, Apollo. Put each one over each one: signs over our members, gods moreover over signs. In Aries and over our head, Pallas. Over Taurus, however, and our neck, Venus; Gemini and human arms, Apollo; Cancer and the breast, Mercury... Understand through this that the whole city ought to be so one made up of many citizens, as a body is one made up of many members. But some gods in this scheme are said to be male, others female, that you may know that both what pertains to matter and passivity and what pertains to forms and actions are governed by the powers above.

(Cited in Carol V. Kaske, 'Marsilio Ficino and the Twelve Gods of the Zodiac,' *Journal of the Warburg and Courtauld Institutes*, Vol. 45, 1982)

### **Shakespeare, *Coriolanus*, Act 1, Scene 1 (1607-1608)**

#### **First Citizen**

What shouts are these? The other side o' the city  
is risen: why stay we prating here? to the Capitol!

#### **All**

Come, come.

#### **First Citizen**

Soft! who comes here?

*Enter MENENIUS AGRIPPA*

**Second Citizen**

Worthy Menenius Agrippa; one that hath always loved the people.

**First Citizen**

He's one honest enough: would all the rest were so!

**MENENIUS**

What work's, my countrymen, in hand? Where go you with bats and clubs? The matter? Speak, I pray you.

**First Citizen**

Our business is not unknown to the senate; they have had inkling this fortnight what we intend to do, which now we'll show 'em in deeds. They say poor suitors have strong breaths: they shall know we have strong arms too.

**MENENIUS**

Why, masters, my good friends, mine honest neighbours, Will you undo yourselves?

**First Citizen**

We cannot, sir, we are undone already.

**MENENIUS**

I tell you, friends, most charitable care  
Have the patricians of you. For your wants,  
Your suffering in this dearth, you may as well  
Strike at the heaven with your staves as lift them  
Against the Roman state, whose course will on  
The way it takes, cracking ten thousand curbs  
Of more strong link asunder than can ever  
Appear in your impediment. For the dearth,  
The gods, not the patricians, make it, and  
Your knees to them, not arms, must help. Alack,  
You are transported by calamity  
Thither where more attends you, and you slander  
The helms o' the state, who care for you like fathers,  
When you curse them as enemies.

**First Citizen**

Care for us! True, indeed! They ne'er cared for us  
yet: suffer us to famish, and their store-houses  
crammed with grain; make edicts for usury, to  
support usurers; repeal daily any wholesome act  
established against the rich, and provide more  
piercing statutes daily, to chain up and restrain  
the poor. If the wars eat us not up, they will; and  
there's all the love they bear us.

**MENENIUS**

Either you must  
Confess yourselves wondrous malicious,  
Or be accused of folly. I shall tell you  
A pretty tale: it may be you have heard it;  
But, since it serves my purpose, I will venture  
To stale 't a little more.

**First Citizen**

Well, I'll hear it, sir: yet you must not think to  
fob off our disgrace with a tale: but, an 't please  
you, deliver.

**MENENIUS**

There was a time when all the body's members  
Rebell'd against the belly, thus accused it:  
That only like a gulf it did remain  
I' the midst o' the body, idle and unactive,  
Still cupboarding the viand, never bearing  
Like labour with the rest, where the other instruments  
Did see and hear, devise, instruct, walk, feel,  
And, mutually participate, did minister  
Unto the appetite and affection common  
Of the whole body. The belly answer'd--

**First Citizen**

Well, sir, what answer made the belly?

**MENENIUS**

Sir, I shall tell you. With a kind of smile,  
Which ne'er came from the lungs, but even thus--  
For, look you, I may make the belly smile  
As well as speak—it tauntingly replied  
To the discontented members, the mutinous parts  
That envied his receipt; even so most fitly  
As you malign our senators for that  
They are not such as you.

**First Citizen**

Your belly's answer? What!  
The kingly-crowned head, the vigilant eye,  
The counsellor heart, the arm our soldier,  
Our steed the leg, the tongue our trumpeter.  
With other muniments and petty helps  
In this our fabric, if that they—

**MENENIUS**

What then?  
'Fore me, this fellow speaks! What then? what then?

**First Citizen**

Should by the cormorant belly be restrain'd,  
Who is the sink o' the body,—

**MENENIUS**

Well, what then?

**First Citizen**

The former agents, if they did complain,  
What could the belly answer?

**MENENIUS**

I will tell you  
If you'll bestow a small—of what you have little—  
Patience awhile, you'll hear the belly's answer.

**First Citizen**

Ye're long about it.

**MENENIUS**

Note me this, good friend;  
 Your most grave belly was deliberate,  
 Not rash like his accusers, and thus answer'd:  
 'True is it, my incorporate friends,' quoth he,  
 'That I receive the general food at first,  
 Which you do live upon; and fit it is,  
 Because I am the store-house and the shop  
 Of the whole body: but, if you do remember,  
 I send it through the rivers of your blood,  
 Even to the court, the heart, to the seat o' the brain;  
 And, through the cranks and offices of man,  
 The strongest nerves and small inferior veins  
 From me receive that natural competency  
 Whereby they live: and though that all at once,  
 You, my good friends,'—this says the belly, mark me,—

**First Citizen**

Ay, sir; well, well.

**MENENIUS**

'Though all at once cannot  
 See what I do deliver out to each,  
 Yet I can make my audit up, that all  
 From me do back receive the flour of all,  
 And leave me but the bran.' What say you to't?

**First Citizen**

It was an answer: how apply you this?

**MENENIUS**

The senators of Rome are this good belly,  
 And you the mutinous members; for examine  
 Their counsels and their cares, digest things rightly  
 Touching the weal o' the common, you shall find  
 No public benefit which you receive

But it proceeds or comes from them to you  
 And no way from yourselves. What do you think,  
 You, the great toe of this assembly?

**Thomas Browne, *Religio medici*, II, 10 (1643)**

There is no man alone, because every man is a Microcosm, and carries the whole World about him. *Nunquam minus solus quam cum solus*, though it be the Apothegme of a wise man, is yet true in the mouth of a fool. Indeed, though in a Wilderness, a man is never alone, not only because he is with himself and his own thoughts, but because he is with the Devil, who ever consorts with our solitude, and is that unruly rebel that musters up those disordered motions which accompany our sequestred imaginations. And to speak more narrowly, there is no such thing as solitude, nor any thing that can be said to be alone and by itself, but God, Who is His own circle, and can subsist by Himself; all others, besides their dissimilar and Heterogeneous parts, which in a manner multiply their natures, cannot subsist without the concurrence of God, and the society of that hand which doth uphold their natures. In brief, there can be nothing truly alone and by itself, which is not truly one; and such is only God: all others do transcend an unity, and so by consequence are many.

NOTES

1. In recent years, the opening events of the Dialogues have been always conceived and realized in close cooperation with Francisco Rocca, senior researcher of the Institute of Music of the Giorgio Cini Foundation. We gratefully acknowledge the decisive help of Francisco Rocca in conceiving and realizing these successful events.

DAY ONE  
(WEDNESDAY 13<sup>TH</sup> SEPTEMBER 2017)

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## Composing the New Body Politic from Bits and Pieces

*Bruno Latour*

I am happy to remind you that we started these experimental dialogs with Pasquale, in 2004, with a week on good and bad government, a topic that was not totally unrelated to this one. Thirteen years ago, we were preparing an exhibition “Making Things Public” about some of the same issues. Unfortunately, in the intervening years, it’s fair to say that things have become much worse, not to say tragic. In 2004, we were concerned by the fate of democracy after 9/11 and the insertion of ecology into politics—this is what “things” meant in the politics of things. But today it is more the fate of *politics* itself that is at stake, and not simply democracy, and this is why we decided to focus on the body politic. Pasquale, as the perfect host, has the habit of organizing a marvelous event the day before the dialogs: this one, yesterday, was in my view the best and most moving. In addition to the marvelous music, we heard a series of texts that showed, once again, that there exist, whenever we talk of body politic, a long tradition linking the notion of order with that of the shape of the cosmos. In other words, biology, law and physics are aligned. This is what Mike Lynch and sociology generally would call a “functionalist” definition of the body politic. But in the middle of those classical example of an organicist view of order in cosmos and society, there was Saint Paul’s famous passage in 1 Corinthians 12:26 on the Church as a body politic. Here the question is no longer to attribute a function to the members depending on what has been decided by the frame that holds all of them; but on the contrary, to see how each part takes care of all the others. I remind you of the phrase: “If they were all one part, where would the body be? As it is, there are many parts, but one body.”

“(...) But God has put the body together, giving greater honor to the parts that lacked it, so that there should be no division in the body, but that its parts should have equal concern for each other. If one part suffers, every part suffers with it; if one part is honored, every part rejoices with it.” Here parts are not side by side under a frame that overarches all of them—a bad way mode of organization, as Pasquale knows very well in his academic work on organization theory. Here in Saint Paul parts are overlapping with one another. And this is one of the mysteries I am interested in solving with you during this week.

What I called in *Facing Gaia* the “New Climatic Regime” (a phrase to cover and to politicize the ecological crisis and avoid the word “ecology” as well as the concept of “Anthropocene”), the New Climatic Regime obliges us to tackle anew the notion of Body Politic at its two poles. First, what politics consists of has changed enormously given the number of new entities we have to take into account—non human agencies. Second, the very notion of what is a body in biology as well as in earth science has also been deeply transformed—as those specialists around this table can bear witness. But if you consider the texts that were read yesterday, those two transformation cannot be taken into account: we are still very close from the Fable of the Members and the Stomach told by Menenius in Shakespeare *Coriolanus*. One could object that the liberal tradition—I give names to those two models because we are going to encounter them during the whole week- is very different from the organicist or functionalist one. But this is an illusion. It makes no difference whatsoever if you *start* from an atomic element—individual humans, or individual ants or bees or baboons or cells- and try to see which emerging order you end up with, or if you *begin* with an overall order-the society, the body, the anthill, the superorganism or whatever- and then go on to understand the role each atom plays in the overall order. Or to be fair, there is a difference: the chronology is opposite. But not the only two concepts used in both: there is a whole and there are parts.

In my view, but I might be mistaken, all the people assembled around this table, have found their ways to counteract the weight of those two models. Each of them has invented a research strategy to escape from the two apparently opposite paradigms, no matter if they work in philosophy, law, history, politics, biology, earth system science or ethology. So the stakes for me in this meeting is to see how the New Climatic Regime could be understood to renew politics without resorting to the two models of parts and wholes offered by either the organicist or the liberal version of order.

The public could be wondering why do we have people working on ants, on baboons, on capitalism, on human society, ecosystems, Gaia and cells assembled together. It seems that differences of scale, importance and domains are so great that there will be no match between the different speeches. The reason, very simply,

is that the new body politic, if we succeed in drawing its shape, includes not only humans, not only parts, but precisely this vast diversity of domains, scales and type of heterogeneous entities. So the composite nature of this group is not a fancy of my part but a necessity. They deal with different types of objects and different scale, because those entities, cells, Gaia, ecosystems, capitalism, baboons, animals and human society have in some way to be included into the new politic.

And yet of course, it is not a scientific meeting about ants, it's not a scientific meeting about baboons, it's not a scientific meeting about holobionts, etc. If we are here assembled, it is to reflect critically on each of our own fields so as to escape from the *conceptual apparatus* our different disciplines use. Strangely enough, even though there is a vast difference in topics and disciplines, there are not that many different conceptual frames. The surprise at the origin of this meeting, is that the concepts which allow us to speak about collective entity are not that many. Basically in ants or cells, or capitalism, or Gaia we often use the same conceptual apparatus independently of the type of object. Each of us we have been chosen not for our technical ability only in one specific field, but for our strategy in circumventing the orthodox view so as to offer an alternative. In my view, it is this alternative which should help us to assemble the body politic, an operation wholly impossible with the orthodox way of understanding the link between parts and wholes. In other words, the connectedness of all these different objects is suffering from the deficit of conceptual alternatives.

Before everyone mentions its own interest in the meeting, let me take one example. Scott F. Gilbert introduces the notion of holobionts to get away from the choice between "top-down" (whole to parts) and "bottom-up" (parts to whole) definitions of the cell differentiation. Obviously, his version of cell assemblage has immediate connections with the question of the commons in law, as could be understood by Kyle McGee or the question of human organization as understood by Mike Lynch, a proponent of ethnomethodology. Again, it makes not that much of a difference if you work on human or on cells because the mental apparatus to frame the empirical data might be just the same. Actually the commerce between biology and sociology has never stopped. This is why we have to be so cautious about using it in a new way. As Scott F. Gilbert wrote in the document preparing this meeting: "The notion of 'becoming with the other' has to be taken literally and has to become part of an evolutionary biology that had been based on the war of each against all... If we are to model our societies on the structure of an organism we have a lot of new vocabulary to invent." And I think it's interesting that this sentence comes from a biologist addressed to the philosophers and political scientist.

So this is what we try to do. We sort of know that the situation requires an *extension* of the definition of the beings engaged into politics, but we know that if we

assemble them through the two main paradigms which the Western political philosophy has given us, we will fail to do justice to the question that we want to solve. And that's why the subtitle of this dialogue is called *Sovereignty and Identity*, because those two concepts of political identity, the very notion of what is an individual and the notion of legal sovereignty, are thrown into doubt by the ecological crisis.

In spite of disputes and disagreement among us, all of us share a deep suspicion about those two paradigms and have discovered a way to circumvent their sway. As Tim Mitchell is going to show in a minute, it is possible to study capitalism and its history without resorting to a structural explanation. As he said in his opening statement "If our goal is to formulate a politics that includes a more diverse range of actors and worlds, we must break away not only from the conventions of orthodox political theory, but even more so from the conventional concepts of the economy and of economics. Whether we are considering cells, Gaia, non-humans, or corporations, it is economics much more than political philosophy that today shapes the boundaries and terms of political debate." Strangely enough, we will learn that this lesson is also valid for baboons. As Shirley Strum will demonstrate, you cannot understand baboon society without granting the individual entities a level of complexity and negotiation which neither fit the notion of a social structures *above* the baboon nor of course an atomic definition of baboon *then* entering into relation. We will hear here many examples of that process.

In his opening statement for the meeting, Timothy Lenton used a sentence which is very useful for our discussion when criticizing the notion of emergence—emergence, mind you, is another version of the structural notion. He says "At the same time I am not fond of invoking 'emergence' or 'emergent properties' because it is usually used as a cop out instead of actually trying to explain the origins of collective behavior." This is rather extraordinary coming from a specialist of Gaia. Since it is also a maxim of method that would fit Mike Lynch's ethnomethodology as well as my own in what is called actor-network-theory. So everyone of us, in some sort of sense, are trying to turn around this difficulty by insisting on alternative strategy to define either the individual or the process by which individuals collect one another which doesn't mean having an emerging collective phenomenon on top of it.

Is this hair splitting, and if so why does it matter? My answer: yes, it is hair splitting, and yes, it matters for a reason which is directly connected to the ecological crisis. The ecological crisis is a nightmare that we all have in our psyche, now deep into our gut and which creates lots of anxiety. As Isabelle Stengers and Kyle McGee have shown in their opening statement there is another nightmare which is also possibly forthcoming, that is, the nightmare of a "sovereign state of Gaia." Imagine the monster: suddenly we could be faced with a reinvention of the most radical and totalitarian version of politics granted to an Earth in crisis. In preparation for

this meeting, Kyle calls it a *geocide*, a possibility where the body politic associated with the notion of cosmic order will become a sort of power infinitely stronger and infinitely more reactionary than anything we have heard yesterday in those venerable text about maintaining the hierarchy between parts and whole. Imagine what, suddenly, we would be asked to do in the name of Gaia or in the name of some superior geo-engineering project? Having to take decision about what we eat, how many kids we have, how many kids we have to kill in order to diminish the numbers of people alive. It would be a nightmare joining in the worst possible fashion the cosmic and the social order together.

This is what makes this obscure question of the notion of what is an individual and the difference between parts and whole so important. At least, this is actually my way of understanding why we are here together. The reason why it's important is that if we ignore or don't find an alternative way of defining what is collecting in a collective phenomenon, we miss the possibility of doing something else, which is inventing a *democracy* around the possibility of associating all those entities that are represented around this table. We have no choice: the body politic to be described does include cells, animals, climate, laws and humans; we have to find a way to compose them together.

To sum up the project once more, we sort of know the *what* which is connecting us, but we have yet no precise idea of the *how*. We might be convinced that we have to modify our definition of the body because of the way we understand cells, animals and human society as well as the economy, and of course the biggest of all, Gaia; but we have no idea of how to form a polity out of that without redefining how we collect phenomena.

So when Deborah M. Gordon in a minute will present her work on ants she will show what it means to have a research strategy that avoids the older paradigm. When she writes in her opening statement "The fundamental question in the study of collective behavior is how do the interactions among individuals—that is, the means by which one participant influences and responds to the behavior of another produce the outcome that we see?" it is clear that the notion of individual is modified. Since the individualization of the ant is actually due to the number of other ants met during the day, she will offer a very different definition of the individual than the one which would be used for the classical paradigm which implies atoms, plus relations, plus emerging properties.

To conclude, it is very important when you do an experiment to know where it will fail. This meeting in my view can fail for three reasons, one scientific, the second philosophical, the third political. First, we fail if we enter into interesting scientific discussions each about our own research strategy but without being interested in how this research strategy could allow to help the other participants around the

table. Second, we will fail if the philosophers then say, “Well look, you are practitioners of many different sciences, but you don’t know the origin of your concepts, and you don’t realize that many of the concepts that you develop when you talk about collective phenomenon are actually coming from a philosophical tradition which you should not ignore.” We would have an interesting philosophical discussion about it, but not documenting any change in any of our own respective discipline. And the third source of failure would be if we jump to political consequences too quickly without taking the time to get inside the data of our disciplines where, in effect, lies the real political import of what we do.

But the meeting might succeed, if we manage every time we enter in one of these three sort of lines to be reminded of the two others: the *what* which is associating us, again with very, very different scale and types of entities as well as the *how* we compose the body politic. We should not be afraid of proposing a master narrative since the situation, thirteen years later, is much worse than when we considered the atmospheres of democracy here in Venice. What is “sovereignty” in the time of Gaia, when we know that neither the State, nor the definition of what is individual, nor that of biology, nor that of the Earth as a planet, work. What is it to invoke a politics of nature when nature and politics have to be reimagined? So we have to invent some sort of *quasi legal entity* to which some sort of authority is recognized, who possesses some sort of agency for what Tim Lenton called *Gaia 2*. Suddenly we have a completely new question and it’s terrifying to imagine that humans are in charge of that system. Kyle proposed the nice word of *ligature* to express the types of connectors we might be able to imagine once we will have concentrated our attention of the what as well as the how to compose the new body politic. It is a good term. He also introduces another nice expression of *geodicea* patterned over the old word of *theodicea*. Kyle invokes the justice of the earth, or rather how the new question of earth politics *judges us all*. If we are able to do this feat of the imagination, then I think we will have succeeded.

## DEBATE

*Simon Schaffer*

Ok, so now each of us is going to define briefly where we find ourselves in the three-part map that Bruno has just drawn. So rather timorously I’m going to start: I’m an historian of the sciences by training and profession. That’s an enterprise which, as a great philosopher once put it, is designed to make the familiar strange

and the strange familiar and that reversal seems to me absolutely called into question in a very profound way by the agenda Bruno has just set. The history of the sciences shows, I think, that he's right, that the idiom of collective and individual is very scale-insensitive indeed; that's to say my discipline uses precisely the same techniques at each level that it analyses from the very, very long-term changes of, for example, western knowledge, right down to micro-biographical studies of how individuals scientists and groups behave and work.

So even if I were not a citizen of the Anthropocene, in which like the rest of us I am, this would be modestly a challenge and an important one for my own field. There are many ways therefore, in which the agenda speaks to what bugs me. I'm much less clear about what I can bring to the table but I hope (I know it's a bad word) that that will emerge.

One theme which I feel one might have something to say about, from the historiographic point of view, is the notion of metaphor, which is crucial but absolutely unmarked—did you notice? In Greece, every bus carries on it the word metaphor because that's what metaphors are, they're modes of transport. I remember being very struck that you get from Athens to Piraeus on a metaphor. Well, metaphors in my field are bad things.

James Lovelock puts it beautifully in a passage which I noticed Bruno also cites in *Facing Gaia*. Metaphor was seen as a pejorative something, inexact and therefore unscientific. In truth, Lovelock concludes, real science is riddled with metaphor, so he uses a metaphor, wonderful metaphor to describe the place of metaphor in the sciences, juxtapose that with by far the greatest condemnation of the politics of metaphor in English which is in Hobbes's *Leviathan*.

*"The light of human minds is perspicuous words, but by exact definitions first snuffed, and purged from ambiguity; reason is the pace; increase of science, the way; and benefit of Humankind the end. And on the contrary, metaphors, and senseless and ambiguous words, are like ignes fatui; in other words deceiving lights, will-o'-the-wisp, jack-o'-lanterns and reasoning upon them is wandering amongst innumerable absurdities; and their end, is contention and sedition, or contempt."*

That's Thomas Hobbes, so in between those two extraordinarily plausible positions—a) science is riddled with metaphor, b) metaphor ends with contempt and sedition and contention—there must be a third possible position and what I hope to contribute to (but also learn from the dialogue) is what that place for 'transport' is, and we'll see if that works.

*David Western*

If we can't deliver to the public—Bruno's collective—some meaningful sugges-

tions about how to cut across disciplines to confront global challenges, then where do we go from here? I will argue that people who are deeply embedded in nature and have to live within its limits have an intimate connection between themselves, their domestic animals and plants, and political governance. They have to cooperate in managing the local commons, and as the world converges from discrete political and economic entities, we face the ultimate challenge of managing the global commons. The challenges on a local and global scale are similar, but today we face the ultimate test of all humanity—living with planetary limits. That means we must understand planetary process to avoid overshoot. But do we? Is a metaphor like Gaia up to mobilizing public engagement and capturing the essence of the earth systems science needed to manage the global commons? Can Gaia serve both purposes?

Another important point for discussion is scale. So many of the issues we're talking about today have been solved by local small scale societies. But how do we live together as a global community to tackle the looming threats to our planet?

Throughout the Neolithic we have diverged into myriads of cultures speaking different languages. How do we transcend these deep divides in our global age? How do we work with each as a global society as we've done within groups over the past millennia. Language is key. I have to work with over 40 language groups and cultures in Kenya. If I cannot translate lofty scientific ideas into simple concepts, then how can I bridge the gulf? How can I forge the collective Bruno is arguing for as the way ahead?

I'm interested in how we transcend these different scales and cultures through the social media. Fifty years ago the world of the Maasai was not much more than 20 kilometers from where they were born. Today the very same individual have offspring who work in New York and Aspen Colorado and regularly communicate by cell phone with relatives back home in Kenya on how to manage their family herds.

We live an extraordinary age transcending thousands of years of human diversification. The challenge for us with a foot in academia, is how to cut across disciplines and translate our understand of how we and the world works into ideas and explanations that mesh with people on the ground. If we don't, we either have to question the veracity of our own ideas, or figure out how to change misperceptions.

The metaphor of Gaia is important because it has the potential to take us beyond our disciplinary, political and national cells to find common ground in managing planet earth, even if the mechanisms prove different from its original conception. What matters is that it calls for a common caring for the earth.

So my question is how we draw on and scale up from small scale societies that have confronted local limits in the past, to a global society that must face up to the ultimate global limits? That, Bruno, is why I think you brought to the table.

*Timothy Mitchell*

Thank you. I might start briefly from the concern raised in the opening statements circulated by Kyle McGee and Isabelle Stengers, which Bruno just mentioned: the danger of Gaia becoming a vision of the whole, a higher order that we come to be ruled by. One way to situate some of my questions for this Dialogue, is that they begin from the question of what we're ruled by currently and in the recent past: specifically the way in which one object, the economy, became exactly that: became a totality, a higher order, that laid down a set of rules and procedures according to which we are obliged to live together as a collective body. My interest is partly just to understand how the economy came into being, and how more recently the idea of "the market" came to replace the economy, and things like that. But more specifically to think about this concept of the collective by going back to a period before the term "the economy" was used. This change was remarkably recent. Essentially, before the 1950s we did not speak this way about our collective life. That earlier period was another world, to which, in a way, the economy was meant to be an answer, was meant to be a sort of stabilizing object around which we could reorganize our life.

Since I'll be speaking about this in the next session I'm not going to say too much about it now, but I would characterize it in one way. What I began to understand by looking at a set of histories over roughly the seventy or eighty years before the invention of the economy is a new way of thinking about relationships to the future. That seems to me central not just to the work that I've been doing but to our larger project here, because what has caused so much of the ecological crisis is indeed our inability to act collectively in ways that we might want towards the future.

I want to try and characterize a certain way of acting in relation to the future, and having the future act on us, that came into being, or rather, became prominent, in the late nineteenth century. I don't think we've recognized this change when following the usual ways in which we think about modernity and the future. Whether in terms of the acceleration of the future, or of the rapidity which we are cut off from our own pasts, or of our ability to plan for the future, we have a set of existing ways of thinking about the relationship between our collective and its future. None of those adequately capture what actually happened in that period about a hundred to 150 years ago. There's another way of characterizing the kind of relationship to the future that developed then and became a very powerful organizing principle. One of the ways this matters for our conversations here, is that we are now living that future. We are living with the consequences of what came into being. That's part of what I want to bring to the discussion.

### *Isabelle Stengers*

I will take back Bruno first word which is “we are experimenting.” I think we will not solve the question of the future. As Mitchell said, we are in a future which was invented and captured what may be called the body politics. It was one of my main feeling, becoming aware of the new climatic regime, that we may well have a lot of powerful technology, but that we are less well equipped than ever to face what is happening.

The feeling that we are desperately blocked and that nothing is possible is thus to be taken seriously, not as a symptom of something we would dissert about. But we can also take seriously what will happen here, between us. We can experiment what may be generated in this encounter when people with different backgrounds endeavor to think together. We are anything but a body, we have different backgrounds and agenda and we meet about a question that is beyond us all, but that concerns us all, and to which we think we may contribute since we accepted the invitation. I would propose that we take this invitation as an occasion to test what I have called the infrastructure of any politics, or of any emergence of a collective, whatever its specific composition. I tentatively called it “mutual sensitivity” in my text. It is a requisite for any emergence even if in each emergence it will be characterized, fostered, canalized or repressed in many different ways. One way to repress it is precisely the deaf ear we are so used to turn to each other in the academia. We pay a lot of explicit attention to our competent colleagues’ objections, we recruit allies but the concerns of most others are mostly noise we proudly ignore – let us not even speak of the concerns which we associate with opinion. From this point of view, our meeting has something of a Sabbath, a suspension of our professional canalization. Very often it is taken as a time of rest. Here it may be an occasion to experiment with the possibility that what assembles us get the power to collect us, activate mutual sensitivity. It does not mean to come to an agreement or to convince each other; but it may mean a change in the way each of us relates to her or his own reasons to think and argue as she or he is used to. Not a conversion but an inflection. Not being polite and nicely interested but slightly transformed.

I think that in many so called tradition peoples, what Bruno proposes that we call the body politics refers to occasions where mutual sensitivity is cultivated and activated in such a way that composition may emerge which belongs to nobody who would win the argument but to a togetherness which has been collected by the situation and made some common sense about it. In Africa it is called Palaver, a rather derisive word European used to qualify those long exchange of words they add to endure. We have lost such a culture, and it has made us vulnerable to the capture by a future which disempower the present. We will not here reinvent this culture

but we can, maybe we can, pay attention, experimentally, to what it takes to have what others say matter, and to let the way a common issue matters for them inflect your relation about what matters for you. This kind of experimentation is what interests me in the contemporary resurgence of the commons. Commoners have to take time to listen to each other and also to the many components of the holobiont they are part of and have to compose with. Commoning, as they say, learning how to think like a commoner, is reclaiming the culture of an infrastructure which has been devastated, leaving us off-ground.

Obviously, our common ground, Academia, is not the crucial one when it comes to equipping ourselves to face Gaïa. It is rather a good example of the great vulnerability of an institution which has entertained the confidence that its own value was able to stand by itself, and be respected as such, an off-ground institution claiming the right to produce so called disinterested knowledge, that is indeed a knowledge that does not cultivate but despise or appropriate the emergence of common concerns. We have not even been able to devise common ways of resisting our redefinition in terms of “the economy.” Most of us are now so busy to struggle for survival that they have really no time to lose to wonder what kind of body we and our different research organs could compose together. Mutual indifference permits fast production. Our case has nothing exceptional about it. Everywhere the same redefinition has taken place. But it may be said that our example is particularly scandalous since our charge is also to equip students who will have to live in the coming times.

There is no possibility of resurgence without appetite, without the experience that what we have been deprived of may indeed be sustaining. I hope that we can experience together here that when we take time to listen to each other, we are not losing our time. But my greatest hope would be that we do not take this for granted. This is why I speak about experimentation. About paying collective attention to what it demands to achieve a thinking together, a polyphonic composition.

### *Scott F. Gilbert*

So, what's the body of the body politic? If we wish to talk about the body of the body politic, it would be good to know something about the body. I profess embryology, the science of body construction, a science that is full of metaphors, full of similes, full of analogies and full of images trying to understand how bodies are made.

And so I get to study how the sperm and the egg interact—how two cells at the verge of death merge to form a zygote, and how this zygote—this unity—splits and keeps splitting to make cells that create differences, and then how those different

cells interact to give us things like eyes, hearts, and limbs. You get one heart and it goes to the left side of the body, usually. You get two eyes, usually; and always, if you have eyes, they're in your head and nowhere else. You get limbs, you get hands that grow the same size, within a centimeter, after 20 years. We have this incredible construction of the body, and in the past two decades we've learnt so many new things.

Many of the things that we've learnt are not in textbooks yet. We've learnt about the interactions between body parts and how these interactions are critical in the formation of new body parts, we've learnt about symbionts, and that the body is not constructed only by those cells coming from the zygote. Thus, there are other organisms that are intimately involved in our construction, and we are not fully formed without the instructions coming from, for instance, bacteria, organisms of another kingdom. We've discovered a whole new level of what we call developmental plasticity, where the agency is not only in the cells, and it's not only in the DNA. The agency is also in the environment.

I've studied turtles, and what determines the sex of a turtle is the temperature of the egg during a certain period of incubation. It is not uncommon for the environment to have such agency. So we now have an embryology which is not only about getting DNA transferred between generations and the instructions for development being in that DNA; we're now talking about interactions between DNA and proteins, interactions between cells, interactions between the organism and its environment, and the interactions between the developing organism and symbionts such as that it's very difficult to tell what is outside, and what is inside.

Now, how does this relate to the body politic? We talked about metaphors, similes and analogies. Somewhere in high school we learnt the difference between metaphor and simile, and that simile uses "like" or "as." I actually think that the difference between metaphors and similes is one of most important things we have and that's that because metaphors are magical and similes are logical. Metaphors make identities. "You are the promised breath of springtime" doesn't say you are *like* springtime or that you're *like* breath. No, that would ruin it, making it rational. I want to see what happens if you make the Gaia metaphor and other metaphors into similes? *How* is Gaia like a plantation? *How* is Gaia like development? *How* may Gaia be like terroir? What are the possible ways of relating something as complicated as Gaia to something that we may already know? So I think we all have to be in this willingness to play together. One of my junior colleagues said that she doesn't want a mentor as much as she wants an interdisciplinary playmate. I think that that's kind of what we're looking for here: people to have serious play with. Isabelle Stengers mentioned in her paper the notion of palaver, where people are willing to be together to discuss their differences without acrimony, and I think that this is a wonderful kind of a metaphor and wonderful paradigm to put us in. So thank you.

### *Didier Debaise*

I would like to settle the problem of the body politic inside a very general question: what is nature? Of course, this question might seem too huge, too ambitious, too general to receive any useful answer. But if we analyze more carefully this question, if we precise *when* and for *whom* it might have any importance, the question might lose its generality and might become really more precise and more obvious. We can begin by this first aspect of the question: *when* was invented the nature that we inherit in all aspect of our experience? Following Whitehead, I claim that this invention was produced during the 17<sup>th</sup> century and finds its necessity in the practical questions of the scientific experimentation. It finds its source in the experimental sciences and was diffused from there to all other domains. To understand it, we have to interrogate the *gestures*, the *operations* that are in the center of its invention, instead of the categories that were associated to it. The two main operations are the *bifurcation* and the *simple localization*. If we understand well the status of these two operations, the reason why they were so important in the constitution of modern sciences, we will understand to which interests correspond the invention of nature and to what kind of problems the invention was supposed to give an answer. So the general question “what is nature?” can be reformulate: what kind of gestures produced during the 17<sup>th</sup> century what we call “nature”?

To continue our inquiry on the constitution of nature, we can now precise the “we,” to whom this invention was so important. I remember when Bruno used for the first time the notion of “moderns” in *We Have Never Been Modern* and the notion of “humans” in *Facing Gaia*, some readers asked “who are exactly these moderns?”, “where they live?” Even if they never existed, what was this pretention, this ideal that can be summarized as “modern”? I think I have a small answer to these objections: the moderns are the one who bifurcated and localized the nature, or to be more precise, one can say that as soon as there is an operation of bifurcation and localization, there is something that we can call “modern.” So of course it’s not limited to Europe, it is everywhere that you have these two operations. From them, we can understand the status of the nature and the practical meanings of the categories that were so important for the moderns.

My interest for the question of nature is very pragmatic: what was its function? What were its effects? My hypothesis is that the pragmatics function of the notion of nature has to be found in the way by which it allowed to articulate, to organize, or to settle all sorts of beings. It did it by subtraction: the subtraction of all modes of existence, through the operation of bifurcation, to only two (real and apparent), the subtraction to all kind of entities to only one (the matter).

*Mike Lynch*

I will try to be fairly concise, although it's hard to do that because Bruno and I go back quite a long way, as Simon and I also do. About 30 years ago, we were identified against our own leanings with a movement called Social Constructivism, or sometimes Constructionism as Ian Hacking preferred to call it. And that idea was widely misunderstood to be skeptical of science, in the sense that social influences coming from outside science were distorting its results, distorting its representations. As Bruno also did, I tried to correct that misunderstanding, to the point of abandoning the very terms Social Constructionism, and I think that, like Bruno, I have a different picture of what those words could possibly mean, rather than suggesting some sort of post truth philosophy.

Instead of being skeptical of science, our understanding was that each science is itself a source of understanding of the Social and, more than a source of understanding, a source of the creation of what social relations become at a given time and in the future, not just through technology, although novel technology is certainly a part of that story.

I started in sociology as an undergraduate student, but as a post-graduate student I became dissatisfied with it and began working with Harold Garfinkel, the founder of the field Ethnomethodology, which, to put very simply, is a study of the practices through which what we call "social order" is constituted. When applied to the sciences, ethnomethodology is the study of the practices that scientists use to co-ordinate and to create what becomes part of the world subsequently.

And as you can see from the makeup of this particular panel, we're certainly not hostile to science although in the current situation where climate change has been questioned by my home nation's elected government, skepticism about particular sciences is very much in force, 'in the air,' so to speak, and we—I think, I speak for many of us here—are in a position where we cannot be aligned either with a defense of science that portrays science as something that transcends earthly existence and that is representative of a world as it is or always was, or with the tendentious questioning of the truth claims, of the representations, that come to us through climate science and many other, particularly environmental, sciences today.

What could emerge from a dialogue like this in the long term, would be a different understanding of science—that is not necessarily endorsing whatever it presents as the truth in public forums—as representing the world as it is. Instead, it would be an understanding of science as something more creative, dynamic, infused with metaphor; using metaphors not only to represent, but also to co-ordinate relations in and between the sciences. This would be a picture that I think is more compatible with what scientists do, and more interesting than conventional versions, and

in the long run I think also more productive.

So, as many of us have already been saying, the picture is one that's interactional rather than individually based. This conception of sociality does not envision society as a big thing, overarching all of this interactional work, although certainly it isn't just a bunch of small, disconnected bits, atoms that somehow emerge into something larger. Consequently, I'd say that in the map of our viewpoints here, I stand with an understanding of the *how*, the practical and the productive. The distinction between a specialty in sociology and other specialties is of very little concern, and the particular practitioners and practices that are at stake here are sources of wonder for me, not just as objects for a possible explanation using the tools of my discipline. I'll stop here because I'll be speaking more about this later, this afternoon.

### *Tim Lenton*

Hello dear friends, hello audience, I feel the weight of perhaps Gaia on my shoulders, as I am probably the only one here who's spent all their career so far trying to understand how today's Earth came about, or let's call it how the Gaia phenomenon came about. So first of all I'd like to say that I've always felt part of a pretty small and also privileged minority of scientists who have chosen that as their subject, object, system—I'm not sure if any of those words are apt and I'm still on that journey—meaning we're still striving to understand how the Gaia phenomenon could have come about: How can we be here reflecting on these questions after 3.8 or more billion years of the history of life, able to create an oxygen-rich atmosphere, a stable climate and a phenomenal material-recycling system, powered by sustainable energy?

As it stands, I think we understand the kind of plurality of processes that contribute to this planetary-scale phenomenon, involving feedback, networks, information, selection mechanisms (dare I say it), all of them unconscious up until now, or at least until recently—and that's the Gaia 1.0 that we know.

There was what Dawkins would call a blind 'Gaia-maker' up until now, but we're not blind anymore. I come to the meeting as a child of the Anthropocene, unashamedly thinking about how we could use a little of this scientific understanding to help us construct a future world with a sustainable, happy future for humanity within Gaia—and that's what I'd call Gaia 2.0—just to recognize that it will include our conscious agency and reflection in some form. Whether that is for us to please simply ourselves and our societies, or whether it's because we entwine ourselves in the processes and workings of the planet in some way, I'm honestly not sure. I should state at the start that I would completely agree with others around

the table that we obviously can't take all our lessons from Gaia. In fact, we can't really take any political lessons from this prior system and we certainly want to avoid the kind of tyrannies that that might imply. On the other hand, I think we probably can learn some useful lessons from such a long lived and you might say successful system, at least in terms of our collective relation with energy and with materials and the stuff of which we make both ourselves and our societies (for want of a better word).

So, I'm gently trying to unpack what those lessons might be that we could take forward, whilst at the same time understanding that we don't really understand the original Gaia phenomenon properly yet. I'm well placed to say that, because I've been trying to understand it for a long time. We understand pieces, fragments, the map is incompletely drawn. But at least I think we understand enough to take a little guidance and, if we were bold, we might think about how we could design the kind of processes of transformative change subject to selection that have actually given us a very successful self-regulating Gaia phenomenon in the first place. In other words, within the milieu of our cells in our society could we, somehow, design catalytic networks where innovations started on a very small perhaps ecosystem scale, but those that are collectively deemed successful or recognized as a step in the right direction towards an agreed shared goal of future sustainability—could we design a system that would allow those to spread at the expense of things we might deem detrimental to our future, sustainability and happiness?

Well I don't know, but I'm thinking about it and I will cheer you up with the thought that I'm not as pessimistic about human potential as my great mentor James Lovelock. One of my favorite quotes from Jim is: "*I would sooner expect a goat to become a gardener as humans to become responsible stewards of the Earth.*" So yes, I would love to come away from this week with some new fragments of insight into the part I feel least qualified in my own head to pontificate on—which is the politics, ultimately, of this coming transformation.

### *Deborah M. Gordon*

I'm an ecologist and I study ants because I've always been interested in what Bruno calls the way out of this problem of treating the collective as a thing, or the individual as a thing. Ants are good for that because they don't let you forget that they live in a colony—but they are individual animals walking around on their own. So when talking about ants it is impossible to come to the kind of equilibrium where you either have individual ants or a colony.

Beyond that I don't know how talking about ants or ecology helps the problem that we all face as citizens of the Anthropocene. I do think that the more we learn

about how the world really is, the more we can decide what to do. It would be great if we understood enough to design processes for making the world better. I'm not sure if that's possible. I hope that by talking to each other about how we work, and how we think, that we may be able to, as Didier says, arrive at ways of thinking that would will be helpful so... I'm hoping to learn more about how to think about politics by being here.

### *Kyle McGee*

Thank you. First, I am compelled to offer a very significant apology for being the one to have introduced Donald J. Trump to the discourse. As the group knows, I've published a short book a few months ago, with an open-access/creative commons publisher, generally about the phenomenon of Trumpism and political ecology. Since Bruno already made reference to it and its concept of geodicy, I just want to add that while I think these reactionary developments in politics raise substantial and legitimate problems about sovereignty, ecology, and national identity, there are also elements of distraction and gaslighting wrapped up in this ongoing phenomenon, and I see it as my duty to you to attempt to filter out the junk—which may be easier said than done, given that we are confronted with a mobile political trajectory that in some ways draws its efficacy, if not its claim to legitimacy, from new variants of traditional sleight-of-hand techniques and outright fraud.

As the lone lawyer on this tremendous board, I thought I would say something very briefly about the scope of this particular discipline. It's something Bruno and I were discussing yesterday, and it got me thinking about how seriously we should take the following idea: that jurisprudence is defined as 'the knowledge of things divine and human, the science of the just and the unjust.' That's an extensive definition of jurisprudence or law, to say the least. It traces back to Justinian's code, the *corpus juris civilis*, and even further than that if you dig more deeply. What was interesting to me in placing this classical articulation into dialogue with contemporary politics is that, on this understanding, a phenomenon like Gaia appears to be actually a small region within the open manifold of law, and I find this to be somewhat unorthodox and perhaps counter-intuitive, and so perhaps worthy of teasing out at some point in our dialogue.

We'll certainly circle back to this point but I wanted to tie that into how I see my role here at the dialogue. Initially I thought I would take a sort of defensive posture in something like the sense that Isabelle was talking about, of mutual transformation in which I would occupy the place of my discipline in the skein of the different disciplines that are represented here, with politics, with the sciences, and serve as a point of articulation of controversies, perhaps acting the antagonist and

giving voice to overlooked elements worthy of concern. So that is how I envisioned my role but as I am hearing your rich and evocative statements and how you see the outlines of our collective problems in this meeting, I feel like there may be quite a deep potential for transversal communication and that's something I am now hoping to fully explore.

If you draw any new insights about law and how it may connect with your own concerns from this meeting, I hope it is that law is a far more extensive phenomenon, a much more complex and diverse range of phenomena than you had initially thought. You might reasonably have confined the concept of law to court systems and legislatures and so on. But it's much more than the formal institutional apparatuses; it's in the atmosphere, it's in the gut, it's in our technologies, it's in between us. That is what I like to think of as the infra-judicial dimension, which is at once doctrinal, normative, and formal as well as practiced, lived, and sensed. We'll perhaps have a chance to work through that topic in a while. If you take anything from me, in summary, I hope it's something along those lines, and maybe to complicate your own relations to legality. For my part, what I've learnt from this opening introductory session is that it turns out I have a lot to learn about the 'science of things human and divine' from each of you. So, I am excited to embark on this process of constructing a chain of mutual transformations with you.

### *Shirley Strum*

I'm Shirley Strum, I'm an anthropologist, I've been studying baboons for 45 years. Baboons were different from what people thought when I started. What I discovered made me think that baboons were "almost human" but decades later my focus is on why baboons aren't human. This "not humanness" may limit my ability to contribute to our discussion.

Bruno and I started out together a long time ago. He was studying Laboratories the Salk Institute and I was studying baboons and teaching Anthropology at UC San Diego, across the street from the Salk. We collaborated in "looking at humans studying nonhuman primates." That collaboration helped me shift to examining process not just looking at outcome. This has been very constructive and productive for me in recent decades.

I began studying baboons because I didn't want to study people yet baboons have been the harbinger of the Anthropocene, the age of humans, and so they dragged me into situations where I had to deal with people. Relevant for our discussion, I realized that for baboons at least, the social and the ecological can't be separated. I will be trying to illustrate that a little bit. I think this principle of integration also applies, in the Anthropocene, to humans. My work with people in the Anthro-

cene, and what I've learnt from that process may be of some relevance. However, I have never actually researched humans in the Anthropocene. Jonah's is the one that has studied people and the ecosystem, I have adopted some of his methods in my location. In this way, I think of myself as a mini Jonah. He can tell you about the big picture; I can tell you a little bit about one specific place in time and space.

This is why I'm agnostic about my contribution to this discussion. I'm glad I've come last both today and in the program because I think, just like Kyle, what I might say will be determined by what the rest of you say. I see overlaps, but I'm not certain.



## The Ecology of Collective Behavior

*Deborah M. Gordon*

I will try to give you a sense of what we do learn about how ants work together, and about how their behavior is connected to the situations that they are in. An important part of what I want to do is to show you pictures, which are a form of metaphor that give some sense of how to think about how ants work together.

I study ants because I'm interested in systems where it is obvious that there is no central control. I will start with a picture of a school of fish turning. There are many obvious examples of systems like this. In fact I think it is true of every biological system that there is no central control. One of the ways that we have gotten into the trap of the tension between the body and the parts of the body, or the individuals and the collective, is to focus too much on looking for analogies among outcomes: the school of fish turns or the herd of wildebeest moves across the prairie. Instead it helps to think not so much about the outcome, but instead about the process that generates that outcome; every outcome is the result of some process. The question is how that process responds to, and affects, and adjusts to changing conditions (1-3).

As an ecologist, I think about how ant colonies change and respond to different situations.

There are more than 14,000 species of ants, and they live in every conceivable habitat on earth and behave in many different ways. All ant species have in common that they live in colonies, consisting of one or more reproductive females that we call 'queens.' The queens just lay the eggs, they don't tell anybody what to do, they have no political authority, and they don't give any instructions.

Instead, the ants perceive each other and interact with each other mostly through

smell. They can feel touch and smell with their antennae, so when one ant touches another with its antennae it is smelling the other ant. The ants are coated with a layer of a greasy substance that carries an odor.

My work is about how these patterns of very brief interactions regulate the behavior of the colony. One kind of experiment that we do is to take little glass beads and to coat them with the chemical that produces the odor (4). We've learned from experiments like this, that I've been doing for many years with Mike Greene of the University of Colorado, that there is no message in the contact. It's just the rate of interaction that matters.

We can drop beads that smell like ants into the nest and the ants will react as if they were meeting other ants. The beads are not communicating anything other than their odor. Each ant is reacting to the rate at which it smells another ant. There's no other message.

In this video, there are some ants moving around in a box in a lab. As an ant walks around and touches other ants, it is using its accumulated experience of how often it met other ants to decide what to do. Now the trajectories all of those ants—and here is the one we got out of this video—create a network that's always changing. It is that changing network that regulates the behavior of the colony (5).

Now I'd like to give you some examples of how different kinds of ants in different situations use these patterns of interaction. I will compare one species that lives in the desert, that uses resources—seeds—whose distribution changes very slowly, in an environment where water is limited, —with another species, in the tropical forest, that uses resources that change very quickly.

The desert harvester ants forage for seeds. The site is in southeastern Arizona, in the southwest US, near the Mexican border. I have taken a census of all the harvester ant colonies on the site every year since 1988. To do this, each year I find the colonies that were there the year before, and take the dead ones off the map, and put the new ones on. In this way I've been able to follow colonies over their lifetimes, and to find out how colonies grow (6). To find out how a colony changes in size as it gets older, we dug up colonies of known age and counted all the ants. We learned that the colony, which begins with no worker ants, just the founding queen, gets to a size of ten to twelve thousand sterile worker ants when the queen is five. That's when she begins to reproduce, producing the winged ants that mate to found new colonies. The queen lives 20-30 years, but a worker ant lives only a year. As the colony gets older and gets larger, the same queen produces all the ants. The worker ants in an older colony are not any older than the ants in a younger colony because they're replaced each year.

The colony's behavior changes as the colony grows older and larger. This is what got me started thinking about rates of interaction, because an important difference

between older and younger colonies is not the age of the ants, but simply that the older colony is larger.

To give an example of how we can think about the identity of a colony, let's consider nestmate recognition. Often when ants of different colonies meet, they fight. The most common explanation is the idea that each colony has a characteristic odor that belongs to that colony, which acts like a passport, and that each ant knows the odor of its own colony passport. Then when an ant meets an ant from a different colony each of them would say, you have a different odor or passport so you don't belong to the same colony as me.

The only way we have to find out about this is to take ants from one colony and ants from another, and put them in a box together. If they fight, we say they must have recognized that they were from different colonies, but of course, if they don't fight, we don't know if that's because they didn't recognize each other or they just didn't feel like fighting that day.

Working with Fernando Esponda, we developed a distributed model of nestmate recognition (7). We assume that the ants within a colony actually differ in odor, so they don't all have the same passport—and there is experimental evidence for this from some species. We also assume that an ant has a decision boundary in the space of all possible odors. The decision boundary defines what the ant recognizes as being from another colony: any odor on one side of the decision boundary is considered to smell like a nestmate, so there is no fighting, but any odor on the other side of the boundary is designated as not a nestmate. Finally, we propose that the boundary changes over time. At first, the default is just to accept the other odor as that of a nestmate, but over successive encounters this changes. For example, if the ant meets another ant and is attacked, then it puts that attacking ant's odor on the other, non-nestmate side of the boundary.

If you were to look at all of the ants in a colony at a given time, they would all have different odors (and this is confirmed by looking at the chemistry of the substances on their bodies that carry the odors)—and in addition, they would all have different decision boundaries. In this illustration from a hypothetical colony, there's only one small space which every ant has in common as designating as not a nestmate (Fig. 3 in [7]). At any time, if you take out some ants and put them in a dish with ants from another colony, some of them will fight and some of them won't, because they smell each other and react differently, because they differ in what they perceive as the boundary between nestmate and not a nestmate. Thus there is no such thing as the colony identity, except this aggregate of all of the different, changing, shifting boundaries of the ants.

If this is true, then as an ant gets older and it meets more other ants, it should become more discriminating; it should get better at identifying ants of another col-

ony. We tested this with the harvester ants. In my work on harvester ants, I separate the tasks of the ants outside the nest into 4 categories (8, 9). First, the foragers go out and collect food. The patrollers come out first in the morning and they meet the neighbors, and their return stimulates the foragers to leave the nest. The nest maintenance workers build and clean up the nest. The midden workers sort the midden, or refuse, and put an odor on it.

Some experiments that I did early on show how ants change from one task to another (9). The ants of each task were marked with a spot of paint on their heads. Then I created a situation in which more ants were needed to do each task. When I put out extra food, they needed more foragers to collect the food. Workers of all other tasks—the patrollers, midden workers, and nest maintenance workers—switched to foraging. When I created a disturbance that required more patrollers, the nest maintenance workers switched to patrolling. But if I made a mess that more nest maintenance workers were needed to clean up, then none of the ants in other tasks switch back to do nest maintenance work, so the new nest maintenance workers come from the younger workers inside the nest. Thus there is an irreversible flow of ants from nest maintenance up through foraging. (By the way, this is the work that I did early on that went against what was then the prevailing view that each ant has its genetically determined task—because it shows that when conditions change, ants switch tasks).

In our experiment on nestmate recognition (10), we took the older ants that work outside, that had a chance to meet ants of other colonies, and we put them in a dish with outside workers of another colony. We did the same with younger ants that had not worked outside yet and so had not yet met workers of another colony. The ants that had been outside, that had more opportunities to meet ants from another colony, were much more likely to fight. The default response for the ants that had only worked inside, and not yet met ants of other colonies, was not to fight. Instead they accepted the ants of other colonies as if they were nestmates. This is consistent with the idea that ants change their decision boundaries over time, in response to their experiences with the other ants that they meet.

Here there's a clear analogy with the adaptive immune system in mammals. An infant starts with few cells that recognize pathogens as foreign or dangerous. Over time, the adaptive immune system allows the individual to acquire different cells, each of which can recognize a pathogen. No single cell can recognize every pathogen. What the individual responds to is a consequence of the particular experiences that they had, the diseases and vaccines they've had. At any one time you are an aggregate of different recognition boundaries. So there's no passport; there is no particular individual identity.

Another example of how ants work together is how harvester ant colonies regu-

late their foraging activity (11). The ants eat seeds that are scattered on the ground by wind and flooding, and stay there for a long time. Because the seeds are scattered, and not in patches, the ants do not use chemical trails to recruit to food.

In the desert, water is scarce. When it rains, the plants produce more of the seeds that the ants eat. When it is dry, not only is there less food, but there is also a moment-to-moment cost: an ant loses water just walking around outside. When it's dry the ant loses more water. Basically the ants have to spend water to get water: they lose water by being outside looking for seeds, and they get water by metabolizing the fats out of the seeds that they eat. Thus for the colony, there is a decision about how much to forage at any time.

The colony solves this problem by using the rate at which outgoing and returning foragers meet. The ants going out to forage use the rate at which they meet ants coming in to decide whether to leave the nest on their next foraging trip; an outgoing forager does not leave the nest until it meets enough ants coming in with food. We know about this from experiments in which we take away the returning foragers coming in with food. After a short lag, there is a decrease in the rate of ants going out, and this decrease is larger than can be accounted for by the number of returning foragers we removed (12). Changing the rate at which the foragers come in changes the rate at which they go out (13). It's very noisy; it's not the case that every ant is responding deterministically, and what each ant is perceiving is stochastic. Yet collectively, in just 3 minutes, the colony can respond to a change in the rate.

That foraging is regulated in this way makes sense when you consider a foraging trip of one ant. The ant leaves the nest, goes out for a while in the stream of ants, and then leaves the trail to meander around searching for seeds. The ant keeps searching until it finds food, and then, as soon as it finds food, it turns around and goes back. Thus how much food there is out there determines how long it has to search (14). This is simple feedback that leads to more foraging effort when more food is available: the more food there is, the less time ants spend searching, the foragers return sooner, and more foragers go out to forage.

We've been able to look at this more closely by digging up the soil on the surface and looking inside the chamber inside the nest where all this is happening. Then we asked, how does an ant assess interaction rate (15). Each interaction stimulates some neurophysiological process that has a decay (Fig. 5 in [15]). Over time, if the ant experiences enough interactions, it crosses a threshold past which it is likely to leave the nest on its next trip. Here there's an analogy between ants and neurons; a neuron also uses the rate at which it gets stimulation from other neurons to decide whether to fire. In both ants and neurons there is a decay—in the neuron it is from the electrical charge that 'leaks' out of the axon. To develop and test a model based on this analogy, we traced the paths of all of the ants in the chamber inside the nest

chamber of an actively foraging colony in the field. In this illustration (Fig. 2B in [15]), each line is a trajectory of an ant, each little circle is an interaction, and the different colors show the ants that came in with food, the ants that went out, and so on. Using data like these, measuring the path of each ant and its interactions, we could fit the data to a leaky-integrator model, which draws on the analogy between an ant accumulating interactions and a neuron, which accumulates stimulation from other neurons. This model includes the rate at which there is a kind of decay as the ant forgets each interactions, but the interactions add up. We ask how much each interaction pushes the ant toward the threshold where it is likely to leave the nest to forage. Although we can show that the data fit the model, the model doesn't fit perfectly and we can't predict exactly what each ant is going to do. It is a messy, noisy system and even so, it works.

It turns out that colonies differ in how they spend water. Some colonies, when it's really dry, are likely to reduce foraging. These difference among colonies persist year after year. We were able to ask how is this related to how well the colony does in reproducing more colonies. To do this, we identified mother and daughter pairs of colonies using genetic variation (16). We found that offspring colonies resemble parent colonies and how they spend water (17). We don't yet know how this is inherited; perhaps there are physiological differences in how ants respond to interactions.

When we looked at how colonies reproduce, the results were surprising from an economic perspective. It was the colonies that forage less on dry days, that don't get as much food as possible, in order to conserve water, which are the colonies that are having more offspring; this is why I called the paper on this "The rewards of restraint" (17).

We did this work in a time of a very serious drought in the whole southwestern US, and it may be that conserving water allows colonies to reproduce more when it's dry—but if conditions change, for example if the drought ends, the direction of natural selection could change.

In this way, we can see how natural selection is currently acting on the collective regulation of foraging; differences among colonies are playing out to lead to differences in how many offspring colonies they produce.

For another example of how ants work together, I will take you from the desert to the tropical forest (18, 19). The site is on the west coast of Mexico. These are turtle ants. They are arboreal ants; they nest and forage in the trees. This is a very different kind of ecological situation from the desert, because the resources are changing quite quickly. Activity is easy, the air is very humid so water loss is not an issue, but in the tropics, there are many other species competing for resources.

Turtle ants make a network of trails that forms a circuit, going round and round

in the trees to connect nests and food sources. The network of trails is built on a network of vegetation; an ant can go only where there is a branch or stem to walk on. Moving through this very tangled canopy of trees, bushes and vines, an ant walks about 5 meters of trail per meter of linear distance.

Here the ants we've been studying is not touching antennae, but instead using a chemical, a volatile trail pheromone, that each ant puts down everywhere it walks. Another ant comes along behind the first one and smells the trail pheromone if it has not yet evaporated. As in antennal contacts, the ants are smelling each other, but with a lag: one ant smells the trail pheromone recently deposited by another. As the ants walk along laying down pheromone trails, when an ant comes to a junction in the vegetation, where a branch forks off or one branch or vine is linked to each other, each ant is likely to choose to take the path in the direction that has the highest concentration of pheromone. So each ant goes to the place that most ants have recently gone.

We can illustrate this trail network in this way. In this figure, each box is a junction in the vegetation and one colony has many different nests (Fig. 1 in [19]). This trail network is a circuit in the sense of an electrical circuit; there are many nests and the ants have to keep going round it to keep the nests connected. Off from the main circuit are temporary trails to food sources such as nectar in flowers.

One of the first questions I asked is, how does this network change? How do they extend it to new resources? One question is whether the same ants tend to use the same parts of the network repeatedly. To find out about this, we marked ants with nail polish. We found that the same ants tend to use the same trails day after day (18). But the ants cannot always take the same path, or they would never find anything. I put out baits away from the trail and found that they were leaving the trail to explore; every so often an ant makes a mistake and doesn't take the path with the most pheromone. That is how the colony finds new food sources and nests.

Another question is how the network is repaired. The ants nest in rotten wood that frequently breaks off, and a passing lizard or the wind can break a vine that is part of the trail. When that happens they have to find the trail again. We do experiments in which we cut the trail (examples in Figs. 3 and 4 in [19]) and see how the ways that they search and the constraints of the vegetation lead to the repair of the trail.

Working with Saket Navlakha and Arjun Chandrasekhar of University of California at San Diego, we've come up with an algorithm that is very simple, based only on the probability of exploring, or making a mistake, and the decay rate of the pheromone (20). This is a very different kind of process from the one that the harvester ants use. The harvester ants are using interactions at the nest, which is a slow process because ants have to go out to forage and back to the nest to partic-

ipate in the feedback, while for the turtle ant trail networks the regulation is very local, at the node, and thus much faster. The outcome is to keep the network going no matter what.

There is a contrast between the harvester ant system in the desert, and the turtle ant system in the tropical forest, that corresponds to the different conditions in which they evolved. In tropical forest the feedback is set up to keep the foraging process going, and breaks are repaired very quickly. In the desert, where water is scarce, the ants do not forage unless they are stimulated by something positive, the return of the foragers (1, 2). Looking at different species of ants in different conditions, there are diverse collective processes responding to diverse forms of changing conditions (21).

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## The Body Politic that Captured the Future

*Timothy Mitchell*

I am going to start from a surprising discovery that I made more than twenty years ago: that no economist talked about *the* economy before the middle decades of the twentieth century. Of course the word “economy” was used from long before, without the definite article in English (and with an equivalent meaning in French, and related terms in German and other languages). But like other key concepts of the social sciences, economy previously referred to a process and not a thing. It meant something like governing well, or managing resources prudently. Then around the middle of the twentieth century “the economy” became a thing, a measurable object, marked in English by the addition of the definite article. If we think of the themes of this Dialogue, the significance of this new object was that it could be used to make self-evident, or apparently self-evident, how the parts are connected to a whole, without the necessity for direct government control. I forget the phrase you used when showing your very first slide, Deborah, but like a school of fish or an ant colony, the economy can appear as an outcome, a principle of order, that seems to govern the relations among its parts.

I think that this “holism” was one of the most important effects of the new term, this new preoccupation with the economy, from roughly the 1940s, and especially through the 1950s and 1960s. The economy laid out a set of relations, interactions, exclusions, and inclusions, explaining not just the interrelation of parts and whole, but what constituted a part, and what was the whole. At the same time, it established a set of equivalences. That is to say, with the idea of the economy all the different things that constitute the parts could now be treated as nominal equivalents. So a household and a business corporation in early models of the economy,

for example, could be treated as equivalent units.

The new conception did much more, because the emergence of the economy came at a certain moment in the changing relations between places where this term was being developed, the U.S. and Britain principally (but also other countries of the north), and much of the rest of the world, the colonized world. The colonial world was fitted into this scheme in a specific way. It was imagined as the world of places that didn't properly have an economy; it was the world that had to be transformed, so it could have economies. This is the process that came to be called development. So the new term set up a way of thinking about the relationship, not just between parts and wholes within the economy, but between colonized parts of the world and the old imperial centers—between different parts of the planet.

That set of imperial or north-south relations, of planetary relations, was now reduced to a kind of interstitial space between these economy-objects. This space was reduced to some residual dimension of things, to be known as “the international,” that was not contained within the basic set of relations of the economy. So all these things were sort of laid out, as a set of interacting parts. I'm not going to talk today, in the short time I've got, so much about this question of the invention or the making of the economy (calling it an invention, of course, is not to say it's not something real, it became enormously real and powerful), but about the world before the making of the economy. Turning to what existed before the making of the economy offers a way to understand a bit more clearly the specific nature of its invention.

What was this world, to which, if you like, the economy was an answer; to which this new mode of explaining relations among parts seemed to offer some set of solutions? One common response would be, well, before the emergence of national economies, the world was understood in terms of markets. In Karl Polanyi's account of *The Great Transformation*, the nineteenth century was marked by the emergence in Britain and other countries of “market society;” forms of collective life in which markets had become dis-embedded from the dense connections and constraints in which commercial life was previously contained and began to determine the rules and norms of human interaction. That's one account and of course there are many other versions of how we came to live under the rule of the market.

But while the idea of “market society” captures some aspects of the world before the birth of the economy, I don't think it's entirely helpful to think about that previous era by describing it in terms of our current conception of “the market.” Even that term, in the way we use it today, may have acquired an abstractness it did not enjoy in the past. The market has become another totality, a sort of synonym for the economy. In fact, alongside the making of the economy as a new kind of abstract whole, in exactly the same period during the middle decades of the twen-

tieth century, the idea of the market took on a new form. Like the economy, the market became an abstraction. That abstract market is what we recognize today as the market of neoliberalism. Neoliberalism is not something that appeared out of nowhere in the 1970s. It was a program that was formulated, at the same time that the economy was coming into being, by conceptualizing “the market” as a parallel kind of abstraction, offering a rival totality to “the economy.” This occurred in exactly that same period in the mid-twentieth century, from the first meeting of the neoliberal movement in Paris in 1938 through a critical series of post-war meetings in the 1950s and beyond.

So to describe the world that existed before the invention of the economy, I’m not going to talk about the market. I want to put that term aside as another abstraction that, while it has an earlier history, in the mid-twentieth century (like the economy) took on the possibility of serving as a kind of governing principle. It is a term that in the post-war decades took second place, if you like, to the economy, but then, more recently, began to supplant the economy as the principle of government – as a way of talking about the whole, or the body politic.

What worlds were there before, what body politics, if we don’t want to think about the period before the making of the economy as an era of “market society”? One concept was among the most common terms to describe emergent forms of the body politic in the early twentieth century: the term “business.” Economic and political discourse referred increasingly both to business, as a form of collective life, and to the problem of “business cycles.” The study of business cycles was a way of making sense of periods of extraordinary expansion, then of “panics” (the collapse of stock markets and of the value of businesses), and of the wider crises that followed from them. The panics and collapses were related to other forms of catastrophe, such as ecological destruction. For example, in the United States, there was the problem of the rapid destruction of old-growth forests across the continent, and many similar concerns about nature and natural resources that emerged in the late nineteenth and early twentieth century as part of the problem of “business.”

Other forces and interactions seemed at the time to have come into being with this new world of business: imperialism, militarism, war, colonial crisis, and anti-imperial resistance. So there were many other ways to characterize the experience of the several decades prior the mid-20th century; but if you simply look at some of the key concepts in use, the term “business,” much more than the economy or markets themselves, would have been central. Now, following Deborah and following some of the other papers circulated for the Dialogue that examine ways in which biology and ecology are thinking about the question of the collective, I have found it helpful to think as richly as possible, not about the traditional objects of social theory, like society or economy, but about the forms of association, interac-

tion, interpenetration, and infection, that define the actors that we are interested in studying.

In the world of “business,” there was an underlying interest in the extraction of resources and forms of relationship with nature and with technical processes and materials that result from that. I mean, that’s a very general set of parallels with the readings we’ve shared in biology and ecology; but I wanted to take those parallels in a particular way to think about this earlier world, because one of the things that happens, I think, if one looks at the period, I roughly have in mind somewhere from the 1870s onwards, so five decades or so that follow that, is an extraordinary expansion of the scale of a set of interactions that are just not captured by a term like the economy. So one looks around for other kinds of ways to capture the scale of what one’s looking at. One term that’s been proposed recently is “the technosphere,” meaning that complex of human sociality, but also of material life, of energy systems, of material flows, of extraction of resources and of the built forms of that world: roads cities, power stations, transmissions lines, but also farms, plantations, the level of equipment, tools and so on.

A recent paper by Zalasiewicz and others in *The Anthropocene Review* tries to estimate the size of the technosphere. Using some rough approximations, the authors estimate the mass of this built world of things to be thirty trillion tons. To give some perspective to that figure, it can be compared with the human biomass, which has been estimated at three hundred million tons. That’s huge. It’s apparently twelve times the biomass of all wild terrestrial animals. Yet the human biomass is tiny in relation to the technosphere that we have built. (Perhaps you’ve been watching the television images this week of the damage from Hurricane Irma in Florida. You can see in those images of destruction the extraordinary mass of roads, bridges, buildings, and canals, of managed wetlands and industrial farms.) We have built, in a relatively short time, a quantity of technical structures and equipment whose total mass is apparently something like a hundred thousand times our own, human mass.

Now, one way to think about this extraordinary *accumulation* of technical structures that constitute our human technosphere is that we have developed the ability to make the worlds we build, and interact with, unusually *durable*. We’ve achieved this durability, in part, by developing new kinds of composites. Take the example of one composite material, steel. While the making of steel has a longer history, the manufacturing process became much cheaper after the 1860s. Or another example, concrete: again an older material, but then used in new ways, particularly in combination with steel, making it possible to build structures of much greater height or span; or the development, later on, of plastics, and many other composites one could talk about. And not to mention, alongside these, the buried stores of carbon—coal, and then the oil and gas—which have been important to almost

all the processes of producing those composites, through their use in powering blast furnaces, in manufacturing plastics, and so on. In most cases we began to use all these materials at an accelerating rate somewhere around the 1870s and 1880s. This acceleration continues today. We've been using petroleum, for example, on a growing scale since the 1870s—for about 150 years. But more than half the oil that humans have ever burned, we've burned within the last thirty years. So the materials that build new forms of durability have expanded in use at an accelerating rate.

Those composites, I'm suggesting, created an interesting kind of durability, the durability of what can be built for human purposes. Now, I don't want to focus on the durability alone. We're sitting here in the Longhena Library, which is several hundred years old, and formed part of an institution, the Monastery of St Giorgio, that endured for about 900 years. So obviously there's a much longer history of building durable forms or arrangements, both in their built fabric and in their political or social longevity.

What to me is interesting about the specific kinds of durability of the technosphere that emerged over the last one hundred or 150 years, is the way that the longevity of new technical structures, built with materials like steel and concrete, allowed projects to be "projected" into the future: in such a way that, in business ventures, the future could be captured in a new way. My interest here is in the processes of capture. I think Deleuze's term, an "apparatus of capture" is quite useful for thinking about something that is much larger than just the market, or material production, or the factory system, or other ways in which we've thought of the history of capitalism.

Capture takes many forms. While it can take a form such as the factory, where an assembly process is organized to capture and concentrate revenue, it can also be as simple as, for example, the toll booth or the customs house, something that imposes a detour and extracts a payment from some traffic or process going through. But while the form of the apparatus of capture can greatly vary, over the last 150 years there has been a marked change in how capture happens: certain technical developments have created the ability, not just to build systems of assembly or detour, but to build an apparatus of capture that appears to extract revenue from the future.

The most obvious example of this new ability to capture income from the future, in the period I'm sketching here, was the long-distance railway. There you see the importance of durable materials such as steel. Until the 1860s, rails were usually made from wrought iron. Because iron is a brittle material, subject to fracturing under repeated stress, the rails had to be replaced every twelve months. So there was a certain limit on the distance over which it made sense to build railway systems. When it became possible to use steel, a more durable material, instead of having to replace the rails every twelve months, they could last for ten times that period. The

use of steel rails is one example of changes in durability but of course other forms of engineering were associated with this. So you could build something that was both extended in space, transcontinental railways, colonial railways and so on, much larger than the local railways of the first part of the 19<sup>th</sup> century; but also extended in time, because the line that was built promised a revenue back to those involved in the enterprise that could reliably be expected to flow for the next ten, fifteen, or twenty years.

That reliability was something more than just the technical durability of the materials. It was dependent on that technical durability, but it has many other components. One of them was the law: dramatic changes occurred in legal relations, in fact forms of quasi-sovereignty were associated with the granting of rights to build railways, whether across the continental US or in other colonial contexts. Building a long-distance rail line also involved and enabled new forms of violence: military power-- the ability to use the railway to move military forces, and to use the new forms of weaponry that went along with this same technical transformation: especially, the self-loading machine gun, for the first time a weapon that could load and re-load itself and therefore begin killing at a much higher rate. There were other examples besides the railway, other equally extensive and durable kinds of project of the same period. The building of the great inter-oceanic canals, the Suez Canal and the Panama Canal. Building these projects included the funding of French newspapers to get ordinary Parisians and others to pour money into the buying of shares in these ventures. And this publicity and promotion became an important part. The point is, the durability and reliability was produced not only at the level of the technical materials, but involved law, violence, sovereignty, and publicity, all of them parts of an apparatus of capture.

Now, these durabilities took over an existing institution and transformed it, and created the phenomenon that came to be referred to as "business." And that's the joint stock company. It has an older history, which I'm not going to discuss. But what a company is, as an entity, was radically transformed in this period. The joint stock company is a business venture that offers shares to investors, but what a share represents was completely changed. Prior to this period, legally a share was a representation of the holder's part-ownership of the physical assets of the business—the buildings, tracks, rolling stock, manufacturing equipment, and so on. It was transformed quite rapidly into something very different. The new technical and political durability of railways made it possible to turn the share into a form of property in its own right, consisting of a claim on that durable future—on the future earnings of the business. Its value was no longer based on adding up the material worth of the firm's physical assets. It was based on projecting forward this apparatus of capture to calculate the value of the future ten, fifteen, or twenty years

of revenue, sold to an investor in the present. So in the case of a railway, the share value was now based on expectations about the amount of freight the line would transport, the number of passengers it would carry, what rate could be charged for that freight and those passengers, what wages might be paid to those who were going to run this apparatus and so on. Out of those future calculations an estimate could be made of the surplus that might be paid as an annual return, in the form of a dividend, to those who purchased the shares. The share had become a device for making widely available in the present a financial claim on the future.

That was a radical transformation in relations to the future. It was a transformation that has not been captured in the accounts we have of the history of the business corporation, or of modern capitalism. The history of the business firm is always written the other way round. The large, shareholder-owned business corporation came into being, according to the standard account, because things got so big and so complicated that firms *needed* to be able to draw in larger amounts of capital to pay for these much larger operations. We should now tell that story the other way round: thanks to the new forms of durability, it would be *possible* to devise apparatuses to draw in these forms of share-purchase, because you could now promise this future. The task was not to build railways because of a need for railways, or canals because of a need for canals—on the assumption that we are part of the process of history unfolding that always needs more things. Rather, it was now a question of what opportunity the business person could look for and seek to justify, such that he can set up this apparatus of relations to the future and bring the future into the present and profit from it. Because that's the way it worked. What happened, is that this right of the shareholder became recognized as a valid claim above those of others on the future earnings of the apparatus of capture. So that every future worker, employee, manager, passenger, and user of goods shipped on that railway, would all be paying a tax, if you like, that was represented in the value of the share, or in the work that has to be done to maintain the value of the share going forward.

Now, the person who profited most immediately from this power to claim the future was the entrepreneur, the “undertaker” as he was called in this period; the person, or the group of persons, who set up the whole apparatus. Entrepreneurs used a variety of relations—political ties, engineering connections, financial relationships, and so on—to launch the apparatus of capture and then immediately reap the profit from the future through the sale of shares. As soon as they set up the apparatus, if they could show, through these arrangements of technical durability, legal claim, political promise, quasi-sovereignty (including colonial sovereignty), and so on, that the business had a reliable claim on future revenue, then they could start to offer shares in the apparatus according to the present value of that future. In

this way, the apparatus transferred the future into the present. The machinery was set up, as it were, to tax the future and bring future income into the present. Previously, if there was a power to tax the future, it existed mainly in the exceptional form of the power of the state, to raise a national debt and tax a population for its repayment. But this new relation to the future now proliferated, becoming a basic way in which forms of collective life would be organized, through such forms as the modern business corporation.

The railway company and other large business firms were not the only example of constructing this relationship to the future. There were parallel changes in the modes of urban life. From the late nineteenth century, the city in the modernizing world was undergoing a similar set of technical changes, made possible by building with iron and steel and concrete, by the invention of machines like the elevator, and by employing new political and legal arrangements for planning and regulating the use of space. A speculator in real estate could now do the same thing as a railway entrepreneur. The property speculator could erect a structure whose value, from the day it was built (in fact even before it was built, as soon as the speculator started selling "shares," which might take the form of individual flats or apartments), had little to do with the cost of building it. The "price" of real estate, in the modernizing city, corresponded to the value at which the speculator could sell the right to live for, say, the next fifty years on that spot of land. Thanks to the new durability and scale of buildings, neighborhoods, and property rights, urban living became another apparatus in which entrepreneurs could capture revenues from the future and realize them in the present.

The city was not understood, however, as an apparatus for capturing the future. When economists had to explain to people why the price of housing could become so much higher than the cost of erecting the building, they did not explain the difference in terms of the new ability to capture revenue from the future; they explained it in terms of the changing value of nature. Urban development, they said, transformed natural or "unimproved" land into real estate. The difference between the cost of construction and the price at which a building could be sold was ascribed to the rising "value" of the "land." Writers like Henry George and other now forgotten political economists fought against this simplistic way of explaining the strange ability of speculators to capture future revenue through the device of property development. But the new theorists of the price system explained value as the product, not of an apparatus of capture, but of a simple mechanism of supply and demand. The technical novelty of the durable apparatus, in which the price mechanism played a minor part, soon disappeared from view.

So this is not only a story about the modern business corporation. The modernizing city was at least as important as a way in which this new relationship to the

future was built. In fact, at the turn of the twentieth century, it was in the study of the city, more than in studies of the business firm, that one finds a new sort of objective social science emerging. If you think about the work of Simmel or Weber or of many others, before the new concept of the economy had emerged in its mid-twentieth century sense, in order to conceptualize the whole, the new body politic, writers frequently turned to the idea of the city. The city literally concretized the problems of modern collective life. Just as the problem of “business” did, in a parallel but smaller way, in writings on government, bureaucracy, and political economy.

The set of political arrangements and technical devices in which it is possible to tax the future, it is possible to draw income from the future into the present—I think one’s got a way of approaching, as I said in my remarks in the first session, a different understanding of time and modernity.

If you wanted to give it a more conventional set of terms, we have a lot of ways of thinking about how the experience of the time changes in the later nineteenth and early twentieth century: a notion of the acceleration of time, of history happening more quickly; a notion that the very acceleration is cutting us off from the past, so the past becomes a traditional world to which we no longer have access; a notion of the destructiveness of this rate of change, as in Marshall Berman’s famous quotation from Marx, “all that is solid melts into air.” There are also positive views of the experience of time: the future is now going to be experienced in terms of the ability to plan, to build, with a longer term calculation, and others aspects of the representation of the future that I talk about in the paper I circulated on “Economentality.”

However, there’s something different in the particular relationship to the future typified by arrangements like the joint stock company and the new forms of urban property and the city. If we were to think of it in terms of the interaction among organisms, in the way we’re interested in talking about in the Dialogue, the change can be understood partly in terms of different ways of feeding off the environment, or rather, of ways of entering into other kinds of processes and colonizing those processes. We want to change the way we understand what has previously been called organism here and environment there, so we ought to change the way we understand present and future.

The difference here is precisely of that order: between a present moment and the future. There emerged this way of entering into and feeding off the future and bringing it back, which is a parasitic process of impoverishing the future. Because that future, when it happens, will be a future that has to pay back the debt; a debt that was not incurred as an investment of the actual cost of improving things, as I’ve just suggested with the example of the cost of buildings, where much of the price is due not to the expense of building but to value of capturing future revenue,

mistakenly attributed to the “value” of land. It’s an imposing of debt that, thanks to the new apparatuses of capture, represents a calculation of how much of a future revenue can be recouped. So people in the future—ten, twenty, or a hundred years down the road—will be people living that future, who have to pay back the revenue that has been already accumulated by those who were able to set up those futures, those apparatuses for penetrating and capturing the future.

The spread of this world of “business” has been quite phenomenal. The forms of crisis and impoverishment it produced were stabilized and ameliorated, in the middle decades of the twentieth century, via the invention of the economy. But we now live in that future—not so much the one promised by the idea of the economy and its growth, but the future impoverished by the apparatuses of capture. We are the people impoverished by previous moments of extraordinary accumulations and appropriations that were gained at the expense of the future.

Somehow we’ve been able to live with this inverted relationship to the future for 150 years or so. How? How have we managed for so long to persuade ourselves that it was okay to continually impoverish the future? How have we managed to live in the world of the business firm and the modern city, in which the entrepreneur and the speculator are allowed to extract ever greater amounts of wealth to be imposed and repaid as a burden of debt on those who come after?

One of the ways to make this relation to the future appear to work and to make it seem viable was to say, well, don’t worry, because this apparatus we’re building, this railway, let’s say, is going to grow. It will contribute to a dynamic of growth. It’s going to carry more passengers every mile, more freight, it’s going to extend its network. This growth will enrich the future. We came to think of growth, not as the speculator’s unreliable promise, but as a sort of underlying economic energy that drives modernity. However, understood as an apparatus for capturing revenue from the future, from this perspective it’s not. Rather, growth is a compensation arrangement that you have to promise to explain to people how it’s possible for so much wealth to be accumulated from the future without the future seeming to suffer.

The future won’t suffer, we were told, because there will be growth. The pie will get bigger and bigger. From this perspective, I’m suggesting, growth is not the sort of natural unfolding of the powers of the development of productive relations. It’s a compensatory mechanism that we get stuck with because we’ve bought into these apparatuses of capture. And of course it has its limits. The growth of the enterprise often doesn’t work out. It doesn’t matter to the original entrepreneur that the project doesn’t work, and his railways are going to go broke. The Panama Canal project was, at least on the first attempt to build it, by Ferdinand de Lesseps, a complete disaster. It doesn’t matter to those who had already pocketed their money and had the statues of themselves built.

I want to draw this to a close. I think in terms of Bruno's questions about the politics and the composition of the collective, one thing this way of thinking helps us bring to mind is that that collective includes the future. Not because suddenly, confronted by the threat of climate collapse, we have to be more responsible towards our grandchildren; but because we've actually developed over the last century and a half a very novel way of acting in relation to the future. But we have not recognized it, not acknowledged it, and not brought it into our politics. One of the ways we could do that is to become much more attentive to these mechanisms of capture that work this way and try to operate our politics on those mechanisms. By making visible, and articulating, the terms in which they establish relations between ourselves and those who come after.

## DEBATE

### *Bruno Latour*

I want to underline that for me, coming from social science, Deborah's demonstration is of extreme importance because, as you just saw, she found an alternative and a visual display of this alternative to the two paradigms I started with an hour ago. There is not really a "colony" as abounded overall whole, and yet she does not shift to individual ants each of them conceived as a sort of atomic entity entering in relations with the others ants. She manages to modify and the notion of the whole and the notion of the parts. If you followed what she showed, each ant is overlapping with all the others and what is called the "colony"—the specific recognition of this or that colony—is in continuity with those overlapping ants and not floating above them as a unity. It simply the smallest common denominator of all the overlapping trajectories of ants. This is quite an achievement and I understand why, in her statement for the meeting, she had said that we should entirely by pass the false dichotomy between parts and whole. It is a great lesson for studying human societies. And that's the connection in my view with Tim.

### *Deborah M. Gordon*

If you could make a picture of the immune system it would look the same. If you had a diagram of how every cell of your body would react to meeting other cells, both from outside and from inside the body, it would be a similar diagram.

*David Western*

I would like to hear a little bit of the difference between what Deborah said and Tim what you just said, because to me if you look at ant colonies they're a close system, whereas if you look at a macro city it's an open system. They are both operating by similar rules of resource limitation but the big difference is when you get to a city, it's really operating on a global scale. So where I see the breaking of barriers in human beings which distinguish us from ants, is the fact that we learnt long ago, long before economics even came into the picture, how to break ecological barriers and benefit from the economy, sorry: the ecology of scale. We work over big and big areas, we collected tools from different areas, we began to create cultures which manufactured different tools and so we expanded in space whose extent we ended up on a global diaspora long before economics came into effect. So what is it that distinguishes the human ability to scale up and up and up and up and come up with the global economy? I suggest this one thing that's really very critical.

Hayak and Keynes have long had this dichotomy of the individual being the entrepreneur who drives things whereas Keynes saw the necessity to pull risk into a model economy. So how do you go from one to the other? And in particular, what common sets of rules you see that operate between both?

*Mike Lynch*

This is a more particular question for Deborah. Your visualizations were fascinating, wonderfully creative. One could view what you're showing to be a human-ant vocabulary that you're exposing in a way that I guess has not been done for the immune system: how each individual ant is leaving trails, and those trails become meaningful to us, humans, as we use them for various purposes.

Do you have a sense that the ants become more legible as you continue to explore their pathways? For instance, one thing that occurred to me is that the pheromones may have a grammar that could be exposed through marking; for instance, by noting minor chemical differences between one trail and another, and then taking an intervention on your path 2 test to expose those differences, just as it takes marvelous interventions to cut off the pathways of the ants to keep track their movements. So, I'm wondering if you find greater depth in the ants' relation to us through the analogies that you can draw, opening up and deepening that relation as you continue this long-term exploration.

*Deborah M. Gordon*

I think Tim made a very interesting point. It's not just space, but time, in which people can expand in their imagining of the future, which is something that ants don't do. So I think that relation with time is a really important difference between people and ants.

As you were talking I was thinking about the harvester ants in the desert, which build nests that are very permanent. A colony stays in it for 30 years. The soil is like rock, and the ants carve chambers and plaster the sides of the chambers with moist soil, that makes an adobe finish when it dries. By contrast, the ants in the tropical forest are working in a world where something can come through and break the vegetation their path is on from one minute to the next. They nest in rotten branches of trees that often rot further and break off so the ants have to abandon that nest and find another.

In general, there are ants everywhere on earth in places with very different dynamics, and a particular species of ant can't get out of the dynamics of the place where it lives. The ants of the tropical forest can't make a permanent nest. They can't go get steel and make railways, and so they can't extend out—either in space or in time. That seems like a really fundamental difference between the way that we affect the world and the way that ants change the world that they're in and respond to it. You point out that there's a huge effect of what we imagine to be true, for example selling stuff to be used in the future, and the future value of the property. All of that is something that we invent in our heads, and thus value based on what we imagine, as you say, as an enormous temporal effect, not just a spatial effect. Those are really important differences between people and ants. We are stuck paying back the past because of what people in the past sold to people who imagined the value that it would have in the future.

About the legibility question. We can't measure the pheromones, the quantities are too small. For me, making the diagrams of the turtle ant trail networks that I showed [from *Am Nat* 2017, reference 22 from my talk] made a huge difference to what I could see. I spent several years developing a way to keep track of the trail networks. First I tried to mark the trails by leaving sticky markers on the leaves, but those came off. I spent a long time trying to draw pictures of what the path of the ants through the vines and branches actually looked like. I would get back at the end of the day with a drawing full squiggly lines showing all the branches and vines where the ants went—but I could not find them all the next day from my drawings. When I decided to make the flat two-dimensional diagrams out of this three-dimensional trails, that completely changed my ability to track the ants, because I could go back the next day and say OK, I know that this is the place that

I called node 42 yesterday, here's node 42 today, and so I could say for sure whether the ants were using node 42 or not on the 2nd day. Creating the pictures made the ants more legible to me. The diagrams provided a way of showing what's happening at a particular time, but also a way to track what happens over time, and in this way, making the pictures made it possible to learn more about the ants.

### *Timothy Mitchell*

Thank you. I find it very interesting to think about these differences – closed/open, static/temporary—but I don't necessarily find it helpful to think of them as binary oppositions. So for example in one of the papers—did I circulate my “mosquito” paper? I can't remember. I did, yes—part of the problem with the arrival of mosquitoes bringing falciparum malaria to Egypt during the second world war was precisely that the mosquito was much more mobile than the farmers who were its victims. The mosquitoes came to Egypt from somewhere to the south, Sudan, possibly even from West Africa, and they moved by train, by boat and so on, in very opportunistic ways. The insect bred using shallow pools of water formed in pits dug during the construction of those railways.

And again, static versus temporary: the thirty-year life of your harvester colony isn't bad, because although you build a railway expecting it to last 30 or even 50 years, the revenue could only be calculated over about 10 or 15 years, because you have to discount its future value to take account of uncertainty. If you discount the future by 5% a year, after 10 years or so the value is becoming negligible. That doesn't matter, you can still sell that future revenue. So even in temporal duration, this is clearly one of things I want to think about, think about how it changes and shifts.

I'd say the same with imagination, and I think it's important to do that. You said to me, is it not the case that this is all made up in people's heads, this value of the future? Not really. There are a set of technical processes that produce this future. So, for example, the world of business required publication of bulletins that reported on the actual building of the railways, how many miles of track had been laid, how many passengers carried, and so on, in order to calculate future revenue. The pioneer of this in the US was a guy called Henry Varnum Poor. His name survives today because of the S&P Index. Standard & Poor's is the successor of the knowledge infrastructure he built for reporting. Of course, you know, that stuff now is done in totally automated forms so it doesn't rely so much on heads. Inside people's heads is one place it happens, but inside computers is another place it happens, in all kinds of ways. I wouldn't necessary single out the heads as the key place for organizing that. And also is it categorically different from the pheromones or the smells on the ends of ants, antennae? I don't know.

*Deborah M. Gordon*

Well, you're talking about information. But Standard and Poor's reports on how much the house is worth are based on something that someone thinks. The house is real and it is probably going to stay there, but what is important for its value is that someone thinks that it's going to be worth something to own that house later. So that's the difference I meant, not the existence of the information but the value of it, which is an idea about how it will be used later.

*Simon Schaffer*

I'm reminded of what Marx's notoriously said which is that the worst of architects is better than the best of bees since a building first exists in the architect's mind and the same is not true, he said, of bees. And clearly what you've shown, it seems to me is that on this occasion, he wasn't talking about ants, he was talking about bees, that discrimination doesn't work terribly well.

*Deborah M. Gordon*

There is no building in the mind of the bee, or the ant. Whether there's a building in the mind of the architect, I don't know.

*Tim Lenton*

So my reflection was going to follow this theme really, because Deborah you described beautifully a kind of learning algorithm for the ant colony, which doesn't rely on any of the component ants having any conscious sense of the whole. Certainly, as you said, they don't have a conception of the future, and yet they learn through making stochastic mistakes. They have their end with pheromone trails etc... they have a learning algorithm. I think that kind of algorithm has a name – I think it's Hebbian learning. For me what's interesting is as I listened to Tim's beautiful description he is essentially also talking about a form of learning. Of course when we're talking about human agents they have both collective awareness of a phenomena like the growth of the rail network, but are also able to have foresight to conceive a future for it, which I am going to presume the ants aren't doing. That's what the entrepreneurs did who changed the meaning of shares and realized the value they can derive from changing the meaning of the share to be an option on a future drawing, a future asset. That difference counts because we

have the capabilities to imagine the future as well as all this information about the present. That seems to me a different kind of learning to the advantage of some of those said individuals, and those who can choose to purchase the shares perhaps. For me the broader point is really how we learn and what learning algorithms are appropriate if an imaginary of the future were to change. I think for many of the friends here around the table the imaginary that convened us was the *Apocalypse Now* in Bruno's *Facing Gaia*. Some of us share the desire to have an imaginary of a happy and sustainable future. But as Tim beautifully articulated what is challenging is that the current learning algorithm (or whatever we want to call it), is still taxing the generations of the future, our generation, and we're still doing that even more so for the coming generations.

### *Bruno Latour*

I am somewhat surprised to see Tim (Lenton) and Jonah aligning with what Tim (Mitchell) said, because they seem to me to go in exactly opposite direction. There is a divide here that is important for the meeting and that I don't want to see papered over. I think we could agree that ants are blind to the future—and agree also, that does not take too much audacity—that human societies are just as blind. Lenton and Western are somewhat hopeful that those blind human societies could in some ways gain some sort of foresight, what Lenton calls Gaia. 2.0. But the other Tim (Mitchell) does not only say that human societies move blindly into the future, but that they have *been blinded* by a specific temporal mechanism that renders totally impossible not to transport the burden of the past into the next generation, making it impossible for the next one to do anything! This is what Isabelle calls the *sorcery* of capitalism. So, we will have some time to work out this question. What to do with the science of economics. Is it one of the ligatures useful for assembling the body politic or not. We don't want to do as if we agreed on that division. Did I understand you right?

### *Timothy Mitchell*

Yes, I'd agree with that. The other thing that I'd say about my resistance to a categorical distinction between a human ability of foresight and an animal blindness, if you want to use a crude term: not only Bruno's point that one of the interesting things is the ways we produce our own blindness; but that these moments I am talking about, from around the 1870s, coincide with the elaboration of new accounts of what is going on, that argue that *everything* can now be understood in terms of that human foresight, in terms of that human calculation. In fact, the en-

tire world we live in. Simon referenced William Stanley Jevons, in one of the papers he circulated. Jevons was one of the formulators of marginal utility theory, of modern economics as it became. He believed that everything that was happening in the economic life of his day—and he published this in the early 1870s—could now be understood as the working of the mechanisms of human calculation; as the reflection of purely mental phenomena. Everything that I’ve summarized in other kinds of terms, through a history of technical durability, he claimed could be understood as the working of a purely mental machine. It’s the same thing when one moves forward, whether to Keynes, say, or Hayak: the critical dynamics for economists are going to be mental phenomena—whether the psychological tendencies of groups, at the collective level, in Keynes; or of individuals, at the level of calculative ability, in what becomes neoliberalism. We need, you know, to counter that way of thinking about thinking. The work we have to do to remove that, or to fight against that, is so enormous—that’s the source of my resistance to the more categorical distinctions you want to make between human foresight and the blindness of nonhumans.

*Scott F. Gilbert*

I think these notions of planning the setting of high standards by these unchanging algorithms contrast greatly with the data that we saw about the ants. The ants provide a very optimistic model, by making mistakes and rectifying the situations. Again, one finds that this resembles, in a remarkable way, as you mentioned, the human immune system, where mistakes are programmed. You have a situation where a cell that’s making antibodies, let’s say, to the polio virus or influenza virus, will divide, and a certain percentage of those descendent cells will mutate to make some other antibody, maybe better, than the one they had been making. So some of the cells still make the antibody that binds, but other cells experiment. Those antibodies that bind the virus better are able to multiply faster, and so it’s by these mistakes that we get antibodies against a particular disease. But making mistakes is part of the program. Your program to make mistakes is a lot better, I think, and a lot more fluid and flexible than having pre-made mathematical algorithms.

*David Western*

I think that going back to “Inheriting the Past” (1) it’s very easy to forget how much we’ve inherited from the past whether there’s all these wonderful books here, whether there’s some capital that goes in to Railways and so on. So what is really quite stunning is the economy of scale when you look at cities. It scales at 0.75 exactly the same as the metabolic rate of long species. Why? Because it gets cheaper

and cheaper and cheaper to do the same work. So we have to accept that the past we have benefited from but also the future we threaten. So the words the economists have used are a consequence horizon. What they really mean by that is the economic investment horizon and what (Tim, you asked a question about Gaia) is different about us that allows it to project forward and I referred to the book called “homo prospectus.”

It’s not just that we can think and anticipate the future, not as economists but as individuals. Because when we project the future, our emotions are also in that future, it’s not just economics. So we always imagine our future to be sunnier than it really is going to be, we forget the past, we discount the past, if you like. So, one of the jobs I see of the historian is to remind us continuously of why we’ve always had this glorious future in mind and yet it hasn’t played out, and secondly I think it’s the role of the Gaia scientists and others to say look, we haven’t taken into account a very important aspect, two important aspects really of the future. Economics, yes, we discount the future, but have we taken into account the ecological consequences and have we taken into account with the social. And I think that’s really what we’re struggling with here. How do we put back into the World Trade Organization, the Bretton Woods institution which came up with this glorious future of the economy scaled modern trade, the social and ecological. And unless we understand that consequence horizon, emotionally ecologically and socially, we are going to repeat the same mistakes as the economists always have.

### *Timothy Mitchell*

This is on Scott’s point about mistakes and errors because I want to add an extra dimension to this aspect of the future and the calculation and accumulation for the future, because actually, what the new claim on the future sets up is two processes, speaking in simplified form. One is that there’s a future revenue that can now be valued and claimed in the present by selling on those claims to others, at the extraordinary profits of the undertakers of the project. But the other thing is that we now had a world that was more and more made up of ordinary people holding these claims on the future (in those days these were just people investing in railways and perhaps government bonds and things, but of course has now become an everyday aspect of our life, through retirement funds, forms of personal debt and so on). Now, the thing about those claims on future revenue that people just hold, hoping they will increase in value and they’ll be able to sell them and realize a profit, is that their value fluctuates; and that fluctuation, the fact that they can fall in value, becomes itself a source of making money, because there develop specialists in the fluctuation—speculators. You see this in the same period with the

transformation of commodity futures exchanges into these extraordinary centers of speculative profit. William Cronin's account of that is enormously important for understanding the Chicago futures exchange as a new kind of technical apparatus. Something very similar was happening at the same moment with other big commodity futures exchanges, like those in Cairo and Alexandria. So, the very business of setting up claims to the future produces this second life, a form that is parasitic on the first. The speculator is dependent on the continuing validity of the ordinary stock-holder's claim to the future. But then the uncertainty, the vulnerability, the fact that there can be revealed to be flaws in the calculations about the future, itself offers an additional way of profiting from this process.

### *Deborah M. Gordon*

I want to go back to thinking about mistakes and learning. When I said that the ant makes a mistake, I meant that the ant doesn't follow the rules. The rule is, "choose the branch where there is the most pheromone". Sometimes the ant doesn't go where there is the most pheromone, but that doesn't mean that the ant is deciding that it would rather make the trail this way, or that it feels better about a network that goes on one branch rather than another, or anything like that. The ant is not making a mistake in its evaluation of the whole process, it's merely not doing what most other ants would do at that point. That's related to the idea that there's learning. No ant is learning anything. You could say that the network over time improves in some way, for example the turtle ants prune away extra loops, or minimize the number of nodes, which in turn minimizes the probability that ants get lost because ants can get lost at each node. But no ant is deciding to make those improvements. This goes back to what you said about how hard we have to work in thinking about social processes to distinguish the explanations for why everybody does something or why the economy is the way it is, from why it really works that way, which might not be the same. It seems worthwhile to be careful, even when talking about ants, to distinguish between what the ants are actually doing and what we can say afterwards about why it looks better if it were done that way. The latter is a story we make up about the ants. To say the ants are learning might just be saying that we like something they did, and we consider it an improvement, but that doesn't mean that the ants are thinking that it would be better if they did it that way, or that the reason they do it is that they think it's an improvement. It seems important to make that distinction.

*Simon Schaffer*

So you're happy with the expression "programmed mistake."

*Deborah M. Gordon*

Well, I was interested in the way that you said that, because even in telling that little story you had to say "the cell knows who it's supposed to attack" or something like that. I think there's some interesting blending of economic explanations that have come into biology here. So in the same way, as you said, that we have to do so much work not to use those kinds of explanations, maybe we have to do that same work as biologists, also.

*Simon Schaffer*

One of the motivations for the conversation is precisely the immense amount of transfer and leakage of precisely those metaphors and images across all the boundaries that we've just been considering. What comes to mind is James Gould in the 1980's in his work on social insects in general and bees in particular. And he, with Carol Gould, writes: "a honey bee colony possesses an innate sense of free-market economics which allows it to turn it (it's the colony, right?) to turn in a higher and more consistent profit than any other group of social bees." Now that's clearly rather a good capture of the way honey bee colonies work but it carries with it precisely the kind of models and algorithms which I do exercise on exactly this moment. But we'll come back to that.

*Deborah M. Gordon*

Honey bees are domesticated animals that we have selected for ten thousand years to make them do the work he is describing. If that's true, it's because of what we did to shape the evolution of the honey bees.

*Bruno Latour*

What you said is true, but I don't want to re-introduce a division a priori, between humans and all of the other non-humans, which this meeting is precisely trying to avoid and make sure that we lower the level of cognitive ability attributed to any entity because ants and humans, if there is something that is blind I under-

stand it's the architect as well as the bee, at least we should try to work out without the division between human and nonhuman.

### *Tim Lenton*

I'm going to be really careful for the next few days, because I'm automatically using language which is for me familiar scientific language for complexity, but I think it carries a loaded meaning that I didn't spot immediately on my mental radar. That said if I were to try and rethink my language before I opened my mouth in this discourse, I would be hopelessly hamstrung. So in the case of learning theory (or whatever it is we want to call it), it's just the statement that the collective phenomena in the case of the ant colony learned in the sense that it acquired improved functionality over time, based on experience. In learning theory natural selection is described also as a learning algorithm; it's a different one to the one that Deborah beautifully illustrated for the ant colony and there are other learning algorithms in the sense I've described. So maybe that helps, Bruno, because that is all I mean by 'learning.' I don't know whether the language of a collective phenomenon or a network over experience phenomenon is helpful but that is at least how we talk about it in the science of complexity. As for foresight, I don't want to imply that it's necessarily used to the good, quite the contrary, I thought what was beautiful about your example, Tim, is the fact that some entrepreneurial individuals, as you described it, were able to use foresight to see how they could gain an advantage and I think that's fair to describe that as learning as well, on their part. I'm not saying that's either wise or indeed intelligent or indeed that many of the ways we've used that foresight are either. But I wouldn't throw the baby out with the bath water...

### *Didier Debaise*

It's a very difficult session. When I read the papers and when I talked to both of you, I had the impression that there was a strange temptation: to link directly the nonhumans, here for example the ants, and the humans. Now, after the session, I have the opposite feeling which is another temptation, more classical, which is to delink too quickly and to find all the criteria to strictly differentiate the nonhumans and the humans. Therefore, I would like to try to slow down to be sure that we would not go too quickly in the direction of a strong distinction between nonhumans and humans. To do it, I would like to come back to the use of the notion of "future." Is the "future" something that will happen in another moment, something that will be, later, another present? This is a classical vision of the "future" but Tim shows in his talk something completely different. In economy, the future is not

the “next moment”, but it is, in the present, a strategical dimension of the “offer.” Humans doesn’t have access to the future, they even don’t take care of it in a more intense way, they take care of the present, and they invoke something, a tendency, an offer, a projection, to articulate differently all the elements of their presents. When you say that in the future there will be more resources, you never stop to talk about the present you just transport it—by an imagination act—to a next moment, but you just talk about your present, what you have at your disposition. There is another definition of the future that Scott mentioned in its comments: it is a sense of the alternative. It’s the moment when, for example, in the video that Deborah showed, ants hesitate; they want to continue but there is no possibility; so it’s a sense of an alternative and this is the sense of the future. Therefore, in this debate, I would like to make a provocative proposition: the ants, in the specific context of the experimentation, have more the sense of the future than the Tim’s economists when they try to project the present to a next moment.

### *Isabelle Stengers*

Ants are numerous. People are also numerous, but not in the same way. With ants as you describe them, numbers always matter. There is also the decay-time of the pheromone, rates, frequencies and all that kind of probabilistic stuff. It seems to me that it is a very specific individualization process, because it entails and implicates that probabilities are not just descriptive, they are what the survival of the colony depends upon, what it gambles upon if I may say. They are decisive. So my question would be, what is a young population? What is it when you’re not big number? It must be different ants when they are not in big number.

### *Deborah M. Gordon*

Yes, it’s because of the dependence on rate or frequency that the behavior changes as the colony grows. Not much is known about the very young colonies, even for the harvester colonies. I know that when the colony is very small that is when the mortality of colonies is very high; the most dangerous time in the life of the colony is when it’s so small that it doesn’t have the numbers to maintain the rhythm to keep its activity going. I think those patterns drive the changes in the behavior of the colony as it grows. Their behavior doesn’t scale in a linear way with colony size, because the process works very differently when there are only a few ants.

*Isabelle Stengers*

Exactly. So to me it's something to take into account. No difference between ant and man, but contrast, numbers cause differently when we deal with ants than when we deal with people. What is an individual if number counts?

*Simon Schaffer*

You want to say something about the ant colony as more possessed by the future than humans?

*Deborah M. Gordon*

I think that's great. The ant colony future, you're saying, is what the colony acts upon immediately, while we keep pushing the future ahead but never get there. I think there's something important there.

*Tim Lenton*

I just wanted to pursue a bit further these ideas around ways of learning, particularly in the case of the emergence of economics, because from what the other Tim said, I actually found it quite important the way you framed your argument. In my kind of glib understanding of things the way that Adam Smith's invisible hand is portrayed is as if it is a sort of a blind agency in the magical workings of what we now call the economy, whereas you nicely gave a human quality to particular members of society (economy/whatever) having foresight and using it, or trying to use it, to their advantage. Just to follow the theme to the present which you were touching on a few minutes ago, we were talking about trading in futures. Of course, as you know better than me, a lot of that is done by computers, by algorithms, which you might say are blind mechanical algorithms, but they've been written by human beings with conscious foresight to do so. Of course there's an interesting narrative there—the very quick trades that the computers are doing all the time cause micro crashes all the time, but they were also quite important in the recent great recession. So for me this is really rich territory around blind or not or designed algorithms and how we utilize those and their relationship with our future.

*Bruno Latour*

There's a whole set of discussions here. I want to go back to the numerous, question of number that Isabelle mentioned because if I understood also what just Tim (Lenton) said to Tim (Mitchell). It seems that in human capitalist solution we are not that numerous in making decisions for others and for later generations. So the provocation that Didier pushes should be pushed even a little further. If the ants are allowed to be numerous, to swarm, to have a swarm cognition system, so to speak, which is not really clear for humans, because that the numerosity is also predicated unlimited by the durability of the infrastructures that mentioned Mitchell. Maybe I am anticipated what we will do tomorrow with Gaia, but Lenton makes the point that for Gaia every product, I mean every waste of one is a byproduct of another one. Which is clearly not the case for humans at least since the Industrial Revolution (a recent paper in *The Anthropocene Review* calculates that for every human bodyweight on earth there is five orders of magnitude more material infrastructure weight!). So the question for me is to know whether there is something new since the Industrial Revolution that has made impossible to escape the weight of the infrastructure (the point made by Mitchell that we blinded ourselves to the future), or is there some sort of continuity between past societies of animal or of humans? Are we talking about capitalist humans or humans? What can we do with this scaling? It's exactly the same thing that you said about futures, the way to build the future into capitalism is actually to blind us to the consequences of our actions and we cannot re-use this cognitive mechanism of capitalism in order to do anything because we are paralyzed and paralyzed with the generation before. So maybe this is just for tomorrow.

*Deborah M. Gordon*

I'm not sure I understand what you mean about the relationship between being numerous and the future.

I think we have a starting point for trying to see what we could learn from asking about continuities across these very different areas, rather than thinking about distinctions. The main thing that I've learnt from this discussion, is that rather than trying to split up what's true about ants and what's true about the economy, we can think about what's true of both. Also, this notion of having mortgaged the future is very powerful.

### *Timothy Mitchell*

Well, partly just in response to the point that Bruno made, I suppose to me what I draw from this material I've been trying to think about is, and this builds on Didier's points and many others, is that we build for ourselves not a future, but very specific mechanisms for mobilizing particular claims of futures in particular kinds of ways, in order to be governed or ruined by them. It's getting at the specifics of that, that seems to me important and a way forward. And another thing, to become more aware of the way in which those mechanisms are only one particular way of, basically, of organizing a corporation, a point where there's actually quite an active and live politics. I think for each of them, if one thought of them as instances of the ways in which we have organized our own government, by producing a certain kind of future. That requires a politics that, focusing on that mode of being governed by the future, would be a way forward.

### *Simon Schaffer*

Ok that's, unfortunately, because we're all getting very excited there, the end of our time. I'm not going to try to sum up. I am very struck by Didier's intervention, that is to say let's not spend very much time wondering whether humans are similar or different to and from ants, but rather think through the ways in which these two very, very powerful analyses offer some really quite important challenges to receive notions of temporality and future and planning. Two things immediately come to mind and these will come up again, I'm sure. One is, let's not forget the original metaphor we're trying to escape from, that is to say the metaphor of the body politic was invented in the first place, as Kantorowicz points out in his masterpiece "the king's two bodies," precisely to solve the problem of moving into the future. That's what that image is for: the physical monarch dies but his mystical body survives. The king is dead, long live the king. That's the point of the body politic, it's to try and deal with that problem. Second point, which struck me in both talks, is that then there's something very specific about the relationship between the political economy and the chemical engineering of this story, because the whole point I take it, about anthropogenic carbon dioxide, is that unlike a lot of other processes it's rather easy to think of, the effects of CO2 emissions get greater and greater and greater and greater as time passes. They not only accumulate, but they intensify; that's very unlike short-term immediate pollutions which allegedly get weaker and

weaker and get cleared up, all dissipate. We are not talking about dissipation when we're talking about the Anthropocene, we're talking about something much more like the processes we've just been discussing.

#### REFERENCES

1. Western refers to a previous Dialogue on the theme *Copying with the Past*, see the book P. Gagliardi, B. Latour and P. Memelsdorff (eds) *Coping with the Past. Creative Perspectives on Conservation and Restoration*, Florence, Leo S. Olschki, 2010.

## Metaphors for a New Body Politic: Gaia as Holobiont

*Scott F. Gilbert*

I want to talk about the body politic; and to discuss the body politic, one really has to have some knowledge of the body. What's fascinating to me is that our knowledge of the body has changed enormously since I went to high school. The body that I learnt about is not the body that we know today. Being an embryologist, I'm concerned, obsessed, with the construction of bodies, and I want to talk primarily about the new findings in biology, the things that we may have not have learnt before. Then, once we know something new about the body and its construction, we can ask what this might tell us or at least inform us, concerning a body politic. And I want to use some of the metaphors from the readings that were so wonderfully provided by members of this group: Tim Mitchell's "politics of development," Deborah M. Gordon's "local ecologies of cooperation," and Isabelle Stengers' notion of "diplomats."

So, what I want to discuss first is the notion of bodies forming by interactions. The normative view that we've had in biology for the past half-century is that DNA forms the body. Richard Dawkins (1) gives us this conventional view of the dominant group, writing in *The Selfish Gene*, "We are survival machines, robot vehicles blindly programmed to preserve the selfish molecules known as genes." I bring this up because the Royal Society (2) last month said: "*The Selfish Gene* tops the Royal Society Poll to reveal the nation's most inspiring science book of all time." Even more popular and important than Darwin, Richard Dawkins.

### RELATIONSHIPS AND SYMBIOSES: TOWARD A NEW BODY

This notion that the gene is *the* level of explanation, the notion that genes make our bodies, is a notion that is as antiquated as Richard Dawkins's (3) portrayal of biological information as floppy discs. But biologists have had to use what Michael Lynch (4) refers to as "a general philosophical ontology" that has a pre-theoretical decision, and that decision is that genes are the agents of body construction and genes make the critical decisions. Indeed, if one talks about decisions as being differences, the technical term for different sequences of the same gene is "allele," meaning "that which makes differences." That's 20<sup>th</sup> century biology. I think there's a radical discontinuity between 20<sup>th</sup> century biology and 21<sup>st</sup> century biology, as it now stands. 20<sup>th</sup> century biology was a biology of objects, of entities. 21<sup>st</sup> century biology, I believe, is a biology of dialectical interactions and interpenetrations, a biology of co-dependent origination. It's a biology where things don't exist by themselves. They come into existence through mutual dependence with others (something akin to the Buddhist concept of Pratīyasamutpāda.) So I will talk about bodies formed *through* and *in* relationships for 4 processes: fertilization, organ formation, developmental plasticity, and symbiosis.

I first want to talk about fertilization, which is one of the most misrepresented processes in all biology. When we think of fertilization, we often think of sperm racing through the female oviduct and the victor winning the egg. This story is far from the truth. First of all, fertilization is about two cells interacting, and these are two cells at the verge of death. And somehow, when they come together, they create an embryo that can last decades. Moreover, the sperm does not bore or drill into the egg. Actually, if you look microscopically, once the sperm has reached the egg, the sperm "spoons" with it (5, 6). Then the membranes melt, and the two become one. It's not a violent act.

Also, the sperm that are ejaculated cannot fertilize the egg. These sperm are immature sperm. The sperm get matured by interacting with the oviduct cells of the female's reproductive tract. The oviduct cells interact with the sperm cell membrane in a process called "capacitation," giving the sperm the capacity to fertilize the egg (5, 7). So, the last stages of sperm differentiation actually occur within another organism; they occur inside the oviduct of the female. The oviduct cells interact with the sperm to give it a cell membrane that enables it to receive signals from the egg. Then, the sperm is activated *by* the egg. The egg provides the sperm with chemicals telling the sperm where the egg is and activates the sperm to swim as fast as it can. The egg also provides the chemical cues causing the sperm to release the proteins that enable it to connect to the egg (5). So now, the cell membrane of the sperm

can fuse with the cell membrane of the egg, and the two become one. As I said, it's not a violent penetration.

This is different from the conventional wisdom that says, "The sperm activates the egg." That conventional view is incomplete. Before the sperm activates the egg, the female reproductive tract and the egg activate the sperm. And last, now that the sperm is activated by the egg and the two are together, the sperm can activate the egg... because the egg is also immature. The sperm activates the maturation of the egg, enabling it to finish meiotic cell division (5, 8). The sperm and egg activate and mature each other.

This is a general rule for development: that the body is made from immature cells that mature each other. So that's at the *cellular* level: sperm and egg. On the *tissue* level, organs form by interactions between cell layers. Think about the retina and the lens of the eye. Creationists will imply, "the lens and retina are designed so that the lens is a transparent tissue on the outside of the eye that can focus light on the neuron-filled retina, which is inside the eye," as if the retina and lens were preformed structures that developed independently and happened (miraculously) to be at the right places for us to see with (9-11). But the retina and lens don't come pre-formed. What's really fascinating is that the lens forms the retina, as the retina forms the lens (5). A bulge protrudes on each side from the brain and touches the outer surface, the skin of the head. And when it touches the skin of the head, it tells the skin, "you're not going to be fully developed into skin. I'm going to interrupt your skin development and start you on a pathway towards lens development." And as the lens starts forming, it tells that brain bulge, "and you are not going to be brain anymore. You are going to be retina and that stalk that connects you to the brain, that's going to be the optic nerve." And so the lens and the retina form each other. The lens doesn't become the lens without the retina. The retina doesn't become the retina without the lens. So at the level of cells, and at the level of organs, embryos form through interactions of immature cells.

And then there's the level of the developing organism interacting with its environment, and this is called "niche construction." In this view of evolution, there is no preformed environment that the embryo is going to be born into (12, 13). The embryo helps form that environment, as the environment helps form the embryo. The genes of the embryo do not form a specific phenotype. Rather, they provide a repertoire of possible phenotypes. The phenotype generated from the genes is specified by the interaction of the genes with the environment. The environment can direct the development of the organism. This is called "phenotypic plasticity." This gets us away from classical evolutionary theory, because in classical evolutionary theory, the environment is a selective filter that only allows certain phenotypes to survive. What developmental plasticity indicates, however, is that the environment

is also an agent (or a series of agents) that will instruct the embryo as to which of its possible phenotypes should be made (14-16). So the genotype is not the sole agent of phenotype production. The phenotype (what one observes) is not a read-out of the genotype (the collection of genes formed at fertilization). Rather, the genotype has a repertoire of several possible phenotypes, and the environment is instructing it which of the phenotypes might survive best in this environment. We've gained through evolution the plasticity of being able to respond to the environment.

This is an amazing ability, and we see it throughout the animal and plant kingdoms (15). For instance, two genetically identical mice from genetically identical parents can look strikingly different due to the food the mother ate while pregnant. A mouse whose mother was fed one diet is sleek and brown; the mouse whose mother was fed a different diet is obese and golden. So it's the intra-uterine diet that's the difference-causing agent there, not the genes. In most turtles, the major agent of sex determination is temperature (17). The temperature that the egg experiences during the middle third of its incubation is what determines whether that turtle will have testes or ovaries. Turtles do not have X and Y chromosomes. Population density is another potential agent of phenotype production, and it is critical in causing a young locust to become either a solitary plant-chewer or a gregarious plant-devourer (18). Having a predator in your environment can cause one to develop differently. There are organisms such as *Daphnia*, which, in a pond without predators put most of their extra energy into making eggs. But if there are predators in the pond, the *Daphnia* can sense them, and these sensations change the water-flea's development, causing her to put that extra energy into making a spiked head and a spiked tail that prevent the water-flea from fitting into the predator's jaws (19). Humans have predator-induced plasticity, too. It's called our immune system. Our immune system responds to the outside environment by changing its development (20). Our major predators are not lions, tigers, and bears; but rather, fungi, bacteria, and viruses. The immune system responds to them by changing cell differentiation so that we make antibodies against that predator.

Thus, we form our bodies by interacting at the *cellular* level during fertilization, at the *tissue* level during organ formation, and at the *organismal* level with the environment. And, now, the newest of these notions of co-dependency is that of *developmental symbiosis*: we need, we depend on, other organisms to develop properly (15, 16). This is the notion of the *holobiont*. The term, holobiont appears to be a useful term. It was independently coined at least four times. The current usage of the word was introduced by Lynn Margulis in 1991. It designates the amalgamation of the big organism (the macrobiont, the host) plus its persistent symbionts. The holobiont view claims that the host and the symbionts form the complete organism. For instance, when we think of a cow, we think of this bovine mammal

that eats grass. Only, cows cannot digest grass. There's no gene in the cow's genome that encodes an enzyme allowing cows to digest cellulose. That's provided by that rich community of symbionts living in its gut. Similarly, the termite *Mastotermes darwinensis*, a favorite organism of Lynn Margulis, Dorian Sagan, and Donna Haraway (21, 22), is an agricultural pest. It eats wood, it destroys houses. Only it can't. This termite cannot digest either cellulose or lignum, the wood fiber. It needs a complex community of symbionts to digest wood, and one of those symbionts is *Myxotricha paradoxa*. This symbiont looks like an organism, but it is actually a composite of five organisms, a protist plus four types of bacteria. Together, with the termite, they digest the wood. The bacteria in mammalian guts produce chemicals that induce changes in the circulatory system, aid digestion, and perhaps influence the way we think. They are involved in bone development and are critical for making the immune system. Throughout the animal and plant kingdoms, organisms are composite beings. We are not the zygote-derived, monogenomic, individual we thought we were. Anatomically and physiologically, we are holobionts, an organism that is a complex collection of ecosystems.

Even developmentally, we are not individuals. And this is what brought me into this whole area. There were papers published in the early 2000s that said that the blood vessels of the intestine, the blood vessels that deliver food to our body, do not form unless certain bacteria are present (23, 24). The gut bacteria are producing chemicals which are telling the adjacent intestinal cells to express those genes to make certain proteins, such as angiogenin-4, that tell the cells surrounding them to become blood vessels. So the bacteria are agents instructing the genes of the intestinal cells to make and secrete proteins that instruct the cells next to them to make blood vessels.

And angiogenin 4 has another, off-label, use. The bacteria that are inducing this intestinal gene to be expressed are Bacteroides bacteria. Angiogenin 4, in addition to helping the cells organize into blood vessels, is also bactericidal against *Listeria* bacteria, which is the major competitor of Bacteroides (25). So Bacteroides is telling the intestine: make blood vessels, and also kill my competitors. We've evolved with Bacteroides for a long time.

There's a special case, which is getting a lot of publicity now, which is the brain-gut-microbiota axis, the idea that normal brain development is, in some important ways, being controlled by the microbes (26, 27). The microbes are producing huge amount of chemicals. Serotonin and other hormones are being produced by bacteria or induced by bacteria. The gut microbes influence neurotransmitters, which once they're made, influence stress and anxiety responses. Germ-free mice (without symbiotic microbes) have behavioral anomalies: if you grow mice without bacteria, they have a syndrome of decreased sociability. Mice without microbes

prefer to spend time in solitude, while the mice with microbes like to spend more time with the other mice. And if you add back the bacteria to the germ-free mice, they become more sociable. Also, the mice without the bacteria have more 4 times more self-grooming behavior than normal mice, and you can get that self-grooming behavior to baseline levels by adding the bacteria back (28, 29). Even in human pregnancy, bacteria are involved. The bacteria in a woman's reproductive tract and distal gut during her third trimester of pregnancy are different than the bacteria normally there. The hormones of the woman actually change the bacterial population in those areas from which they will be colonizing the fetus as it exits the birth canal. So the bacteria that will colonize the foetus and give the new bacteria for the gut, are not your normal suspects. They've been selected during third trimester pregnancy (30).

Not only that, once the infant is born, the mother gives it milk. The milk has two sets of nutrients: one set of nutrients is for the baby, that's kind of obvious. The other set of nutrients is for the new bacteria. This set of nutrients contains oligosaccharides, complex sugars, which cannot be digested by any mammal, but they feed bacteria such as *Bifidobacteria*, which you want to be among the first colonizers of your gut. They set the conditions for all the other colonizers. *Bifidobacteria* has seven genes that encode proteins that digest this set of oligosaccharides in mother's milk (30). This has important consequences, for when you change the bacteria, you change the immune system. If you raise macaque monkeys either on bottle formula or mother's milk, you get two completely different types of bacteria (31). The bacteria promoted by mother's milk make a compound called arachidonic acid. Arachidonic acid is a compound which induces the formation of certain types of helper T cells in the immune system. Those helper T cells in the immune system are those that get rid of common infections such as *Candida* and *Salmonella*. So the breast-fed macaques have a different immune system than the formula-fed macaques.

One of the things that has been so remarkable about the symbiotic view of development is that the symbionts help construct the immune system. Without normal bacteria, the gut-associated lymphoid tissues fail to form. These mice lack the activated T-cells and B-cells of a normal gut immune system. Moreover, the gut actually helps these microbes to survive and flourish. Alfred Tauber (32) says, "From a philosophical perspective, the wavering ontological status of immunology's key concepts—*self*, *individuality*, and *organism*—highlights a science in transition." The immune system that I learnt was an armed defense force protecting us against the microbial onslaught. You had these two layers of the adaptive and the innate immunity. What we're seeing now, is that the immune system is like a force of diplomats, passport control agents, or even park managers. They know who to let in and who to keep out, and they establish symbioses among different partners. The microbes

help construct the immune system, and then the immune system helps control which microbes get in. The immune system is a holobiont property; it's not merely the host's immune system (33). It's the holobiont's immune system. So this means that we should no longer consider ourselves genetically pure. We have numerous genomes. It's all about body politic metaphors. The bacteria and the host make the immune system together, and there is no pre-existing harmony. The immune system is constantly changing, and the environment that the immune system sees is constantly changing. This notion of self is an emergent network property. Donna Haraway (34) says immunology is a discipline dealing with postmodern bodies, and Bruno Latour (35) and Peter Sloterdijk (36) claim that immunology is the first anthropocenic discipline. Exactly.

You can see history in terms of the holobiont. The conquest of the Western hemisphere during the great Columbian Exchange was done not by the armed forces of Pizarro or Cortéz. It was done by diphtheria, cholera, smallpox, rubella, and *Salmonella* (37-39). The context determines the relationship. The European travelers brought with them all these microbes, which they had learnt to live with. The American Indians had no experience of these microbes, and it is estimated that 85 to 90% of the indigenous American community was wiped out by European microbes. What was mutualistic symbiosis to Europeans became parasitic symbiosis to the native Americans.

Such mutualistic symbioses (where both partners benefit) is really the evolutionary strategy that supports life on earth. Whether it's the legume-rhizobacterial symbiosis that allows plants to make fertilizer, the coral reef and tidal seagrass symbioses that sustain oceanic biodiversity, or the symbiotic webs called "organisms," "cells," or "genomes," we have a new biology of relationships. Within this web, the holobiont is continuously being constructed, and harmony is not something given, but rather something that requires interactive agencies of these networks throughout the lifespan of the organism.

### METAPHORS OF GAIA: TOWARD A NEW BODY POLITIC

In discussing the body politic, we have to deal with our new, relational and symbiotic, view of the body. I'm currently playing with the analogy that the classical body is to "nature" as the holobiont body is to Gaia. That is, "Classical body: Nature = Holobiont body: Gaia." The holobiont body is an unbounded, temporally changing, intertangled mingling of components that is both manipulating and interchanging with the environment. It is a complex web of ecosystems, where the

mouth, gut, fingers, and reproductive orifices each support different communities of microbes. Like Gaia, it calls into question the distinction of organism and environment. And I think that you have here this notion that Gaia, to quote Bruno Latour (35), “is only the name proposed for all the intermingled and unpredictable consequences of the agents, each of which is pursuing its own interests by manipulating the environment.” So, maybe Gaia can be likened to a holobiont. (Indeed, Lynn Margulis may be a source for both these concepts, and they may both spring from this view of reality.)

But there is a problem if Gaia is to be seen as a holobiont. If the function of metaphor or simile is to explain the unfamiliar, like Gaia, by its similarities to something familiar, claiming Gaia to be a holobiont is not going to help. We are still finding out what holobionts are. This is new turf. So what might be better? One idea is “terroir,” the natural environment in which a particular wine has been generated, including factors such as soil, microclimate, topology, rainfall, and harvesting. So, you have an interaction of climate, soil, terrain, and also tradition. The humans are part of terroir, just as they are in Gaia. But can this concept be used as a metaphor for humans or Gaia? Indeed, it already has. In the recent book, *A Gentleman in Moscow*, Towles (40) writes, “the contents of the bottle in his hand was the product of a history, as unique and complex as that of a nation or man. In a sip it would evoke, the timing of that winter’s thaw, the extent of that summer’s rain, of the prevailing winds, and the frequency of clouds.” Terroir is being used as a metaphor for both body and body politic. Also, scientifically, grapes are holobionts, having different microbes on different parts of their bodies and in different geographic locations. There is a local earthbound microbial habitat that interacts with the global climate. The agents making terroir are both local and global. Climate agents actually might be working both by themselves and by specifying the microbes. (And it seems very appropriate to be discussing about Gaia and terroir with Latour in a building housing Veronese’s *Wedding at Cana*.)

Another notion, another metaphor for Gaia could be *development*. Development can be seen as a progressive and unidirectional movement, such as that of an embryo to an adult or of a larva transforming itself into a butterfly or a frog. “Development” is being used this way all the time: “land development” and “economic development” both see nature as primitive and having a *telos*, namely the managed city. Primitive societies are seen as being tied to nature, while the managed city is seen as having escaped from nature. Land development and economic development lead to something that we talked about earlier before: Earth as managed plantation. This is Donna Haraway’s (41) notion of the plantationocene; and in the plantationocene view, the Anthropocene crisis is a good thing. It is metamorphosis, bringing us and the land to higher, more developed, stage.

There are other, and I think more interesting, developmental metaphors. The epigenetic landscape of Conrad Hal Waddington depicts a cluster of similar pluripotential cells rolling down separate paths into separate cell types. This model has been modified by people who view the cell types as basins of attraction. These attractor basins are the stable networks of genes and cells. Thus, there's a stable set of gene expression which gives you a blood cell, a separate set of interactions which give you a muscle cell, and a separate set which give you neurons. And there are other attractor basins where cell division is encouraged, and these are the cancer networks. This notion of a basin of attraction has recently been used to study Earth's history and, in a paper by Gaffney and Steffen (42), one sees these glacial and interglacial periods as stable attractor zones. After these basins, however, there is the Anthropocene state, and maybe it will become stable there. However, if it is not stable, it may create a state of instability that leads to a stable, but lethal, Venus-like atmosphere.

So the basin of attractor has been used not only for developmental history but Earth history as well. What, then, is abnormal development? Abnormal development is cancer. And cancer is an abnormal interaction between cells. It's not really a cell becoming bad; it's a cell not responding to its environment (43). This notion of humans as the cancer of the earth is widely disseminated. You can even purchase a "Humans are the cancer of the Earth" t-shirt from the web. The famous Pogo cartoon (44), used on Earth Day, parodies Oliver Hazard Perry's famous slogan to say, "We have met the enemy and they are us." Cancer is a disease from within the body politic, not from outside it (such as infection metaphors; 45). I hadn't put much stock in the cancer metaphor until a paper came out a few months ago, which looked at cancers as generating their own travelling niche (46). Most cells die when they leave their tissue environment, but cancer cells don't. Cancer cells, it was found, make their own supportive environment. They make dividing cells (on which researchers have been focusing), the cancer stem cell. The non-dividing cells turn out to be niches for the cancer stem cells. They allow the cancer stem cells to survive. I think that we are also secreting our own supportive environment, and what we're secreting, what's allowing us to propagate, is technology. I think the technosphere, *la Technique*, as Jacques Ellul (47) called it, is the "second nature" in which we live, our supporting environment, and this has allowed us to propagate beyond nature's capacity.

Latour (35) considers the new climate regime as a "mutation." I don't think it's a mutation, but rather as a cancerous phenotype, a manifestation of a series of mutations under particular conditions. So what are the mutations? Just as in cancers, there appears to be a series of mutations that are needed, not just one: the first mutation might have been the invention of agriculture, which David Western

and Shirley Strum (48) have shown to be altered interaction between humans and nature. The second mutation, as Bruno Latour (35) points out in *Facing Gaia*, may be immanentism, wherein governments are expected to make Heaven on Earth. This view altered the interactions between government and religion. Then I think a very important mutation, natural theology, the license to perform science as a religious practice, enabled the propagation of science in the West (49). And the last mutation was techno-science (42, 50, 51), the fusion of two very different ventures, technology and science, which probably began in the 1800s and then accelerated in the 1950s. This series of mutations did not occur in all parts of Gaia, but specifically in that node of interactions called “the West,” and this might explain why the nidus of the Anthropocene crisis is here.

But the West isn't alone in producing metaphors for the new world's body. Asian tradition has several, and one that is being used to show a world of an interactive, interpenetrating, co-constructive agents is “Indra's pearls.” The world Indra created was a web of jewels. Everything that exists (including concepts) is part of that web, and each jewel is tied to each other and each reflected in each other (52). Everything that exists shows everything else that exists, just as much as the paper in this book was caused by the tree, its symbionts, sunshine, rain, the forester's parents, the iron of the woodchopper, and eventually, everything else (53).

Thus, there is a new “body” that is being brought into existence. This is a body that is not genetically pure, that is a set of continuously changing interactions with its environment, and that is predicated on series of relationships. It is a complex web of ecosystems, each of which functions in sustaining the body. Whether this holobiont body can be a model of the “body” of Gaia (or some aspects of it) remains the topic of exploration.

I would be amiss, especially in a paper on mutualistic symbiosis, if I didn't thank my colleagues who helped bring this chapter into existence: Michael Flower was a major force in this, as were extended conversations with Lynn Chiu, to Fred Tauber, Donna Haraway, and Deborah Heath.

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## Sem(b)iosis and the Political Economy of Nature

*Mike Lynch*

On my flight over from the United States a few days ago, in order to get some relief from thinking about this session, this talk and this *Dialoghi*, I relaxed and read the latest issue of *The New Yorker Magazine* and, lo and behold, there was an article by Siddhartha Mukherjee (8), on cancer, and it is related, I think—somewhat different, but related—to what Scott has just told us about. The article is called *The Invasion equation*. Mukherjee is a doctor, an oncologist, who deals with cancer patients and he's talking about a woman who is diagnosed with a tumor in her breast. He says:

“... we have no clue how these tumors, the ones found incidentally, behave in real life. Would the alliances formed between the woman's tumor cells and her tissue cells enable widespread metastatic dissemination? Or would these encounters naturally dampen the growth of the tumor and prevent its spread? Nobody could say. ... It was a classic denominator problem but my response seemed supremely unsatisfactory.”

The “denominator problem” is that he is faced with the patient, the woman who has a positive diagnosis for this tumor, but he doesn't know how many others who were not in his presence, not having been diagnosed, would have very similar cells in their bodies. He quotes a specialist on cancer research Rusian Medzhitov, who wrote of the “new rules of tissue engagement.” Mukherjee says:

“Medzhitov believes that all our tissues have ‘established rules by which cells form engagements and alliances with other cells.’ Physiology is the product of these relationships. ... Medzhitov's point is that cancer cells produce cancer—they get

established and grow—only when they manage to form alliances with normal cells. And there are two sides (at least) to any such relationship.”

Mukherjee uses two common analogies to open up this question about the environment in which cancer cells, which are found ubiquitously in bodies and in the blood, grow. One analogy is with seed and soil, and he is concretely looking into soil. The other is with invasive organisms and he speaks about something that is very familiar to those of us who live in upstate New York: zebra mussels (*Dreissena polymorpha*), a species native to the Caspian and Black Seas that colonized the Great Lakes and also the Finger Lakes near where I live, with thousands of them in a square meter. And, again, the issue is why is it that these creatures, with predators in their own habitats, are in some sort of balance and are not considered a horrendous pest, but when they move to a new environment they just proliferate and become, sometimes for quite a long time, predominant. So, what I find interesting about this article, which I just happened to come across, is it alludes to just the kinds of things that Scott has shown to us with his very wonderful slides. You start seeing this everywhere, and I don't think there's any need to search for the politics of science, particularly of genetic science and biology; the politics is in the language used to describe them, incidentally: the cancer cells disseminate and encounter normal cells, they engage with the tissues and form alliances. It is as if Mukherjee and Medzhitov had been students of Latour (and maybe they were). Politics, in this case, is not an addition to cellular physiology and pathology from some other domain that affects or somehow changes the science; it's part of it, it's part of its language, it's intrinsic. Though in this case the politics is part of the way pathology is described, we saw many cases from Scott's talk in which it is not a pathological way of informing and elaborating biology. Scott has treated us to a holobiontic political economy of nature, and I suggest that it's also 'sembiotic' in the sense of being a kind of portmanteau between symbiosis and semiotics where we can pay attention to the language in which biology is expressed, not just as incidental language, but as the very opening up of discovered domains for further research and clinical practice.

What I want to do in the rest of the time I have today is to very briefly talk about ethnomethodology in the body politic. Ethnomethodology is my field, it's not widely practiced, it's probably scarcer now than it was when I started doing it 45 years ago. So, I'll give a little bit of a lead in to that field, and then introduce what I want to talk about: genetic indexicality, notions of information, and associated with them *instructed actions*; themes of interest to ethnomethodology. And, finally, I'll spend some time explicating situated uses of distinctions in law, not as a critique of legal language but as a way to situate our understanding of those distinctions when they travel to domains like Law.

So, a little bit about ethnomethodology. Ethnomethodology developed both from and in opposition to structural functionalism. In his introduction today, Bruno mentioned that some of the classic texts we were treated to in that wonderful performance yesterday, had marks of functionalism, a way of thinking that comes as much from biology as it does from sociology. The picture of functionalism that Talcott Parsons (9) developed—which, in its own way, is a very harmonious, beautiful picture—is that modern society is an integrated whole with differentiated parts, and a key aspect of his notion of modernity is that the parts differentiate to become autonomous. In sociology of science we are most familiar with Robert Merton's (7) notion of science as an autonomous institution that is connected to other institutions, but is nonetheless, in many ways, governed distinctively and to a significant extent self-governed. So, in that picture there are institutional orders of the economy, polity, religion, and so on, which are likened to organ systems in the body, such as the respiratory system, the digestive system and so forth. Individuals, in this picture, are integrated into the whole society through socialization. They take roles, they follow rules and norms, and values are the integrative abstractions that tie individuals to that society. Actions performed by individuals, at least those individuals who are considered most important, are purposive and circumscribed by values and norms. According to Durkheim, whom Parsons and Merton 'translated' into familiar categories of American Sociology, human actions cannot be reduced to psychology or sociology, and Durkheim's nascent science of society is thus distinct from biology and from psychology. There are lots of problems with functionalism, and some of them emerged very early. One is often called by philosophers, *the problem of relevance*, which is how do you provide identities for actions, how do you describe them, how do you characterize them? How do you characterize actors? You can characterize them by gender, you can characterize them by nationality or by their job, or by the particular actions they happen been doing at a given time (for example as a "driver" of an automobile). The question is, what is the most relevant characterization for a given action and actor at a given moment? There's also the problem of following rules, following norms, following recipes: how is the action that follows from a rule or an instruction related to the instructions. We all know, from our practical actions, that often we do not just make errors when we act differently from what the instructions 'tell' us; indeed, we necessarily must devise how to act, given the unique circumstances the instructions cannot possibly anticipate. So, with ethnomethodology, the approach to social action broke away from the functionalist integration of a holistic society, and developed a distinctive empirical approach to describing actions as they occur in situ, locally, and ethnomethodology abandoned the two-level macro-micro scheme, wherein the actions of individuals relating to one another, their interactions, are viewed as a microcosm of some larger

society. The possibility of such integration was suspended rather than used as the dominant interpretive scheme. So, my teacher Harold Garfinkel wrote a book called *Studies in Ethnomethodology* 50 years ago (1), which may be familiar to some of you, I know it is familiar to some of the people on the panel. Ethnomethodology aims to describe the production, the display and the accountability of everyday actions. The term itself refers to methods, I prefer the term practices, through which interacting individuals, not individuals in isolation, produce language and embodied actions—produce ordinary as well as specialized activities—and constitute what Garfinkel (2) called the “immortal ordinary society” with ironic references to Durkheim. He also, together with his student, the late Harvey Sacks, who died very early but he inaugurated a field that became to be called Conversation Analysis (10), focused on what they called *Indexical Expressions*. They didn’t invent the term but they used it ubiquitously to describe language as it is used in social interaction rather than language as refers to objects, refers to ideas, as a matter of reference (3). And it’s a very different picture of language, a different sense of what people are doing when their language doesn’t index a thing, it indexes where they are speaking, how they are speaking, what are they doing with their speaking.

Ludwig Wittgenstein’s (12) work is also informative for some of us in the field. So, the orientation here is to investigate the uses of language—actions in which language is used—as well as actions in which language isn’t used. Such investigation is not a method for bringing signs into correspondence with referents. An expression such as “it’s nice to have you here with us” has different uses on different occasions. I could say to this audience “it’s nice to have you here with us.” If one wanted to analyze that sentence, the classic way to do it would be to find referent for “nice” or for “you,” for “here,” and “us,” and to put proper names on “you” or “me,” the speaker. But, as Harvey Sacks too pointed out, indexical expressions are used, not only as proxies for proper names, but also as *usefully* unspecified terms. For example, the sentence “it’s nice to have you here with us” is from a recording of a group therapy session. But if you translate “here” into “in group therapy,” it becomes a different expression, perhaps a more embarrassing expression, and it could be a source of complaint. If you were to say, “it’s nice to have you in this group therapy session,” it’s not just that I wouldn’t use the word “group therapy” for “here,” but that using “here” has a distinct sense... indeed, I could use it right here.

In this game of finding society in biology, it’s not only a matter of polemical language. As Scott showed us, in very serious descriptive language used in biological pedagogy, we can see, we can find, some parallels to what I’ve just said about the vision of language in ethnomethodology. Some years ago, a former student Kathleen Jordan and I wrote a paper on the language of instruction in genetics (6). Richard Lewontin (5) had recently written an article called *The Dream of the Human Ge-*

*nome*, in which he criticized the run up to the Genome Project. In it, he said:

“A deep reason for the difficulty in devising causal information from DNA messages is that the same ‘words’ have different meanings in different contexts and multiple functions in a given context, as in any complex language. ... The code sequence GTAAGT is sometimes read by the cell as an instruction to insert the amino acids *valine* and *serine* in a protein, but sometimes it signals a place where the cell machinery is to cut up and edit the message. ... Unfortunately, we do not know how the cell decides among the possible interpretations” (5).

There are two things here: one is that he is not only speaking of the code in the gene as having contextually specific, different elaborations or expressions, he is also speaking critically, discussing the analogy of genes as instructions to the organism to build protein structures and everything else that follows from them. And, in ethnomethodology, an exercise we often do—which you can elaborate upon endlessly and is always fun to do—is take a set of instructions, or a map, a written direction, or a recipe and then very closely examine it, especially if it is a new one—for an action you haven’t done before. You then examine what you do with it, paying close attention to when you substitute ingredients, when you get lost, when you have to find your way back, and so on. You treat these contingent actions and difficulties as equally informative for what instructed actions are. Some students in a seminar of mine and I recently performed such an exercise with following GPS (Global Positioning System) instructions, which supposedly solve the problems of wayfinding automatically, and it certainly does take care of some many difficulties, but we got into some very interesting situations, particularly when using the GPS in unfamiliar environments (11). We also used it in familiar environments where we knew very well where to go, where to walk or to drive. We followed the GPS instructions to see where it would lead us, for example, to find a different way and even to discover a better way to go. But, often, we would find that there were absurdities in what the GPS programming would have us do, and in any case there were differences in the elaborations of the instructions through performing the action. This is something that, again, we think of as both as a method for doing the action, and a method of research in ethnomethodology, and it finds its expression in biology in that quote by Lewontin. I want to spend the rest of my time here talking about distinctions, in particular one that we’ve heard a lot about—the nature-culture distinction. Rather than attempt to deconstruct or erase that distinction, I want to suggest a different way to work with distinctions. We find many distinctions in use in law. I teach courses on law and science. Unlike Kyle McGee, I’m not a lawyer and he can certainly correct me on my understanding of law, but there is a way in which I find interest in distinctions that are used in legal cases. Even just following judicial decisions or friends-of-the-court (*amicus curiae*) briefs can be very informative

about nuances in the use of distinctions. Distinctions are not necessarily dichotomies, because they are used differently on different occasions to do different sorts of work. So like indexical expressions we can think of the work that's done with distinctions. Sometimes, of course we use the term *boundary work* to talk about that sort of thing (4). Boundary work is not demarcation, it is not a matter of trying to develop stable, eternal, transcendental differences. So, the dichotomy of nature versus culture has interested me from the time I did my dissertation research in a biology lab in the 1970s, following usage about artefacts, artefacts not being the handiwork of craft persons, but often associated with mistakes or problems in biology: intrusions from stains and invisible materials, noise (as we heard about today) that interferes with signal in experimental systems. These sorts of things are called artefacts, and I took the attitude of a practical archaeologist; or, rather I imagined that biological researchers were practical archaeologists: even though they did not like to find that they were making artefacts, they spent a lot of their time searching for artefacts, identifying artefacts, and devising genealogies of how those artefacts might have come about in their research. And so, the distinction between artefacts and naturalistic evidence, or residual evidence if you want to call it that, was something that animated their work, and also was something I followed and explicated.

And now I want to talk about the distinction between what in the US and also Canadian law is called the “product of nature” versus “composition of matter” distinction, and I shall elaborate on that shortly. What I want to do with this distinction is, first of all, to place it in brackets, meaning that I don't want to repeat it or endorse it, at least not initially. I don't want to elevate this distinction to become a conceptual matter that has transcendental significance as a grand theoretical problem. I just want to see how participants in particular legal disputes use it. So, suspending the distinction's use as a resource, in order to examine what is being done with it is part of my analytical ‘attitude.’ I want to situate the distinction in a setting where its use is perspicuous; that is, where it's a specific concern for participants at work, whose skills and discourses develop it in a particular way. And then, I want to go on to explicate how it's worked, or worked with, worked out, on specific occasions and then examine whether and how it does get reified; I may not be able to get through all of what I am prepared to say about this distinction, but let me begin by saying a bit about the history of US patent law—intellectual property law—as it relates to living organisms, and I'll also talk about a Canadian case. US patent law, going back to very early in the founding the United States, provides for the issuance of patents to a person or company that invents or discovers any “new or useful process machine, manufacture, composition of matter” (US Patent law: Title 35 §101). This is very broad language, especially the term “composition of matter.” Criteria used in the US patent office, which are pretty close to those used

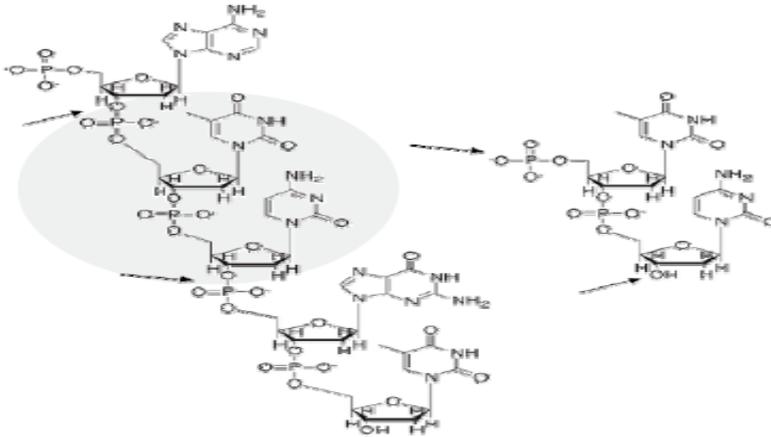
in other countries and the European Union as well, are that the thing must be novel, original, non-obvious, useful, and doable (enable-able). This law applies to processes as well as products of innovation, and the question then becomes: Does or can the language of patent cover living organisms? And this has been a matter of concern, especially in the past 50 years or so. It is not a new concern. Pasteur in the late 1800s patented a yeast (if you consider yeast to be living, among living things, organisms). In the early part of the 20<sup>th</sup> century some plants were included under a special provision of patent law that was very restricted. Then, in 1980, there was a landmark case about a bacterium that was genetically engineered to clean up oil spills, which was allowed to be patented by the US Supreme Court in a case called *Diamond v. Chakrabarty*. The question, in all of these cases, is where, how, or whether to draw a line in the continuity of life?

It is a matter of legal boundary work, case-by-case, of a historically situated demarcation. So, briefly, *Diamond v. Chakrabarty* was a US Supreme Court case, where the court considered the simple question: How do the words “manufacturing” and “composition of matter” apply to genetically engineered organisms? How they answered that question was not so simple: the majority in this 5-4 decision, ruled that they would consult what they called the “obvious meanings of words,” the dictionary meanings of the words *manufacture*, and *composition of matter*. They also, of course, consulted common law and legislation, and tried to determine the intent of Congress when the patent law was originally written and amended over the years; of course, there is a whole school of legal thought about whether original intent should matter or not. In this case, the court interpreted the coverage of the plant protection acts in the early part of the 20<sup>th</sup> century and considered the language in those acts that at that time excluded bacteria from intellectual property law. They also raised questions about the hazards of genetically modified organisms, but the court just brushed aside those questions and left them for the legislature (Congress) to decide, so they didn’t really deal with that. I find this product of nature / composition of matter distinction in law very interesting. It is not the same as nature-culture: nature here is a producer, of *products*. Matter is a *composition* that is manufactured, and so *composition of matter* is not just the content of things, the material content, it is a *composition* in a sense like a musical piece; it’s made, it’s produced, whereas product of nature is something that is part of a commons, it’s available without human intervention or with trivial human intervention. So, all sorts of analogies come into play in questions raised during such court decisions: if you synthesize a chemical or a substance that already exists in nature can you patent it? If you extract or purify a substance, whether it’s a metal like tungsten, a hormone like adrenaline, or a fiber like cellulose—a substance that exist in a plant or exists in the body in impure form mixed with other substances,

perhaps dangerous until purified—can you patent it? There have been different decisions over time on these questions, and each takes up and performs a very particular expression of the nature-culture distinction, of the discovery/invention or nature/technology distinction, where nature is producing a product, composition is equated with manufacture, and nature is a commons—if something is assigned to nature in this context, then in principle it is available for everybody. So, this idea of interpreting the ordinary meaning of words also comes up in a case where a court, this was the Supreme Court of Canada in this case, decided against patenting the infamous Harvard mouse or OncoMouse (*Commissioner of Patents v. Harvard College*, 2002). There was no High Court decision in the USA about OncoMouse, because *Diamond v. Chakrabarty* was followed as a precedent, and the patent office mainly assigned a patent to the Harvard Mouse, and no dispute on the matter was taken up by the Supreme Court. However, the Canadian court did take it up, and in a 5-4 decision, the majority ruled that the meaning of the words of the patent act (which were similar to those in US law) should be “read in their entire context and in their grammatical and ordinary sense harmoniously with the scheme of the Act, and the intention of Parliament.” The majority ruling made comparisons with schemes in other countries, and decided that the best reading the words of the act supports the conclusion that higher life forms are not patentable. So you get these different interpretations of the ordinary meanings of words, where in *Chakrabarty* the term manufacture is used ‘obviously’ to mean products of human intervention whether living or non-living, whereas in Canada the Harvard mouse was viewed as not a product of manufacture, but as something natural, even though it did involve human intervention.

In the few minutes I have left, let me just briefly talk about a very interesting recent US Supreme Court ruling that happened three or four years ago, for a case going back seven years ago because it had a complicated history through the federal court system in the US: *Association of Molecular Pathology v. US Patent and Trade Office et al.*, 2013). The dispute was over a patent of two genetic regions associated with susceptibility for breast cancer and ovarian cancer in about 5% of cases. The two genes (BRCA I & II) were patented by a company called Myriad Genetics. The dispute went through Federal District Court, and twice through the US Appeals Court, before getting to the Supreme Court in 2013. The issues that were at stake were very complicated, I won’t have time to talk about the complications, but the court used many analogies, which, of course, is typical in law. One analogy was that extracting a genetic sequence from its context in what was called “native” DNA, the genome in the human body, was like extracting wood fiber from a tree. Prior decisions had ruled that mere extraction of a natural ‘product’ is not patentable. But a different version of extracting from a tree also was mentioned in the court’s deliber-

ations: that of ‘extracting’ a baseball bat from the wood in a tree: in this case there is a manufacturer, there is an ‘art,’ there is credit to be associated with a novel design, unlike in the case of wood fibers. So, there’s a question of what effort is involved, what credit to assign to an invention, as opposed to simply taking something that is already intact, out of the matrix in which it is found.



A-T-C-G-T polymer (left, with T-C highlighted) versus “isolated” T-C molecule (right)

This diagram (which is included in the Supreme Court ruling) shows an extracted sequence of DNA, which, once extracted and put inside a test system by Myriad genetics, was slightly different at the ends of the sequence but functionally the same, in the sense that it coded for the same proteins as it would in situ (in “native” DNA). A second type of manufacture, not shown in the diagram, is something called cDNA (complementary DNA), which can be likened to compressed music in a compact disc or other digitized version, where in the case of cDNA the non-coding regions, the so-called “introns,” are removed and the remaining coding regions (“exons”) are used in the test system. The Federal District Court in 2010 made a very interesting ruling. Surprisingly, the single judge who reviewed the case ruled against the patent and argued that the genes extracted from the DNA and native DNA were the same essentially. More interestingly, the judge (Judge Sweet of the Southern District of New York) also argued that the genes themselves are not just chemicals, but are bearers of *information*. And so, he argued that if you think of genes as information, bearing the same information regardless of the changes in the

composition of the molecule, then that is the key issue for deciding what's the same and what's different between "native" DNA and the "extracted" sequences used in Myriad's test system. The District Court's ruling was appealed twice, the second time in light of another Supreme Court case in which the Court signaled that they were skeptical of gene patents and were going to apply the product of nature doctrine in this case, but in two 3-2 decisions, the appeal court twice ruled in favor of Myriad's patent. The Supreme Court then ruled unanimously (9-0) to overturn the Appeal Court and to invalidate Myriad's patent on the gene. The report of the decision was authored by Clarence Thomas, and while the decision was unanimous, it included a very brief concurring opinion by the late Justice Scalia. However, the ruling was a kind of mixed Solomonic ruling, where extracted DNA was deemed the same as native DNA and thus not patentable, whereas cDNA with the introns removed was viewed as patentable. Consequently, there remained an open question as to whether the ruling would make any difference in the future; whether or not the ability to use cDNA would inhibit Myriad practices. Currently, there seems to have been some impact, but the implications still have to be worked out.

To conclude briefly, I would argue that the product of nature / composition of matter distinction in US and Canadian law is not covered under the general philosophical dichotomy between nature and culture. Instead, it is highly specific to the histories of law in those countries, and the judges' readings of legislation at a given time. The notion of genes that comes out of the Myriad Genetics case, and other such cases, is bio-legal, in the sense that there is no separating the legal context from the conception of biology that the judges deemed relevant to law, so that the parsing of description of nature and culture in such cases is endogenous to intellectual property law in a particular legal (and political) context.

So what's at stake? I think that is a question I hope we can discuss in the sessions that follow. In this example of legal "sem(b)iosis" of the gene, nature is a commons. Accordingly, what's at stake is what is going to be public property, and what is not. And, it is not that simple, since a patent is not just private property. Lots of things can be private property. A patent confers a limited monopoly that can, of course, lead to high prices, such as we see with drugs and many other things. But, in any case, why I think this is related to what Scott talked about is that it provides a very vivid instance of what he explained to us; a version of the political economy of nature.

## DEBATE

*Kyle McGee*

Those were really terrific papers. So, Mike, I would like to push you a little bit on ethnomethodology. I think your account may expose something that I consider to be a limitation of ethnomethodology.

So I think you're spot on with the analyses of situated relevance and the ways in which rules, or dichotomies, or distinctions, or doctrinal categories and laws are modalized, are operationalized. Speaking from the vantage point of a legal practitioner, I think that is exactly the way to consider those phenomena, as opposed to adopting the sort of detached, allegedly disinterested mode of legal theorizing that is actually still the norm. But where I begin to diverge from you, I think, is in the context of your example of the "product of nature" and "composition of matter" distinction. I would root that distinction in a fundamental anthropological construct within the law, which is the cleavage between a person and a body.

So you provided great descriptive insights on all of these juridical and biological questions raised by your leading cases, but there's no way to account for the meaningfulness of this basic distinction. And its meaning or efficacy derives from this anthropological conviction that there's a difference between a mere body and a legal person. So it's the legal person who has the capacity to own and to act in law, while the body does not have any such capacity; in fact, it's a subordinated, merely material substrate in the classical language of metaphysics, through which the Western legal tradition comes about.

So you point to history and I think that's right, you point to the history of a legal system for instance, as being the explanatory ground. I would just suggest that there's also a serious and essentially non-negotiable anthropological commitment that I think you'd have to make sense of in order to really appreciate why a distinction is modalized in the way it's modalized, which is to say, to account for why lawyers make the arguments they do make in fact, or why judges end up making the decisions they make in fact. It has much less to do with the sciences, I suspect, than with elements that are properly juridical in these biotechnological assemblages. And that's not exactly a question that ethnomethodology asks, and that's why I am suggesting that it's a limitation of that approach, but I would certainly love to hear more about that from your perspective.

And, Simon, if you're just collecting questions, I have one for Scott which has to deal with immunology—we're in Italy, where there's a very potent force in political philosophy called biopolitics, I mean the Italian philosophers of the biopolitical

moment, for instance, Roberto Esposito, who is well-known for his doctrine of the immunitary logic of law. So he likens law to the body's immune system. I know there was a discussion earlier, prior to the meeting today, that this notion of the body politic has kind of disappeared after the dawn of early modern political thought. We no longer see such explicit reference to an organic body politic, not many modern thinkers feel comfortable analogizing the organic and social bodies in the way that John of Salisbury or Sir John Fortescue did, but it's obviously a key connection that has returned in a very important way for these Italian thinkers of biopolitics, where biology and politics are structurally linked, and the political project they have opened up invites or challenges us to figure out how that linkage works and how to do or undo it, or how to do it better. So the question for Scott is: in what way do you think of legality within your political economy of nature? Do you think that it's fair to associate legality with an immunitary function, given the more sophisticated understanding of biological processes that you're bringing to political theory? In other words, I wonder if your take ends up complicating the kind of framing of the law that we've seen with Giorgio Agamben or Roberto Esposito on these questions of immunitarian logic, the inclusive exclusion, the state of exception, and so on.

### *Bruno Latour*

Well, I'll first comment on Scott that the word "terroir" is not really used, but the word "climat," meaning a small portion of a piece of land with highly specific wine and I learnt from you highly specific symbiont. It is actually the word climat that is used and that's why I use "new climatic regime" for this reason but also because of Montesquieu "theory of climates." So for me climates doesn't mean just atmosphere but it means the whole things which you associate with terroir.

Anyway, I'd like know more about the way you understand Deborah this morning. She proposed a redefinition of individuality as connected to the numbers of interaction made by an individual ant. Is this the sort of thing you get when doing developmental biology and embryology; you follow, maybe not exactly cell by cell. but at least aggregate of cell by aggregate of cell. The reason I ask is that words like "holobionts" or "sympoiesis" or "autopoiesis" smack for me of holism. And that is for me slightly different from Deborah's idea. In her argument both sides of the older divide have been redistributed. The individual as well as the whole. And I fail to hear that in your presentation of the transformation of biological concepts. A transformation that is really admirable. Can you specify whether you see the same turn as advocated by Deborah in cell biology, very far from any notion of holism.

*Simon Schaffer*

So, there's a question to Mike about apparent weaknesses of the ethnomethodological approach: persons can own stuff, bodies can't, what you'd say to that?

*Mike Lynch*

Ok, I would... I really can't answer the question without a tutorial, from you. Because I don't know the history of that distinction in law between person and body. I think it probably has interesting interaction with the question of corporations being given rights and so for...

*Bruno Latour*

Although how are we going to build the body politic, if body and person are completely separated?

*Kyle McGee*

It's an enormous problem. We'll talk about it tomorrow.

*Mike Lynch*

I guess the best that I can think of to answer you is—again, I need the tutorial in this particular usage of person and body in law; I want the tutorial, actually—but when these justices, the Canadians and the Americans in this case, turned to the dictionary, they turned to what they described as the ordinary meaning of words. Now, of course, they are doing that to justify a decision, probably made on other grounds. I think that you might want to argue that, but where a philosophical distinction between person and body, even if it is embedded in history of law, is worked into the use of ordinary language by the judges, and even though these are, in a sense, technical terms in patent law, the judges certainly have to be aware of the history of common law in both Canada and the United States. Perhaps it's not a philosophical doctrine or a historical doctrine—I need to know more about that, because I'm quite ignorant of it—but I would want to see how it is that the history informs them. It may be a limitation of ethnomethodology that we're looking for situations of usage, how people talk, how they act overtly with one another interactionally, when we attempt to find the relevance of these grand distinctions.

But, in these cases, at least with the limited access I have to the court's reasoning, I don't know how I would find the relevance of that distinction between person and body. It's not explicated in their words and in their rulings. Perhaps it's hidden in there somehow and I need to know how to read it.

*Kyle McGee*

It's in plain view in the sense that it's simply replicated in the distinction that you're looking at, which is the "product of nature" vs "composition of matter," right? What I'm suggesting is that this is a familiar pattern, it's a replication of a pattern that we've seen for a very long time, deriving from the person/body dichotomy, and it makes sense in law, even if it doesn't make sense outside of a legal discourse, precisely because there's an anthropological commitment to this distinction which is not necessarily the case in, say, biology.

*Mike Lynch*

"Anthropological commitment"—can you explain what you mean by that?

*Kyle McGee*

Sure. If we go back to the Romans at large really briefly, we don't have to go very deeply, you would find this tripartite distinction within the law—within "all the law that is useful," *quo utimur*—of persons, things, and actions. This comes from the classical jurists, Gaius in particular, so, someone needs to write the book called *Facing Gaius*. Anyway, when I say anthropological, I mean that, to form an operational concept of person, there's an entire hierarchy, an entire set of cognitive distinctions and an ensemble of terms that comes with it. And that's articulated in the law of persons. And the outer boundaries of the person are set by the freeman on one hand and the slave on the other. The slave is the border between the law of persons and the law of things, in a way included and excluded from both, belonging ultimately to neither. And so the slave is closer to the mere body, closer in any event to body than it is to the construct of the proper, full legal person. And a whole ensemble of relations arises from this way of organizing legal concepts and what I'm suggesting is that, before we can draw a distinction such as "product of nature" and "matter of composition," we need a distinction between person and body which is historically ingrained. In the case you discussed, it lies beneath the surface, to your point, but it's there nonetheless, and it shows you why the cascade of legal

reasons flows the way it does, why the chains of reasoning take the shape they do. And it has little to do with biological factors; it has to do with legal history and the pathways of legal thought that have developed over a long time, for good or ill. I suspect ethnomethodology fails to grasp this silent force of history and doctrine, finding itself adrift among lawyers' and judges' inevitably faulty speculations about biological matters.

### *Simon Schaffer*

I want a tutorial. And Scott is going to respond to the distinction between *terroir* and *climat* if you want, maybe not. How do you feel about the development of the programming bio-politics which after all, and this is very important for the discussion, absolutely, might be said to invert the analogical relationship between Immunology and Law, right?

And, on the other hand, there was a question that Bruno posed to you about individuals being defined, as Deborah told us this morning, through the number of interactions ants have, and Bruno sniffs holism in the word *holobiont*. I mean frankly that's not a very difficult thing to spot, right? I mean, given the first four letters of the word, there's something like holism going on in *holobiont*, I should have thought, but we want to hear Scott respond to those two fascinating questions.

### *Scott F. Gilbert*

Well, actually, I was thinking of the question that Kyle raised, and this all fits together with the role of the immune system in defining the body. I want to talk about this because, if I recall correctly, it's the analogy that the law protects the body politic like the immune system protects the body. I think that this was a fine idea under the old notion of the classical body and the immune system it generated. The immune system was our defense, and the body was pure; but the body was also susceptible to outside influences. So there were metaphors of infiltration. Communism infiltrated the body politic, just as pathogens could infiltrate the body (45). The immune system was like Cicero's image of law as a sword within its scabbard; present, but inactive except in times of need. I think now, though, that you can expand this in an interesting way in that the immune system of the *holobiont* is partially responsible for mediating defense against the outside, but its larger role is to kind of make treaties with the outside environment, allowing entry to some microbes. I didn't get to talk about Isabelle's notion of diplomats and that the immune system, in a way, is acting very diplomatically. The immune cells, the lymphocytes, are part of the body, but their DNA is different than any other cell in the body. It's

rearranged DNA, it's not really the body, it's like the body-prime, a different notion of the body. The rearranged DNA of the lymphocytes doesn't have the same genes as the rest of the body, and it is allowed to make these treaties for a more sustainable relationship, because the body without these bacteria is not sustainable. The body needs its bacteria, but only certain bacteria. So the immune system is like the law in some ways because it has this treaty-making mode; which I think that that is more important than armed-forces part of it. A year or so ago, there was a meeting of the Unified Microbiome Initiative in Washington, DC in the State Office buildings. It was actually held in the Cordell Hull Room, which is where all sorts of treaties had indeed been signed, and Ned Ruby said that perhaps we are here that day to make a peace treaty with the bacteria. It turned out not to be the case, but it was a great idea.

Next, the question concerning holism and holobiont. I think in many ways there is a bad whiff to holism because it had some rather bad friends, both politically and scientifically. But in the history of embryology, it has a role as the third-way between reductionism and vitalism (54, 55). I also think that it integrates the older notions of individuality, which were primarily neural, immune, and genetic (56). There was the immune individuality, which is the ability to protect our turf. If I were to put my skin onto yours, you would reject it. You are not me. We had the neural individuality, given by our brains: if I were to put my brain into you, you'd be me. And then we had the genetic individuality: we are what are genes say we are. This is still a very common view in the United States. The DNA testing services tell us: "send us a DNA swab, and we will tell you who you are." The holobiont view claims that none of these former notions of individuality work, either for the body or the body politic. So, let's try something else because half our cells are bacteria, and we have to recognize that. They're not fellow travelers with us helping digest food in our guts; they actually making us, they're helping construct our bodies. So I think that there is something holistic about it because the environment, the bacteria especially, are not only part of our being, but part of our very becoming.

As to the distinction between *climat* and *terroir*, I would leave that to Bruno to explain.

### *Didier Debaise*

My question is addressed to Scott. Thank you very much for this extraordinary description of the transformation of biology and I see you've settled the ground on which all the question has to be addressed. I have a question concerning the last part of your presentation and I think it may be a link also for the session of tomorrow so I'm a bit impatient to have this link. You say that the holobiont is Gaia. Today...

***Scott F. Gilbert***

I'd rather use a simile than a metaphor: that the holobiont is *like* Gaia.

***Didier Debaise***

Indeed, but my question concerns the reason to invoke Gaia on this scene and maybe it's also already a good occasion to distinguish different invocation of Gaia. Why we invoke Gaia? I think that there is already around the table different Gaia: the Gaia of Bruno, the Gaia of Isabelle, the Gaia of Tim, your Gaia. I have the impression that in the plurality of this invocation there is a common reason to invoke Gaia: to name, to situate, a change of epoch. Something is radically changing and Gaia is the name of this radical change. But in your way to invoke it, I don't see this dramatization of the change of epoch. When you define and characterize the Holobiont, you do it to describe the living whatever would be the epoch of this living. It is a definition of the living that you provide, and not a description of a change of epoch. So my question is: in which sense your Gaia qualify a specific situation or can it be applied to all situation of living beings?

***Isabelle Stengers***

I would like to and I think we will go on back to that, come back to this notion of individuality. The one proposed by the ants and is very, very interesting but do we really look for a good cross specific definition of individuality? I think it would be a mistake to look for a definition. It seems to me that individuality is a question, is a problem and a problem to be asked again and again, and always in relation with relatedness. I am afraid that to ask for a good definition for individuality, may be as dangerous as asking if the part is smaller or bigger than the whole. Such questions induce false problems because they induce us to feel entitled to separate without wondering what this separation is doing. But the same may be true for relatedness. What manner of relatedness? I was very, very interested by the way Canadian first Nations conceive treaties. Treaty-making is world-making, I mean, the cosmo-ontological event by excellence and they will not betray the treaties, even if European settlers trample on them, because it would be betraying the Cosmos. They claim they are not free to do so, to bring separation between what a Treaty has bound together. Obviously a general distinction between culture and biology is inefficient. Some Americans cultivate ferocious individual survivalism but they are not at all the witnesses for some biological human individuality, not more than anchorites. I would love to recall that Whitehead said somewhere that if there is a dangerous

because falsely simple word, it's the word "and" because it confuses all the different manners in which the aggregated terms may be related. "An ant and an ant" has not a lot to do with "a baboon and a baboon."

*Scott F. Gilbert*

In biology, the holobiont can be revolutionary because holobiont theory is postulating an individual with several genomes, and evolutionary modelling is based on one genome per organism (16, 57). Here we're saying: no, actually there are several, maybe hundreds, of genomes per organism, and selection, survival of the fittest, might actually be due to genes of the symbionts, rather than genes of the big guy. And we know this to be the case in many instances. We know that in certain insects, for instance, pea aphids, that there are certain strains which are resistant to heat not because of the genes in the aphids, but because of the genes of their symbionts (58). There is a wonderful story about a population of Japanese bugs that became resistant to a pesticide because it incorporated a bacterium that had a pesticide-resistance gene (59). So the holobiont notion is giving us a revolutionarily new individual. But it does not have to be the specific type of individual for the Anthropocene event/crisis that I believe Didier is describing. It does not need to have that sense of urgency. But it is an individuality predicated on relationships that continuously create an individual, and in these relationships, especially with our symbionts, the environment is part of us and helps make us. Destroy that and you destroy us. It does make us precariously dependent.

*Bruno Latour*

But how does it relate to Gaia?

*Scott F. Gilbert*

It relates to Gaia directly, and I am going to quote you (35) here: "Gaia, which is only the name proposed for all the intermingled and unpredictable consequences of the agents each of which is pursuing its own interests by manipulating the environment." We are incorporating intermingled, unpredictable consequences here in our body. Each one of these microbes can be pursuing its own interest (and will kill us if our immune system is in decline), yet is somehow being interacted by a whole host of factors, both very local and systemic, to make a coherent body. Like Gaia, the holobiont can be said to be unbounded, calling into question the distinction of

organism and environment; and like Gaia, the holobiont integrates local and global agencies.

*Deborah M. Gordon*

I didn't understand Bruno's question to be about defining anything, but I thought he was asking you the question that I also ask every developmental biologist I can. I think what Bruno was asking is, can you say anything about the pattern of the particular entanglements or relationships, cell by cell that in the aggregate produce the holobiont? Ants use not the number but the rate at which they meet other ants. I think there are examples in developmental biology where cells use the rate at which they meet each other, or something produced by other cells, and the outcome is some transformation. Maybe there is a way to characterize the holobiont as a set of activities or things that cells do. I don't know if that was really Bruno's question, but maybe I just heard it that way because I have that question.

*Scott F. Gilbert*

The research, I believe, is in process. I do not know the answer to this. So far as I know there are only two papers germane to this, and they both study the contacts made between the immunological T cells and bacteria early in postnatal development. These studies report a possible co-evolution between the T cell receptors of the immune system and the shapes of the molecules on these symbiotic bacteria (60, 61). The symbiotic bacteria are saying: "We know the password and handshake, so let us in. In fact, our ancestors helped invent these passwords." Reactivity and identity may help create each other. That's the kind of the treaty we may have, and it may be at the level of the T cell receptor. There are people in the audience who know more about this than I do. My colleague, Lynn Chiu, who is here today, is reminding us of Thomas Pradeu's theory of immune individuality (62), which holds that reactivity and tolerance are defined, in large part, by the speed of specific interactions between the bacteria and the T-cells. The difference between killing a microbe or accepting it as a symbiont may be the rate of previous interactions the organism has had with that type of microbe during early life.

*Tim Lenton*

So the thing that's exciting me about this new biology of the holobiont is just the simple recognition of interdependence and the richness of interdependence.

Frankly I'd happily take it further, because we've evolved with our domesticated plant crops and to some degree animals to the extent that we are kind of genetically intertwined and co-committed now. That's also true, just as an aside, for certain examples of agricultural practice by social insects, some leaf-cutter ants that—what's the right word?—*farm* fungi, and true also for some termites and beetles. I believe that they're so co-evolved with the fungi they farm that they're effectively genetically intertwined.

So that, to me, is a simple and important message to take from the new body for the body politic. But to relate either an animal body or a holobiont, whatever that is, to the planet seems to me problematic or missing some basic scientific distinction. This is not a critique to you Scott, but rather just to the thought that we would try and mash the two together—because animals are heterotrophs, so are indeed consuming resources from an environment and they absolutely depend on autotrophs, photoautotrophs in that environment. The planet is an almost perfectly materially closed system at the total scale of Gaia, so it has very little material environment frankly to interact with, just an energetic environment. It has to be an autotrophic and materially cyclic future, technosphere etc. and that is absolutely fundamental. I'm sorry if it sounds trivial—but this is a fundamentally important distinction and will also pertain to the treaties we must negotiate with the other citizens of Gaia, or components of Gaia, or whatever you want to call them—because the dependencies are ever the greater when you're a heterotroph. We must consider the treaties with the photosynthesisers or the solar PV cells that we're creating that will ultimately perform that function for the future body politic, in my imagination at least.

### *Bruno Latour*

I thought Tim Lenton, this Tim is important because if not the answer of Scott would transform the question of you to go on with your argument between microcosm and macrocosm. So we would talk about our own body as we would talk about Gaia, but I think we will discuss about it tomorrow, but Tim Lenton's restriction is that there are a lot of specific things which are trying for Gaia which forbid us, so to speak, to use it in another setting. It's again this resistance to any sort of holistic politics which is so important for me in this venture. Every time we have a way to avoid bringing the microcosm and macrocosm together, I think we should allow to let them. I think the autotrophic argument was absolutely essential to this.

But I want to go back to question, if I'm allowed, to the individualizing question because individualizing is the research strategy of many people here—which does not mean sticking to the isolated atomic individual, quite the contrary. I mean,

after all, the whole argument that we've heard from Shirley is precisely if you begin to individualize baboons you see something else in the structure that was no visible before. Same thing when you follow ants by ants their interactions, or cells by cells in the case of Scott. There is a direct relation between the individualizing research strategy and the abandon of any choice between parts and whole, individuals and structure.

I think it is also what Mike means by indexicality. For me ethnomethodology is a research strategy to get out of the sociocentric explanations and to rethink what individual are able to cope with. So I'd really like to know how Mike heard the argument of Scott about holobiont. This is a diplomatic proposition: I think that indexicality is actually a better word to talk about what Scott described so beautifully. It's a proposition. It's not the question of individuality per se and it's, of course, nothing cross-species. It's a question of how many alternative ways we have to avoid the immediate split between the structures and the elements, so to speak. And indexicality in ethnomethodology has been extremely important and of course the holobiont is very important, because it avoids the notion of boundaries. So I propose that indexicality is a very powerful way of understanding, maybe somewhat that will take the poison of holism out of the holobiont. Does that make sense?

### *Scott F. Gilbert*

If indexicality points to an object or process in its particular context, the new field of biosemiotics has a lot to say. The same process or molecule does different things in different contexts. What is an enzyme in the liver can be a structural protein in the eye. The protein that causes cell death between our digits makes bones in our femurs. In some organisms, you would have a tissue telling the stem cells "divide," while in another organism, you have bacteria doing the same function in the same group of stem cells. So something that is an internal signal from zygote-made cells in one organism is a bacterial-induced signal in another organism. So, in living organisms, the same signal has different functions in different contexts, and different signals can have the same function in a particular context. I don't know if this gets to the notion of indexicality or not; but these are very important concepts relating development to evolution.

### *Mike Lynch*

I'm going to come at this little bit indirectly, which is my habit. Actually, I'm involved in a debate within ethnomethodology, one of many, about a more technical

version of this issue. If you take what Scott is talking about as interaction, so you have genetic instruction, if you want to call it instruction: commanding, inducing, seducing, relating to a response. The debate in ethnomethodology is ... in conversation analysis we have these things we call adjacency pairs, somebody says hello, you say hello back; somebody ask you a question, you give them an answer related to the question.

It's well-established that if you characterize a sentence or an utterance in isolation, you often miss what it's doing, right? So, something that looks like a question could be an invitation, could be an insult, could be a smart remark; it could be all sorts of things when you put it in context. What Emanuel Schegloff calls the next-turn proof procedure, which is that you go to the response to characterize what the prior utterance was—was it a question, was it an invitation, was it an insult, was it a command, whatever? You could object that with this procedure you've got an endless regress, because how do you characterize the response, do you need to consult the response to it? But it is a way, procedurally, to get some purchase, so we're talking about intracellular or intra-organismic communications and interactions, so one procedure along those lines would be to suspend your conception of what's being communicated to the response and this would be indexicality, and you would rely upon, be open to, varieties of responses rather than a sort of algorithmic or automatic transfer underway. Now, I would recommend that is probably something that good biologists always do, they look for alternatives, rather than characterizing an automatism that would reify the relationship. It may be very useful for certain purposes, like designing drugs, but you would instead be open to how the response is articulating what the signal was. I think I answered you.

### *Scott F. Gilbert*

In embryology this is really the rule (5, 63). Some embryonic cells secrete a protein called BMP4. BMP4 gives the death signal for the cells in the webbing of my fingers. BMP4 also tells the heart to develop rather than blood vessels. BMP4 tells the bones to grow stably and to grow more bone. Depending on the history of the cell binding BMP4, they respond differently, and so the signal "BMP4" can be interpreted in at least 6 different ways by the genetically identical cells of the body. And so it's the history that these cells have which allows them to respond or not respond, or to respond differently to the same exact signal.

### *Mike Lynch*

Would you then be open to revising the conception of the same signal in light

of confusing responses?

*Scott F. Gilbert*

It's probably very similar to a person's interpreting a signal. If I were to say something, a person would respond depending on the culture or region in which he grew up. He could say "yeah, right" or he could be highly insulted by what I said. Humor (especially puns) are good examples where the response is culturally dependent. The signal can be given, and get laughs in one group, and looks of confusion in another. It depends on his historical context, neighbors, and upbringing, and I think that's pretty much that way for cells, too.

*Mike Lynch*

I'd imagine you would extend the sequence. One of the popular themes these days in social and information science is "repair" (13). Conversation analysis gives a rather technical definition, so if somebody says something that is taken as an insult, the original speaker has an opportunity to repair the initial utterance, and you can then work that through, so that the insult becomes diplomacy (14). But you would have, instead of a signal and a response, a chain or a sequence in which the outcome of the sequence is not in any way determined by the initial move. If you take the initial thing and characterize it as a signal that is telling the respondent what to do (how to respond), but the respondent does different things, when you take a longer sequence (which is probably impossible to do with some of these systems, because it so complicated to access, to label, to visualize) the chain would not be, you know, an unfolding chain, it would be contingently relevant at each point, feeding back retrospectively and prospectively to the initial move in a way that implicates the sense of the entire exchange.

*Bruno Latour*

I think we proved how interesting it is to move from cells interactions to human conversations, then to ants, not to provide an overall theory of interactions or relations—that would be silly—but because it helps detaching the factual questions from the intellectual frame used by various fields. We will see tomorrow how this comparison can go with Gaia.

### *Simon Schaffer*

One of the things to recall presumably is that the enterprise of the body politic, especially in the High Middle Ages, so in John of Salisbury's *Policraticus* that we heard last night, was precisely to articulate the political order, so that any failing in that order was understood as an infection that the immune system would deal with. That's the point of the body politic metaphor. It's called what's the body of the body politic? So I'm being very literal-minded. The body of the body politic was defined by the text that defined it, so that when there was political trouble what you did was immunological. That's the point, ok? And if, exactly as Tim Lenton pointed out, we just don't do that anymore, then it seems to me, on the basis of this conversation, this double displacement. It isn't just, as it absolutely is, as Scott so wonderfully showed, a reorganization of body, but in particular around immunology which I know is something Bruno wants to talk about quite a bit and rightly so. And we will come back to that tomorrow. I'm also making a list of other things for the feedback session tomorrow. Deborah is still of course extremely puzzled about what the relationship between entities being numerous and the future is, so we can have that conversation. There's going to be excitingly a tutorial about the code of Justinian Trebonian's view on the relation between persons and bodies. And there'll be other things from today that we will have to revisit, so please re-join us in this room at 9 a.m. for those and many other exciting topics and it only remains for us to thank our participants for their extraordinary energy, enthusiasm and geniality.

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DAY TWO  
(THURSDAY 14<sup>TH</sup> SEPTEMBER 2017)

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## CHAPTER 6

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# Feedback on Day One

*Simon Schaffer*

This session is described in our program as feedback on day one, so what we're going to do, folks, is to go round the table really fast, I mean like much faster than yesterday morning, and if any of us have particular themes that you want discussed, just signal what they are. Shirley has already done that to me but let's hear from her again. And there are clearly a couple of other things that we want to revisit, but let's construct a quick agenda now and then we'll have a discussion. Let's start with Mike.

*Mike Lynch*

Ok. Since I'm going first, I can ask about what many of us would want to know about this concept of holobiont: its connection to holism. I'd like to have more discussion about what the objections are to holism by some of the members of this group. I don't wish to defend holism, I just want to be clear about what the issue is.

*Timothy Mitchell*

One question I was left with from yesterday's discussion: Scott spent some time in his presentation trying to suggest metaphors—they may have been similes, they may have been metaphors, I'm not sure. Now one of the things that I learned from

the earlier session with Deborah was how, for example, in her work, so much of it was struggling against the easy metaphors that had governed earlier generations of scholarship on ants. For example, from “the queen” to “the colony,” to everything. It wasn’t clear to me, then, why one would want to search for new metaphors, with all the risks that brings, of imposing yet another sense, another set of simplifications from elsewhere on one’s understanding. So I’m a little bit curious to understand why. Why the focus on finding metaphors for making sense of these new understandings, whether the specific ones are around—not that you were pushing it towards metaphors, on the contrary I didn’t think you were but—or in development biology?

### *Didier Debaise*

I would like to make two remarks. The first concerns the discussion about ants and human etc. I think one way to avoid the false problem of the demarcation between humans and the others is to question the situation where things are articulated. So we should start by the situations. The question should not be “how humans can be linked, or not, to nonhumans?” but “to what kind of situation, partly human and partly nonhuman, are we confronted?” The problem of the number has to be more situated. This is a proposition. My second remark is an insistence addressed to the discussion that we had with Scott. Its methodological remark: when we add a metaphor or when we add a new concept, it might be useful instead of putting it as an assertion to focus on its effects. What does it change to insert this new concept? So I would readdress to Scott: what does it change to invoke Gaia? What difference it makes? It’s a pragmatic assertion; for each concept you can understand its meaning and its function by the differences that it makes.

### *Kyle McGee*

I suppose one of the issues that I was most taken with, across all of the presentations yesterday, could be characterised as the interest in successive transformation as a means of stabilizing an identity and, in this case, particularly a collective identity, and that would be in the form of the holobiont, the economy, the ant colony or just this communicative process that ethnomethodology is looking at. Something that really jumped out at me in all those discussions was the role of what we might call experiment and repair. We heard how Deborah would cut the branch, and then this would alter the ants’ behaviour but it would also lead to what Mike called a kind of repair procedure, and these phenomena prompt us to ask about the role of these kinds of interactions in generating a new event, or a new situation that was unforeseen, in order to restabilise the collective.

### *Isabelle Stengers*

I would like to speak of the future of the two levels perspective, but to insist that the question of parts and whole does not block us. In fact both part and whole are abstractions. They are obtained following different paths, asking different questions. Taking the example of chemistry, the prototypical case where the properties of water was discussed as either reducible to the properties of its part, one atom of oxygen, two atoms of hydrogen, or as the emergence of a new whole. Can hydrogen and oxygen explain the different properties of water? Well, it's a question, but not of emergence in general. It's a question of chemistry... Quantum chemists are still struggling to represent a molecule of water as composed by three bounded atoms, but the atoms entering in the bound are already worked upon in order to be part of the molecule of water. So it's a nice problem but we should first say that we do not know parts in abstracto. So it could be a bit different. What if we called them partners? When you say partner you do not think that you can abstract a being from the situation of partnership it is involved in. The same for holism, which has been linked to emergence. I think we should not be trapped in too defensive attitude and cut words from our vocabulary because they are dangerous. We can work them upon and it may be interesting when we speak about emergence, not to speak about the emergence of a new being, of a new whole, but about the emergence of a new kind of situation, demanding new questions, new approaches. For example, to go back to what Didier said about comparison, Deleuze and Guattari wrote that with the appearance of territorial animals, when territory makes sense for animals, the way we make sense of their behaviour must change. So emergence could be the point where we do not deal with new answers to the same questions but need to reformulate a set of questions.

### *Bruno Latour*

I am a bit anxious of hearing so much about metaphors. We are looking for concepts, concepts able to play the role of ligatures for the composition of the new body politic. What worries me with metaphors is that they always imply that if we were more serious we would have a no metaphorical, literal way of dealing with those issues. Let's say we work with metaphors in ways of being concepts because of our interactions. This being said, I just like to hear more about what I see as a contrast between the Deborah's work and Scott's work.

In the set of texts sent to us Deborah proposed precisely a model using humans and ants, especially ants but also cells, to try to reorganise our own ways of understanding them and I felt that yesterday we didn't push this contrast enough, which

might be relinked to this question of holobiont and holism who I think it's more a technical question which I'd like Deborah to develop more.

*Tim Lenton*

I think I've come away from yesterday basically wrestling with the issue of how can we recognise that as humans we have a particular collective phenomena and things like foresight that we are able to collectively exercise. How are we able to recognise those—I think it's fair to say—*human* qualities and what they bring to Gaia, to our polity, that of course we've constructed, without falling into the trap of the human non-human distinction, saying that we're somehow better than or that different from the rest of Gaia. So for me that was the tension that was arising in the discussion yesterday that I don't think was resolved.

*David Western*

I was sort of taken by the fact that a lot of yesterday's discussion concentrated on the similarities between ants and people and the holobiont and so on, but I think that as we move to tomorrow, and particularly to Shirley's talk, we'll recognise there are very significant differences. One of the things that struck me in your talk, Deborah, is the link to Didier's point that resources affect how you act. Resources affect the density of a population, which in turn affects the number of interactions. Then again, density affects recognition of the individual. An individual in a large society is very different from an individual in a small society. The scale of a society bears on your identity and role.

*Deborah M. Gordon*

It sounds like we have enough to do without adding anything. But could we come to some agreement about how we want to frame our thinking on the body politic and collectives and Gaia. Do we have any common ground in what we think would be a better way to move forward?

*Scott F. Gilbert*

My interest follows right from Deborah's. When we talked about what is the body of the body politic, yesterday, we went to a number of the possibilities. I think that the notions of cognition and autopoiesis were two of them. Is the body

a learning body? Is a body a body that cannot learn? Is the body an integrated body in the sense that it is solely contained within itself, or is it something which might be able to get its energy and information from outside sources? So I think we still have a lot to talk about on that.

### *Shirley Strum*

The topics that I suggested to Simon start with “holism.” I want to know what’s wrong with holism because it has been presented in a negative light in our discussions. But holism for me means recognizing all the interactions that tie things together. The objections I hear seem to contrast holism with emergence. I don’t agree so I would like to have more discussion on that. The next topic is about getting rid of the “individual.” Scott very clearly erased what I think of as an individual when he presented the physiological individual. But my study of baboons is populated with behavioural individuals despite baboons also being part of their holobionts. When they look at each other, when they interact they can’t see or care about each other’ as holobionts. Moreover, there is the social group which is composed of individuals and is bounded in space and time. Reducing the world to the physiological individual flattens reality, which might be one of the goals of the conveners, but I have difficulty getting rid of the baboon “individual.” I’d like to hear a bit more about how others define the individual that they are so anxious to get rid of. My last topic is language. Everyone in this room is struggling with language. Deborah has to struggle against the metaphors and narratives she has inherited. In my case, I struggle against using human language to describe a creature that’s so close to us and yet different. I’ve tried inventing unique terms but that didn’t work. Ultimately we are saddled using human words that refer to human activities. What are our options in this struggle? I like the idea of adding context to words but do we really believe that we can find words that don’t have cognitive baggage, that would allow us to talk about what we’re seeing in a way that is either more neutral or more positive? These are my three questions.

### *Simon Schaffer*

I’m hearing three main themes for discussion. One rather obviously is what is so bad about holism. That in your thoughts expands into a family of concerns. It expands towards the rather hackneyed philosophical tropes of pathos relationships. It is an old trap and we ought to be able to escape that, more to the point perhaps it also raises issues about the predicament of situation. It’s very familiar both in the human sciences and the natural sciences that situated knowledge stands in a very

strange relationship, actually, with the situated quality of most research in the areas that we're talking about, this is the old problem of induction: how do you make what happens, in your case, count more generally and more widely? The standard solution to that after all, in the natural sciences is to generalise at the level of language. And that takes us to a second family of concerns that we have vocabularies which involve, as Mike says, the nightmare of the past living on the brain... on the brains of the living, we just have to accept that baggage, it's a good idea to be aware of that. I don't see yet quite an alternative if one wants to be understood. So, Tim Lenton, for example, points our attention towards terms like learning, like foresight and so on which are deeply proper to human polity... can they be extended and applied elsewhere? That's the second family of concerns. And third family of concerns, which Bruno clearly raised for us, is related to the other two very strongly, which is around the puzzle of what should we call it the dream of non-metaphorical talk or non-metaphorical action? As though we could move without metaphors, well in Greek you can't do that and Bruno's proposal I think is very interesting which is we're after concept, not metaphors, remember Didier's extremely important point we're not perhaps quite so concerned with definitions, we're concerned with transformations, with particular interventions, so the question for a new conceptual apparatus is what's changed by introducing that, that also captures some of Tim Mitchell concerns about what happens when you introduce a new metaphor, are you just doing that for allegedly simplifying purposes or is actually a whole new agenda in play, right?! We're again extremely familiar, especially in the époque of Neoliberalism, with claims that things have been simplified and made more evident and more, terrible word, transparent, when in fact an entire complex of new kinds of politics is being insinuated, because it doesn't dare to appear without a mask. So those were the three themes that I thought came through just then. Let's start, if you allow, with what's so bad about holism and emergence and Bruno is going to speak.

### *Bruno Latour*

It's very ironic because everybody who has been invited to this meeting is precisely invited because we thought holism that is the idea that there exists a "whole" above and prior to the parts had been put to rest. So suddenly there's a sudden very regressive movement around this table and people ask "after all what what's wrong with holism." Of course, if "holism" in Shirley's definition means to take into account as many elements as possible then, of course, it's perfectly okay. But holism is this very concept which I described yesterday using Shirley's, Deborah, Tim Lenton's, Mike Lynch and Tim Mitchell's example in their own papers, it's a cop-out. It breaks the continuity we are all searching between interactions and some sort of

durable overall order. Suddenly something happened in the process of connections between individuals and suddenly something happen which is called a whole.

I'll give you one example because it introduces the topic we will hear in a minute which is this extraordinary book by Toby Tyrell, a colleague, I'm sorry to say, of Tim Lenton, who wrote a book *On Gaia* that should be called against Gaia. But what does he say? It begins like that: "I'm going to test if Gaia is a real entity or not. Gaia should have had on life on earth a controlling principle according to Lovelock. I can show, and that is historically accurate, that is not the case, and many times life was almost wiped out. Conclusion of the book, after 10 very precise chapters, Gaia is a fake idea, because it should have protected life as Lovelock said." Except Lovelock never said that. Tyrell simply imposed a holistic definition on Lovelock's argument as if there were two levels, one for life and one for Gaia. Immediately Gaia becomes an abstraction, a complete monster which is supposed, to be, as he said himself, "at the helm." And this is in a book that claims to give a lesson in objective science to Lovelock, that's what holism does on Gaia, the most important thing around.

But let me take an example from Shirley's own work: she is in a meeting, forty years ago with colleagues who have demonstrated that there is a structure of baboon society where big males are controlling group structure. This was during the heyday of sociobiology. But Shirley had convened the meeting. She has individualized every baboon, given name to them, followed them precisely not as individual in the atomic-part definition but in the partners-overlapping definition, each of them. And she had found that a very small, very small female an old female, old grubby, was actually leading the interactions in the troop whose structure was ceaselessly reconfigured.

I could go around the table, since you have been assembled precisely all of you because you criticize holism and the cop-out of a second level floating above the first, which is supposed to solve the question of emergence, order, durability, essence, etc. But if the new body politic accepts such a discontinuity between levels, then it means it is the old body politics, back to the Fable of the Member and the Stomachs, or the Fable of the bees. It is quite simple, every time holism comes God comes in and it is not a good God at all it's precisely the god of tyranny and despotism so we have to be extremely careful here if I'm asked what's so dangerous of holism. I've stated the reason: despotism.

### *Shirley Strum*

Ok, you're right, that's where I started, but where I've ended up is the development of structure that's negotiated by the individuals. The outcome of every interaction can't be predicted, but there is a whole, without central command, without a

force from above. There are boundaries to the group, and within the group there are sub-groups and individuals that have boundaries and interact in predictable ways. I don't share your perspective. Maybe baboons played a role in destroying holism for you but for me it is different. There is a whole "there". I will be showing you a few short video clips to indicate how much individual baboons are concerned about where everybody else is and trying to repair the whole.

*Scott F. Gilbert*

In embryology, which has been known for its holism, holism came about in the late 1800's because it was the middle ground between the vitalism of people like Hans Driesch and the reductive materialism of people like Wilhelm Roux. And so Oscar Hertwig and others had this notion that you have to have an ontological materialism. Things are not made by vital forces, but they were made in a context of interactions between parts and wholes. Context-dependency was critical, and another embryologist, Hans Spemann, pointed out we are thinking with cells that could have been used for walking had they been in a different part of the embryo. And a linguistic example that I use with my students is the newspaper headline "The Party Leaders Were Split on the Platform." Okay? That could be about politics or it could be about a grisly murder. An Italian newspaper supposedly had a headline about Roman street walkers who thought that the city police were being too rough on them and asked the Vatican to intervene. So the headline read, "Prostitutes appeal to the Pope." So obviously the parts make the whole, but the whole makes the parts, and so it goes in both directions. You don't know what the word means until you have the whole sentence; you don't know what the sentence means until you have the parts and the whole together. Tyranny can work in both ways. It can work top-down, you know, the lords tell the peasants what to do; or it can work bottom-up: it's all material and the rules of humans are just rules of the material. Tyranny can happen in both ways, and organicism, holism, can work as a way of mediating around that problem, because you don't allow either top-down or bottom-up to get precedence. I think that holism has had many bad friends. First of all, as a name, holism has nothing to do with being a whole, nothing to do with being complete. It has to do with recognising that there is a dialogue between the whole and its parts. But given the fact that it has been in company with vitalism, it has been in company with Nazism, it's been in company with Lysenkoism, and it's been in company with New-Ageism, it has had a lot of bad friends. With friends like those, you don't need enemies. I think that holism is important, and it's still something that we can use creatively—in the correct context.

*David Western*

Where does the notion of holism in academic circles come from? My reading is that it was coined by president Kruger in South Africa in the 1920s. His view of holism was very different from its current use and has, for example, been commandeered by Alan Savory's holistic school of range management. The ecology of people and animals interacting with each other will be useful in clarifying our discussions when we come to it. We shall see that scale matters in ecology. It affects how much "noise" we see in a system, and how integrated the elements seem to be. At a local scale we see a lot of variation. Scale up to an ecosystem and planetary scale, and the variations dampen out. Complex adaptive systems is perhaps a more useful way of describing ecosystems and planetary process than holism. Complex adaptive systems have both top-down and bottom-up processes that interact and drive ecosystems, societies and I would say planetary systems too.

*Deborah M. Gordon*

I think we should try to talk about what you meant by the trap. I've come to like the word 'collective' to talk about the outcomes of interactions but I think the trap of holism is that as soon as you start talking about the whole, you have to find something that is the whole, but you can't ever quite get there. You have a group of baboons and they do things with each other and, as you say, they are aware of and responding to the other baboons. What a baboon does is related to what other baboons are doing—that's that all there is. To go back to the ant colony: an ant can't live on its own, every ant lives with other ants, they all function only with other ants, and they reproduce together. We can call all of that 'the colony,' but the colony isn't a thing apart from all those ants. I think what you philosophers mean by 'the trap' is that once you start talking about 'the whole' you're stuck—you don't have anything to be the whole because all you have is this collective behaviour of the components of the whole.

*Mike Lynch*

I'm happy with that answer, but I think that one of the things that may be an issue in this discussion of holism is the connection with the notion of emergence, and I guess what initially puzzled me about that notion is the relation to themes in Gestalt psychology, which is, as you know, a version of holism. One of the texts that is important for ethnomethodology was written 60/70 years ago by Aron Gur-

witsch called *Field of Consciousness* (1) [English translation published in 1964]. I am not much interested in ‘consciousness’ as a concept, but some of the things Gurwitsch talks about and demonstrates with very simple diagrams is what he calls *contexture* (2). If you take marks on a page, you get properties that, for example, with a pair you have a left-hand member and a right-hand member, and left-right is an emergent property of having a pair rather than a single mark. I was always puzzled when I was told that the Baker Street Station in the London Underground was the first underground station; I wondered where people went when they left the station. So, you know, the notion of a network clearly involves complexity, and how you would describe, how you would navigate it would depend on multiples—properties that you can talk about and you can act towards, which are emergent in that sense. But this is a very materially tight, numerically tight, issue of emergence that is different from what you might find in sociology, in tradition where the macro society is endowed with agency and properties that never seem to touch the ground. And such a notion of ‘macro’ becomes a second level, I think, in the sense that Bruno is talking about as a two-level sort of thing. So, when you refer to a bottom-up or top-down approach, I think there is still a problem, because you’ve got a vertical dimension that seems to have an empty space in between, and that’s where I think the problem may lie.

### *Bruno Latour*

I just want to cite three papers by three people around this table here. Deborah seems to make the best way to deal with her philosophical quagmire which is the top down and the individual is to step around it. Papers by Shirley Strum which is about the critique of a notion of emergence, while she says there is a moment when the decision is made and the whole group goes in one direction and then she says when you switch from outcome to process, when real baboon in real time and not in evolution time I’m sure it is not so clear which is the argument about two levels. Ok, so it is very ironic that we all agree on this situation and then Tim Lenton which I have already cited at the same time “I’m not fond of evoking emergence or emergent property, because it’s usually used as a cop-out instead of actually trying to experience the origin of collective behaviour.”

### *Tim Lenton*

So you’ll be confident, Bruno, that I’m with you, I agree pretty much completely that the interesting questions are in the process and understanding those processes. If I were to consider myself a ‘holistic scientist,’ well I’d be first of all mocked by

my colleagues. Anyway I would never think of myself like that because in my head that's a very derogatory label. I do go and teach on the MSc on holistic science once a year down the road at the Schumacher College, because the people behind it and involved in it I think have some of the right sympathies that we share. But I would also, just as a practicing scientist, say that it's essentially a derogatory label and that's why we have what Jonah mentioned, what we might call complexity science or complex adaptive systems or whatever. That is how we negotiate just identifying ourselves as those scientists who want to understand. Well: how did we get here?

First of all, how do we get to any kind of living thing from non-life, that's hard enough. Then when you've got prokaryote cells, how do you get from those to eukaryote cells, which are composed of a fusion of previous prokaryotic lineages and then how do you get from eukaryote cells to complex differentiated multicellular eukaryotes including animal forms and then on up. All the interest is in the processes or, dare I say, the mechanisms of that. But the point I want to make with respect to Gaia or rather to the planetary scale, as opposed to all these other scales is when you're running the logic at the smallest scales, you're in a situation where you have a material environment that's fairly replete with resources. Whereas when you get to the planetary scale of Gaia, you do not have an abundant supply of resources you can draw on, you have a completely different problem—the system is very profoundly bounded by space on one side and pretty meagre exchanges of material with the inner earth on the other side and that makes all the difference. It's not purely about the heterotroph or autotroph distinction, it's about a distinction between consumptive entities that form populations, if you like (and I even hesitate to use entities there, because they're all within a larger milieu) and eventually getting to a fairly hard boundary with little or no environment to draw on. That's why I think that the planetary scale is so interesting and so seductive here because that boundary really counts for what makes, should we call it a sustainable and collective phenomenon or an unsustainable one?

### *Isabelle Stengers*

The contrast Bruno is emphasising between the fact that we are all gathered as opposing an explanation by the whole then say yes, yes but not so quick please, is very interesting. I think it's not regressive-defensive mode. I would say that the explanation by the whole and also the one by the parts, when the parts are conceived in an abstraction of their partnership, are very economic explanations, allowing for command and control, and all that. But each time in a field the situation becomes more interesting, it is because this explanation by the whole has crumbled down and then there is a wonder about this partnership situation. So what was called a

whole each time becomes surprising when we discover the capacity of the partnership to take upon itself what was attributed to the whole. It may be that what seems a defensive reaction comes because each partnership is singular. The partnership between the ants does not provoke the same wonder as the partnership between baboons or between scientists or between whatever. That's why yesterday I emphasised that the partnership between the ants implies many kinds of interactions with specific quantitative parameters. All these are related to produce a meaningful partnership which produce a viable ant colony in the environment the colony has to deal with. So I think that in fact the reaction is yes, yes, yes, but baboons are not ants. The process is different each time, the process is to be discovered. Yes the whole is crumbling down, yes the whole is meant to crumble down, but each time with different means and wonders. Or dangers. It recalls me the Body without organs of Deleuze and Guattari, relaying Antonin Artaud's call to war against the organism, the whole with its organs defined by their role. In *A Thousand Plateaus*, they address the question "How do you make yourself a body without organs?" and they insist—it needs cautious experimentation, an art of caution. The whole is not an illusion to be summarily dispelled. Moreover maybe wondering about something which holds together and cultivating the wonder that it be able to hold together is an interesting antidote against despotism.

### *Didier Debaise*

I have the impression that holism in the way by which we describe it today is a kind of natural illusion. There is two dimension of this illusion. The first one is that we use a concept to make a shortcut. It's a definition of concepts that I take from William James: concepts are shortcuts. They allow us to identify a lot of different situations and a lot of different constraints in once. But we should not forget that it's a shortcut. It allows us to designate a constraint for example for the collective behaviour. Of course a collective behaviour produce a lot of constraints and the concept that we use allow us to quickly see all the constraints. The first illusion comes from the fact that we forget that it's a shortcut and we consider it as a description of a reality. It is a kind of reification; we transform a concept into a being.

The second illusion is to see everything through the success of a specific situation. I think it's Deborah who mentioned it in her text. The success of an experimentation is the success of a specific path. We have the strange tendency, second illusion, to see all the steps that produces this situation, all the previous moments, as if they tend to this situation, as if they had just one function, one direction, which is the realization of the specific situation that interest us. But we should keep in mind that at each moment there is a halo of possibilities, a plurality of paths.

### *Simon Schaffer*

I suggest that we shift our attention slightly precisely in the direction that Didier just articulated, because several of us were concerned about the relation concept-metaphor, several of us were concerned—to channel Tim Lenton a bit—that it’s inevitable that one uses a conceptual apparatus—shortcutting as we are—that is proper to humans and we want to do that without either neglecting the human non-human contrast or affirming it in all too ontologically vigorous way. It’s what Ricoeur used to call the ontological vehemence of metaphors, they come to be in a really powerful way. So might one then suggest that we turn our attention a little to the problem of the human non-human distinctions and how one can legitimately use language like foresight or learning and so on to describe entities that may or may not in fact be executing those tasks? And in particular because many of us raised this concern—what is to be said about models of individuation that depend so much on temporality, on rate, on density, on interaction exactly as Isabelle’s just adumbrated. Hobbesian temptation is quite strong here, where you have interactions that are intense, local, transient, particular, situated, nasty, mean, brutish and short. That’s very powerful model in this culture for what it makes an individual. There’s a set of themes that we all raised and perhaps we’d like to just slightly move in that direction.

### *Shirley Strum*

I just want to interrupt by one concept before we make that move. I owe Bruno a great debt for directing me towards “process.” I’ve spent the rest of my life looking at the process of interactions, the process of socio-ecological interaction. All of us here are focused on process. But there’s an outcome to the process which is being totally ignored in these discussions. I’m not claiming that the outcome is something above that directs the process. I am asking what difference does the outcome make to the process we’re talking about?

### *Deborah M. Gordon*

How do we know what is the outcome?

### *Shirley Strum*

Again, I'm looking at things from a baboon perspective. Maybe I'm the only one of us who is actually part of a new collective. I say that because my vantage point is not me alone, it's me plus the baboons. Thinking about Deborah's pheromone trail, I see the process of laying it down, but there is also an outcome which is the trail that was laid for however long it lasts. This is very obvious for baboons. Accidents of history illustrate this clearly. They constrain what comes after. Not everything is available or possible since the outcome of most events can't be reversed. These frame baboon futures. Therefore, despite being a great advocate of the importance of process, I differ from others around this table because I don't think you can only look at process. Every process has an outcome that feeds into the next process. An outcome channels, constrains, or facilitates the next step. My question is: if we always focus on process and ignore outcome, then do we really have the complete picture? Where do we consider outcomes and their feedbacks?

### *Bruno Latour*

Well, I understand the interesting discussion adumbrated by Isabelle. As Tim Lenton says, we should not invoke the name of Gaia in vain, so to speak. I recognize that each time in terms of facts and results, it is very specific and that baboons, cells, humans, etc. should not be confused. Yes but my impression is that in addition to holism—that I agree we could put aside —, there is another thing on which we all agree, and that is the difference between elements or parts that sit side by side, and elements or parts—whatever they are—that are overlapping with one another. I think a lot of the difficulty is that we still imagine that there are elements which *then* enter into relation. The great advantage of ants for me is that we have no easy access to them so the model of elements plus interactions does not work. Deborah said it beautifully in one of her papers: “This may explain why we know more about how wildebeest act collectively in response to changing environments than we do about cells; it is easier for us see what is happening around a wildebeest than around a cell.”

### *Tim Lenton*

I'm just fascinated by the idea that these collective phenomena, processes, whatever we want to call them, can do things like solve problems in the case of the ants or our cells. Deborah rightly pointed out the close analogy to our understanding

of collective learning—to how neurones and neural networks construct and reconstruct themselves over time. So I stagger back into this territory of anthropomorphizing and talking about how can these systems ‘learn’ because they can certainly solve problems and they can get better over time at solving problems. We now have good examples of that at ecosystems scale as well. So in some ways I quite like the dehumanizing flip side of that; we probably delude ourselves that we solve problems with higher consciousness and sometimes maybe we do, but also I think a lot of our personal capabilities probably can be attributed to cruder mechanisms. My other fascination with this is the fact that, as a scientist, I’m well aware that we now have artificial intelligences and machine-learning algorithms that some of us (or some humans) have created that are now solving problems faster and better than we can. That’s quite interesting as we head into the future, because that’s only going to increase. This functionality, this collective phenomenon and functionality that we see across all these examples, we are beginning to get some inkling of how that can come about in an entirely, in many cases, unconscious way.

### *David Western*

We’ve moved onto metaphors. I would like to cite an example which bears on the Gaia hypothesis. Many years ago ecologists began looking at the interactions of carnivores and herbivores rather than each separately. A herbivore grazing a given patch could have a big impact on the vegetation. Along come carnivores and reduce herbivore numbers, relieving the impact on vegetation and allowing more growth. The interaction gave rise to the green world hypothesis, the notion that carnivores make the world green than it would be otherwise. The more we dig into interactions between species, the more we understand how complex and interactive they are—the more Gaia-like if you will. The selfish gene metaphor has had a powerful sway on biological thinking, and on how individuals in societies function. We are all selfish to some extent, and the metaphor is compelling. But it overlooks another aspect of animal and human societies: cooperation. Fifty years on we are struggling to overcome the lure of the selfish gene and incorporate cooperation into biological metaphors. Where do we stand today? I don’t think we have yet found a metaphor for the complicated interaction of selfishness and cooperation. The interactions play out at many levels from gene to society. But ultimately, to go back to Tim’s point, at a global level the complexity and noise merge into one earth system? Is Gaia an apt metaphor, or does it too have the simplifying allure of a wholly insufficient selfish gene metaphor? We had better get our metaphors right, because if we don’t convince the public about the threats to our planet and mobilize action in the next ten, we’re in real trouble. Metaphors matter. As a conservationist, I see

the Gaia as raising public awareness and concern, whether or not it is persuasive to scientists and philosophers. I think we have to distinguish between a metaphor which has public valence and galvanizes action, and a metaphor that capture the essence of the planetary process. I frankly doubt we can come up with a metaphor that does so.

*Bruno Latour*

Thank you. Kyle would you recognise what might be clarified as the global Gaia metaphor?

*Kyle McGee*

I'd like to try to bring the question back down to earth, away from the planetary scale and the notion of a global system, which we need to find the right expressive language for. It's something that I'm incredibly sceptical of, but I think I can root my comment in something that Shirley had said, drawing our attention back to process and outcome. I want to talk about what that looks like from a jurisprudential point of view. If we look at the situated construction of a chain of legal reasons, we notice immediately that it's a collective endeavour, it's something that's put together using a series of devices that allow the representatives or the advocates or the lawyers to at once co-operate and compete, so there is—at least in the common law legal systems—there's an adversarial nature to the process, but it's co-operative in the sense that the parties are reacting, the lawyers are reacting to one another, and they're putting together different visions or different possible chains that the court could adopt: here's how I win, here's why my argument prevails, here's why my evidence is more persuasive. They have to speak to each other, but it's very interesting that often, strategically and very intentionally they *don't* speak to each other, they talk past one another...

*Bruno Latour*

Like scientists.

*Kyle McGee*

Yes, like scientists exactly, but the point here is that there's a co-operative element and competitive adversarial elements that are deeply inscribed into the process and

its structure, and what happens is that the court obtains its legal agency, its authority to declare the law, by virtue of that process. It's a very inaccurate representation of the way that adjudication works to think of the court as some transcendent seat of authority that's pre-constituted and already there. Really, it's embedded in an interactional process and the authority of the court has to be reproduced every time by the parties. What's occurring when the parties put together their arguments is that they are mobilising different value objects, as Bruno calls them, which are empirical indices or signs of what's important and what demands to be taken into account in the chain of legal reasons that's being jointly produced, that is in the process of being produced through this adversarial encounter.

What I want to shift attention to is the "outcome," that is, what happens when a chain of legal reasons is articulated and a decision is reached. The court has to reach a decision, it's going to come to a resolution. That outcome is truly an element of the process, not something distinct from it, and it lends itself to being recirculated to become a new value object in subsequent interactions, in subsequent adjudicative processes. So in that sense, as a practicing attorney, when I'm citing to another court's analysis or decision, what I'm doing is throwing open a bridge to that prior account or prior decision and I am mobilising it within this new interaction. It's not as though there's just a reservoir of resources that I have; I have to create them, I have to pull from a whole tangled mass of prior trajectories that are recorded in text and put them into my legal memorandum or oral argument, and in doing that I'm doing something that's constructive, that's interactive, and I'm not just following any deterministic or deductive message. I have to invent it, and I have to do it every time, I have to situate its relevance, to borrow Mike's language. Eventually what may come out of this process is a black-boxed legal bond, some kind of stabilized legal bond that other people can simply take for granted: you would be indignant if a particular right was not recognised, if someone failed in what you take to be a basic duty and caused you some kind of injury. You take these things for granted but it's actually—from a lawyer's perspective—a very contingent and very unstable set of relationships that can always be undone within this interactive process. So when we think about systems, social or natural systems, including legal systems, it's very problematic if we don't take the processual aspect into account and we just focus on outcome, and this is my basic legal-theoretical problem with holism and the idea that you have this pre-given system already in place.

### *Mike Lynch*

I'd like to talk a little bit about what the trap (or traps) might be involving metaphor in concepts and language. One thing that impresses me about the way a

trial court's lawyers use metaphors is that they're quite ruthless with many of them, using them in arguments with possible outcomes in sight, rather than getting stuck on a single analogy. Analogy is probably better word than metaphor, in a legal context. They're not quite the same, and I've also noticed that certain metaphors tend to be overemphasized. For instance, in genetics 20 or 30 years ago, there were many critiques of the so-called master molecule version of DNA, as if that was the only metaphor being used for descriptions of DNA, and it certainly was a rather pernicious metaphor, but if you look at written articles or even abstracts of articles in which DNA is discussed at the time, all sorts of analogies come into play in rather partial, situated ways that don't seem to have the purchase, particularly the popular purchase, of such metaphors as the selfish gene, or the idea that DNA is a sort controlling executive function. Of course, such metaphors mislead, publicly mislead research in many interesting ways. But I guess the thing that's interesting with analogy is that they can be used to play with difference and similarity, at the same time and sometimes indissociably. One analogy used in the domain of environmental conservation, which both troubles and interests me, is that of genocide. It is used, for example, to denounce practices such as poisoning sea lamprey (*Petromyzon marinus*), an invasive species (itself an interesting analogy) that inhabits lakes in upstate New York. There are people who defend lampreys, despite the fact that they are very ugly creatures. Lampreys are a fish with circular mouth with hundreds of teeth that fasten onto the side of another fish (including highly valued species) and suck their blood and can weaken and kill them, and yet the genocide metaphor is quite freely used to resist the use of a chemical compound that will kill these things *en masse* when they're spawning in tributaries. This is a very ordinary way that a popularized sense of a recurrent event gets politicised, for better or worse, when a metaphor adopted from a familiar domain of life is used for a less familiar one. That is, of course, a creative process as well, but it's also a way in which we can take metaphors to get around the political implications of other metaphors. The thing that's pernicious, the thing that's the trap, I think, is the disappearance of the *difference* that the metaphor was used to bridge. As you know, we like to speak of *specificity*, but that is often what gets lost with the overuse, the singular use, of a metaphor that becomes popular, almost like a fashionable trend in research and popular usage, and so, I think, maybe more so in law than in science we can find a ruthless use of multiple metaphors, quite explicitly in situations of argumentation. Paying attention to such ruthless argumentation perhaps can inoculate us from being seduced by a particular metaphor that gains seductiveness from its familiarity in domains of public life, and then is used to colonise an area that's novel, not very well known publicly.

*Bruno Latour*

I'd like to go back to the question of foresight and also link to what Jonah said about the importance of global metaphor of the people and also the chains of reasoning which gives in law a very clear solution. I'm alluding to Tim Mitchell's piece for the conference that he demonstrated and summarised yesterday: foresight is fully equipped by statistics, instruments and a whole set of paraphernalia. As a STS student, I share his insight: there is no global view of anything. This is history of science 101, so to speak. No one sees beyond the instruments. I think it's highly important not to use a global view and always insist on the fragility of the equipment. If you cut the money for earth satellites, as Trump threaten to do, you blind the earth scientists, or blur the pixels that allowed to have a slightly less primitive view of our own action on the Earth. So it's enormously important again to resist the notion of global, because the scientific apparatus and the public scene, what Walter Lippmann would call "the public," has been corrupted. So foresight as well as blindness are not cognitive functions, they are highly equipped, depending on satellite statistics etcetera. In Mitchell's case the body politic has been explicitly blinded to this question and every talk about the global views are misleading. It gives the impression that there are some people who do have a global view. None of us has, we look at very narrow. So even Gaia is small. It's not global, and I think that's important, because we can use metaphors maybe for the public, but even we should be careful not to use a global metaphor.

*Simon Schaffer*

Okay Scott, you have the last word and you're not to use any global metaphors.

*Scott F. Gilbert*

The holism metaphors are very interesting for many good reasons, and very few of them, actually, I think I can take a global view. Metaphors channel our thoughts, and I just used a metaphor, for *channelling* our thoughts. And the metaphors in embryology were so strong that in 1905 Ballantyne, a very well-known embryologist, asked in his book, what is the relationship between the five-day human embryo and the uterus? Does the embryo *embed* into the uterus? Does the embryo *attach* to the uterus? Does the embryo *invade* the uterus? All three things happen, all three processes are valid ways of describing the event. But which one you use gives you a mind-set to ask further problems. And so the metaphors actually create what

research project looks possible. If you're thinking of invasion, you ask different questions than if you're thinking attachment.

The metaphors of holism in embryology come out from a very particular type of holism. If you take a four-cell sea urchin embryo, some cells are going to usually become the skin and the other cells become the circulatory system and the gut. If you cut it into four individual cells, each of these four cells develops into an entire whole embryo. If you take a salamander, and you cut off its limb, the limb will regenerate the entirety of the limb; and what's more interesting is if you cut it at the elbow it will start regenerating from the elbow to the fingers, but if you cut it at the wrist you don't get elbows forming; you'll just get the wrist forming and the fingers. And so somehow the embryo "knew" what its whole structure was. It didn't go past it and it didn't go before it. So this holistic notion that we get in embryology comes largely out of regeneration research, and this started a research program in mechanisms of regeneration. And so I think that this integrates metaphor, process, and outcome all into an interpenetrating, incomplete, meshwork. When it comes to the holobiont, I agree wholeheartedly with that we don't have a good vocabulary for various integrations of cooperation and competition. One of the ones that I'm playing with right now is "making the team."

*Shirley Strum*

Will we be allowed to join the team?

*Scott F. Gilbert*

Yes, it's a North American sport's metaphor, and it has two meanings. One meaning is to construct the team, literally, you "make" the team. But the other meaning concerns the *competition* to become a member of this *co-operative* entity called a team. One tries-out for a team. Very often, the process of making a holobiont is very vicious for the microbes to get in our body. Most of them are killed off, and they're not wanted. It's very specific which bacteria the body is willing to take. So the team is a cooperative entity, but it takes a lot of competition to get there, and we need more metaphors of this type of interaction.

*Simon Schaffer*

Ok, we've come to the end. I regret obviously we didn't cover all the issues that people raised. It seems to me especially that we didn't quite get to what I take to be

an important point Didier raised yesterday which is: Yes, we need new metaphors and concepts, no doubt, but the criterion there is their effect rather than their descriptive adequacy for the reasons of under-determination that you gave. So, it seems to me that one should press quite hard on what difference do you want to make with the particular innovation that you're urging at the level of metaphorical or conceptual work: Is it about density? Is it about interaction rate? Is it about the constant levels of material mediation that the allegedly global perspective brings? There are many examples obviously of this. I've said this from the history of the sciences and Scott mentioned several of them. My favourite example for many reasons is William Bateson's work at the start of the 20th century. William Bateson was Gregory's father and he'd shoot me for saying that. He was one of the people who invented the word genetics, he was one of the world's first geneticists, he loathed baseball metaphors and in particular he loathed what was going on at what was then called The Fly Room in Columbia TH Morgan's Outfit, why? Because he thought it was illegitimately extending the metaphors of materiality to what was going on in chromosomes, so Bateson played an absolutely crucial work in identifying chromosome structure without supposing that there are material units of inheritance; the phrase he uses is (I try to remember): "A living thing—says Bateson to Morgan—is not matter, it is a system vortex through which matter is flowing. If you wish an image of this, look at wind blowing over sand or a log floating downstream." So already at its very beginning genetics, as a recognised science, had the same fight, for a very similar reason (Didier's point). The difference Bateson wanted to make was to immaterialize, precisely immaterialize genetics. That's not what happened, but it's really interesting to remember that that fight is there, right at the beginning of Dawkins' favourite science. It's an extraordinary historical irony that I am very interested in, I hope you share my interest, to see returning in force what's got so eloquently pointed out to us yesterday as 21st century science. We're going to resume these topics after the break.

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## CHAPTER 7

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# Gaia as a Collective Phenomenon

*Tim Lenton*

I'd like to talk about how can we explain this Gaia collective phenomenon, or, how do I at least try to explain it? And that's going to be about a plurality of mechanisms and agencies, you'll be pleased to hear, and then I'll try and offer some reflections on what can Gaia offer to a new body politic without suggesting that it should be the body of said body politic. So, how do we get from three and a quarter billion year old presumed prokaryotic cells caught in the act of division and frozen for all time in a sedimentary rock... to this...



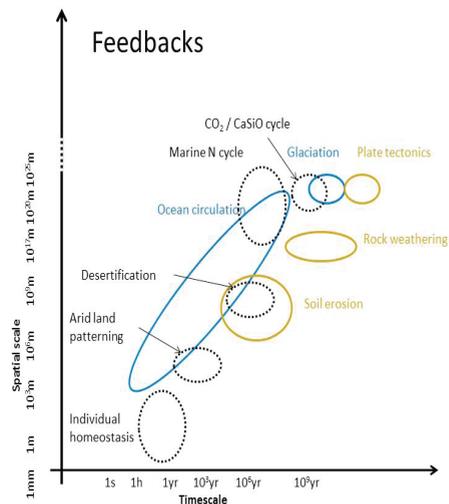
...the Earth system or Gaia as we know it, populated by us, including Jim Love-

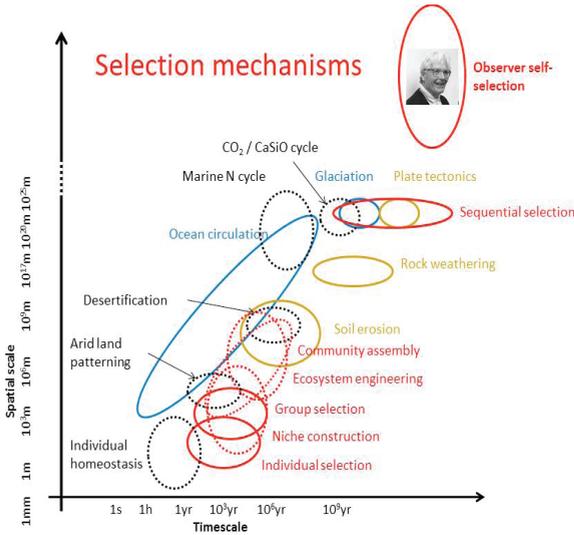
lock and Lynn Margulis, and able to reflect on this situation and propose that, in order to rationalise this long history of life in this remarkable planetary scale phenomenon, that there may be some atmospheric homoeostasis by and for the biosphere (as they originally phrased it), or rather that organisms are somehow playing some part in self-regulating feedback mechanisms that have kept the Earth's surface habitable for life. Then there are these other pesky members of our species... there's a couple of them Richard Dawkins and W. Ford Doolittle who are, perhaps understandably, arguing; how could this collective phenomenon come about? Because the Earth as a whole, it's not a unit of natural selection, so why should the organisms that leave the most descendants be the ones that contribute to regulating the planetary environment, etcetera. I don't want to get too side-tracked by just responding to their narrow critique, but let's put it out there.

So definitions to start with; for the last 20 odd years I would probably have glibly said that by Gaia I mean a planetary scale system, but I've put a question mark on there now, because for this meeting, and perhaps from now on, I'm going to go with something much more un-pithy, I'm going... and this is just last night's draft... with: Gaia is the processes by which the growth and interactions of myriad organisms and their abiotic environment give rise to properties of self-regulation, occasional self-transformation and development, if not evolution across a range of supra-organism or scales up to including the planetary whole. Oh dear, I said whole, oh well room for refinement! Another friend and scientist has written a book on 'Gaia's body', if you're curious to know the body of this body politic and I'll be explaining some of Tyler Volk's thoughts along with my own as we go along.

So part of the conceptual challenge, if I can call it that, to a scientist is to have, let's call them *processes* that can rationalize phenomena that are occurring across a spectacular range of space and time scales. That's why I'm going to use these axes of space and time as sort of organising thread in the next 20 odd minutes.

So we're spanning here the spatial scales from organisms to the planet and the timescales of biology to the timescales of Gaia. As scientists we know many things about many non-living processes that are important and these are just a few across space and time scales. But what I'm



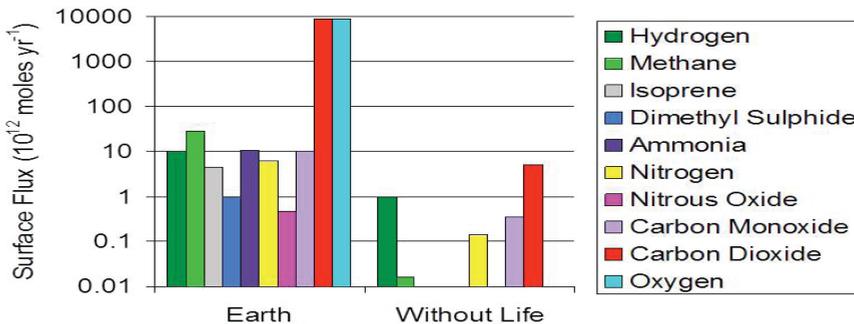


more interested in here is how does this collective phenomenon come about? My basic argument is going to involve a plurality of processes that operate across this range of scales. Before we even get to biology or with a mixture here of biology and non-biology, the theme of feedbacks is going to be recurrent. Feedbacks are operating at all kinds of space and time scales. I'm also particularly interested in what I'm calling

here selection mechanisms (and maybe there's a better language for them but let's go with it).

So let's build the story up by starting with good old familiar standard neo-Darwinian narrow evolution by natural selection operating on populations of individual organisms (and some smaller scales). That is part of the picture, it is not the answer to Gaia that's for sure, but you don't want to throw the baby out with the bathwater either, because there are some very important planetary scale phenomena that we need to be able to rationalize and so the first one I'm going to look at is a spectacular material recycling that's going on at the surface of the Earth.

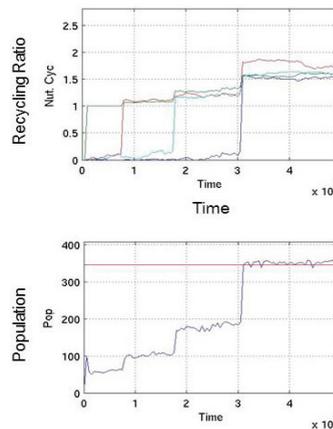
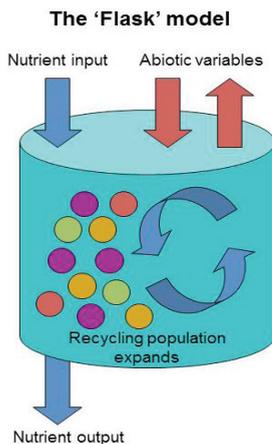
## Fluxes of gases



This is just to highlight that ‘without life,’ the fluxes of gases exchanged between the surface and the atmosphere are essentially those coming out of volcanoes and what geologists would call metamorphic processes. ‘Earth’ on the left, with those much taller bars on this logarithmic scale, that’s the fluxes of gases we observe today absolutely dominated by biology. That shows phenomenal material cycling with several compounds on there that are uniquely biogenic as well as the fact that things that are also produced by non-life or cycled by non-life are cycled far more by life. The point here is; early life had to solve a profound recycling problem which was that the supply of all the materials it needed to build its bodies or the early biosphere was chronically limiting, because we’re dealing with a nearly materially very closed system at the surface of the Earth.

So the first question scientists like me would ask is how can nutrient recycling emerge? I do think that the term emergence is indeed a cop-out, so hopefully I can convince you that I have gained some understanding, or collectively that scientists are gaining some understanding of the actual processes or mechanisms at work.

## Emergence (!) of nutrient recycling



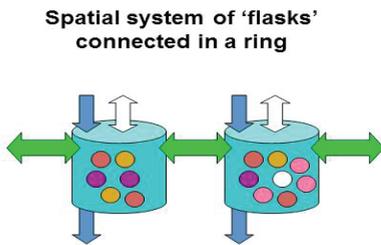
Williams & Lenton (2007) *Oikos* 116: 1087-1105

To do that in this case, with a friend Hywel Williams, we constructed a model in a computer of a sort of imagined virtual world, a well-mixed container of fluid with some inputs of what we call nutrients to refer to the stuff that organisms have to make themselves out of and some things that we call abiotic variables which to you and I could be temperature or pH. We’re going to seed this virtual world with artificial life forms that can replicate and they carry a genetic code in the sense of a

bit string of zeros and ones that encode for which nutrients do they take up which waste products do they excrete and what effects might those have on the environment. Initially a system like this is going to be limited by whatever the godlike programmers have designated as the inputs of nutrients and maybe this clonal community that we start with consumes compound A and excretes compound B, so it is going to be limited by the supply of A coming into the container. In this virtual world we run it many times and we introduce stochastic mutation of the artificial life forms and, sure enough, material recycling emerges as a fairly robust phenomenon and, as it does so, the population of the virtual world increases in the bottom right figure and in the top right figure you're just seeing a measure of recycling and you see these sudden discontinuities where recycling loops close for a series of four compounds. The take home message is that recycling is a very robust result of doing this experiment *in silico* many times. That can be rationalized in fairly traditional ways that it is really one organism's waste product becoming another's food and natural selection is a pretty robust way actually of selecting for these loops.

So we step up a little then—what about multilevel selection or group selection or whatever you want to call it, because life is not just cycling materials on our planet right? It is, we know as geochemists, playing a role in what we'll call regulating the non-nutrient variables, including the temperature of our planet, and for this we're actually gaining some kind of insight with the same toy model, only making it a little more complicated: Imagine these virtual communities of microbes being in a spatially extended situation, a series of flasks connected in a ring or some other topology.

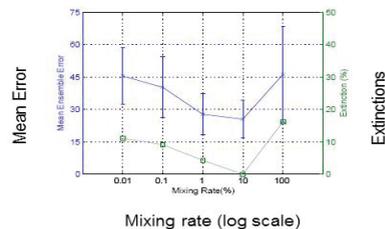
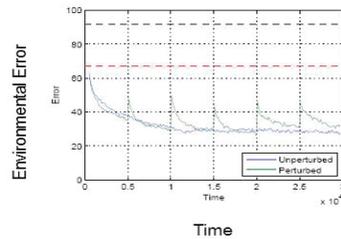
## Emergence (!) of environmental regulation



Measure the 'Error' = Mismatch between the state of the abiotic environment and the organisms' preference

Vary the rate of mixing between the flasks

Here we use fixed, universal preferences

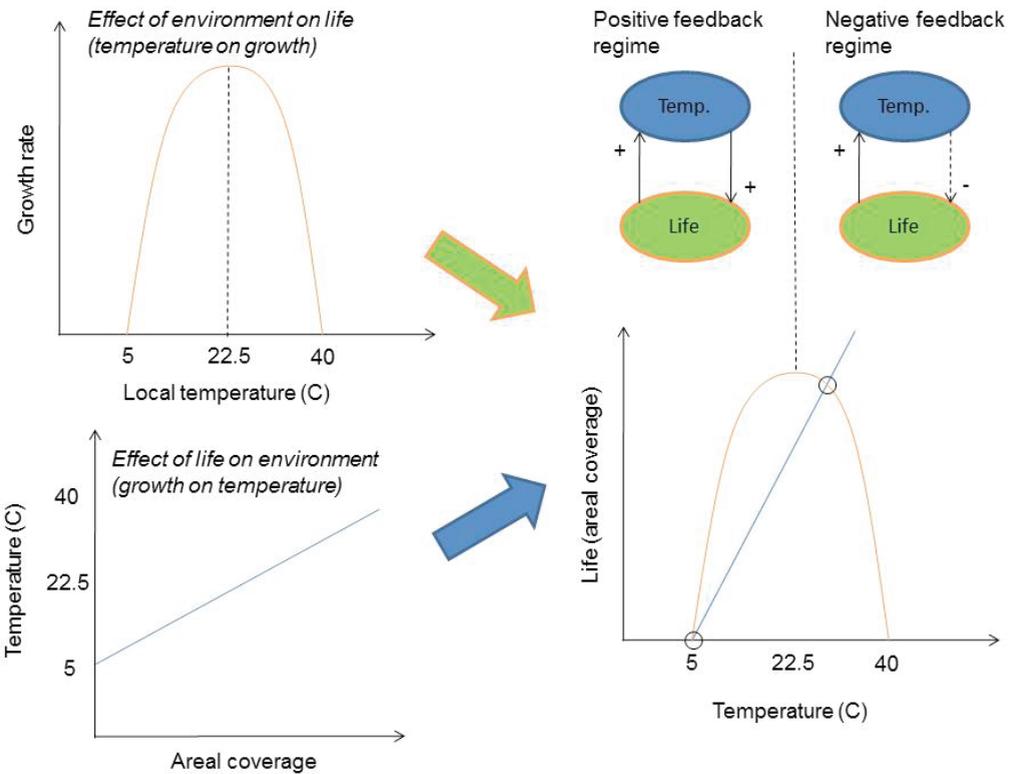


What we were able to address here is the question: Can these collective phenomena drag the abiotic environment, let's call it the temperature, towards their preference? And to clean the model experiment up we assign a kind of best temperature for growth to life in this virtual world and then it's easy to measure whether they push their environment away from their preferences or drag their environment towards their preferences. Again there's no need to worry too much about the details, but we do this thousands of times, we do it where we perturb the systems, where we don't perturb them; the aggregate result in the top graph is showing that on average over say 10000 runs of the model these communities collectively are able to drag their environment or the temperature towards their preference, although not perfectly, they don't achieve perfect regulation for reasons we could discuss later. In this spatially heterogeneous world we can play with the degree of connectivity, what's called the mixing rate in the bottom panel. We find that in a very well mixed, homogeneous system, then what I would call anti-Gaia happens about 15% of the time. That is life causes a global catastrophe and make itself extinct. This also happens about 10% of the time at very low mixing rates. There's a sort of sweet spot in the middle, where an intermediate level of spatial structure means that really good Gaia's emerge, if you like, in the sense that the collective phenomenon can avoid global extinction and is the best at regulating its environment.

So it's all virtual, it's all in the computer, because we only have one Earth to study and it's very hard to make statistical inferences unless you have a sample size of more than one. But we do understand something about the mechanisms which in this virtual world would give rise to what I'm going to call environmental regulation – and it's an ecosystem level selection mechanism: Basically environment-improving communities spread at the expense of environment-degrading communities and, even though there isn't in a true Darwinian sense perfectly faithful replication of inherited variation at the community scale, the replication is faithful enough that this works as a mechanism. Lovelock has often speculated that this is what should happen and this is just a modern day scientific illustration that it can happen. Well that's perhaps interesting, it's another process or mechanism by which we can see regulation coming about. However, I have to confess it does not explain everything that we see about the Earth, because crucially Gaia has some very important well-mixed environmental variables, by which I mean that the carbon dioxide level of the atmosphere or the oxygen level of the atmosphere is pretty much uniform everywhere on the planet, because the atmosphere is one gigantic rapidly mixed container. Unfortunately the mechanism I have just described can explain the regulation of heterogeneous (that is spatially uneven) variables like temperature, but it can't be invoked to explain the regulation of well-mixed variables, several of which are extremely important. So we need something more. There's another issue here as

well in connecting across the scales of space and time, because the timescales of say the replication of microbial organisms and the timescale of variations in the level of oxygen in the atmosphere are spectacularly different, and this can lead to instability.

So here we get into the game of thinking about cybernetics and feedback mechanisms and how very simple feedback principles can give rise to stability of these long-live variables. I'm skipping over quite a lot as I do this, including a whole body of work on what is called ecosystem engineering or community assembly. That is because I want to talk about something I'm going to call sequential selection to distinguish it from standard natural selection, because it's going to be about selection on one planetary scale system. First of all we need a tiny primer on feedback and regulation involving life:

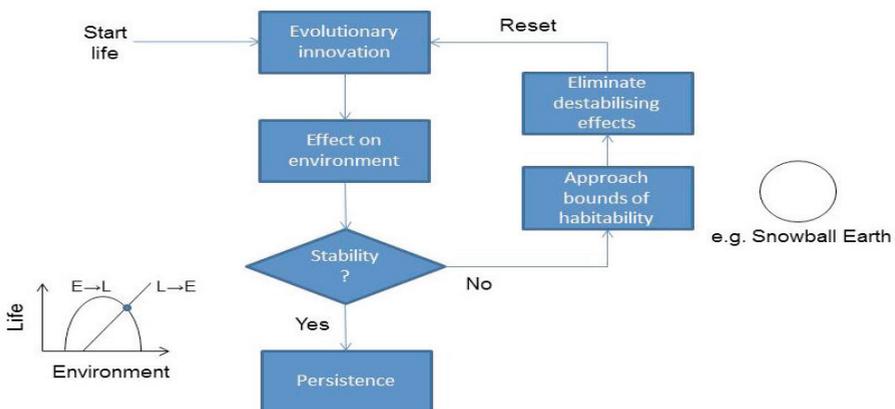


So, in cartoon form, organisms have some kind of peaked growth response to temperature, in this case, that would be pretty much universal even if we'd argue about the shape of the function. I hope we can all accept that organisms tend to affect their environment and that can include the temperature. Here I've drawn a

function at the bottom which is like the black daisies of Lovelock’s daisy world, if you know that, but it’s just a cartoon of a situation where more life equals a warmer temperature, in that case because the daisies are darker than their surroundings they absorb more sunlight. The point is the two left hand plots have essentially the same axes just flipped around so we can literally plot the two graphs together (on the right) and we can ask what kind of feedback regimes can arise from the fact that life affects the temperature and the temperature affects life? Well, there’d be one regime which we describe as a positive feedback situation where if we started cold in this case and a little bit of life was able to grow, it would warm things up and that would increase the growth rate of life which would warm things up further and we would go into this almost runaway situation of self-amplifying change, until life pushed itself past its optimum growth temperature and then more life and more warmth is actually suppressing growth and we get into a self-limiting situation, what we technically call a negative feedback and by definition that’s a stable attractor and therefore a persistent state of the system which it will tend to sit in until something else would push it elsewhere.

Well, just keep that in your mind and let me try to build on that and introduce this idea I’m calling sequential selection. I partly started thinking about this because of correspondence I was having with Bill Hamilton in the late 1990s. This is from a letter from Bill to Jim Lovelock a little over 20 years ago: “I imagine that ‘learning’ through repetitions over time alone in a sufficiently complex system has to be shown able to replace the currently understood and I’m sure much more powerful ‘learning’ through repetitions over both time and space that is natural selection as we know it.” So now my attempt to incarnate that thought for Gaia. I’m going to do it as a sort of process diagram:

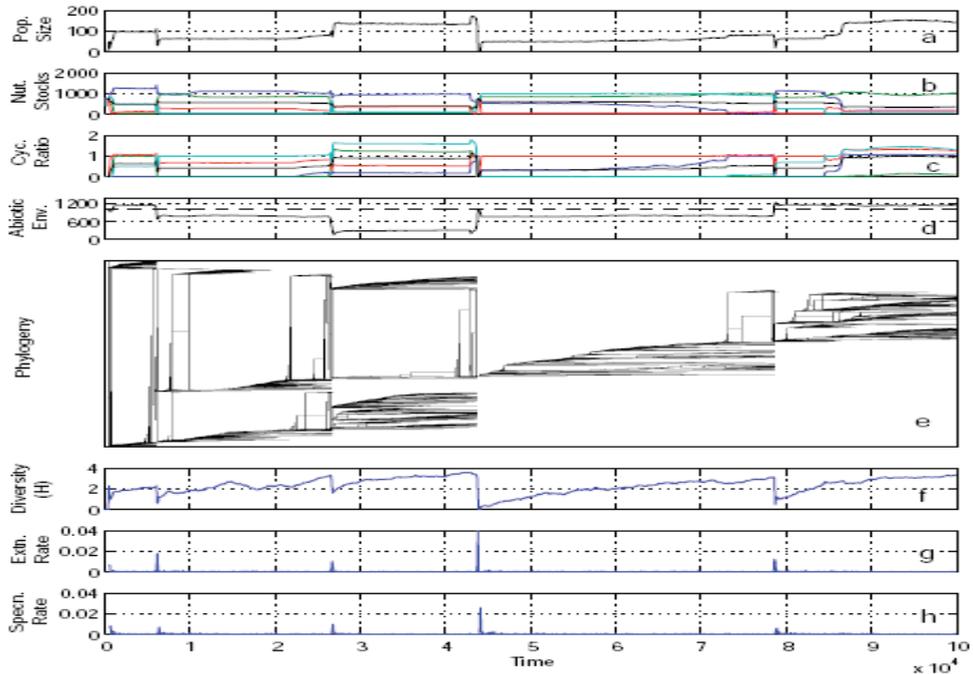
## Sequential selection for Gaia



Let's imagine life starts and let's not worry about how that happens. Then evolutionary innovations happen, I think that's fair enough, they are going to have some effects on the environment but which way are they going to go? I mean, are we going to automatically fall into one of these negative feedback regimes I just introduced. Well maybe the system—I hesitate to use the word—gets lucky the first time and you fall into a negative feedback self-stabilizing situation which by definition tends to persist. Ah, easy, we've answered the Gaia question at the first try. But maybe that doesn't happen, maybe we get something more detrimental, life driving the environment away from the conditions it likes. Then consider this, consider the possibility that you approach the bounds of habitability and in the case of the Earth we have historical examples of this: the Earth has been in a so-called snowball state in which it was nearly completely frozen over and it was a major bottleneck on life. What, though, if that marginally habitable state were to essentially eliminate the de-stabilizer or the de-stabilizing effects of life along with much else, then it's like resetting the system, right? And then, well, we may have to invoke mechanisms of how we get out of the snowball state, but evolutionary innovations can happen and again we can ask; does a new evolutionary innovation chance upon environmental stability? Well, maybe it does, maybe it doesn't, but you can keep repeating. At some point, as long as you don't extinguish all life, you're going to fall into a stable attractor which by definition will persist. Maybe that seems trivial to you, but this might be part of what we're seeing in the dynamics of our planet.

It's also what cybernetician—and by all accounts looking at the photograph entertaining drinking partner—W. Ross Ashby called ultra-stability and he made a little machine called the Homeostat to incarnate this concept of how could a self-regulating system arise? He thought about this purely in a neurophysiological context. Actually in his book *Design for a Brain* he used the metaphor of a kitten sticking its paw in a fire and learning from that experience to avoid doing it again. So he was thinking at the organism scale trying to understand the self-regulation of bodies, in that case animal bodies, but it's the same logic. So, that's getting us up the scales and part of the plurality of processes.

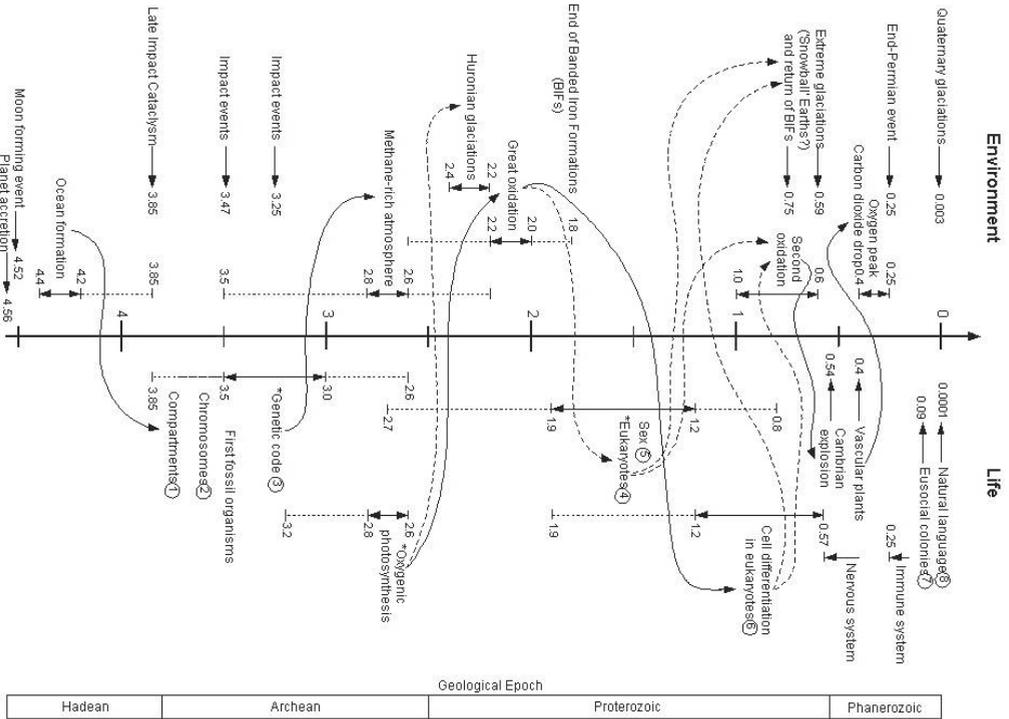




Let me return briefly to our virtual world where we are now going to allow our virtual microbes to adapt their environmental preferences, that is have them mutate and evolve over time as well as their effects on the environment. Here is just an example of what typically goes on in the model world for population, nutrients, recycling, the temperature, environment and the phylogeny of everything in the model world. What you see, in pattern terms, is punctuated equilibria; intervals, long periods of stability of the environment interspersed with periods of convulsive change which correlate with mass extinctions. Then the system re-finds stability and it does so through something equivalent to the sequential selection mechanism. That might give us a template for how we'd expect history to look and indeed in Lovelock's *Ages of Gaia*, I think his best book, he is making simple models and drawing cartoons of changes in atmospheric composition and temperature over our history that follow the same template of long periods of stability, short periods of convulsive change. Oh yes that's us on the beach 20-something years ago where I lived in Cornwall talking about this stuff that has been a major bugbear of my career. Sorry, time is precious...

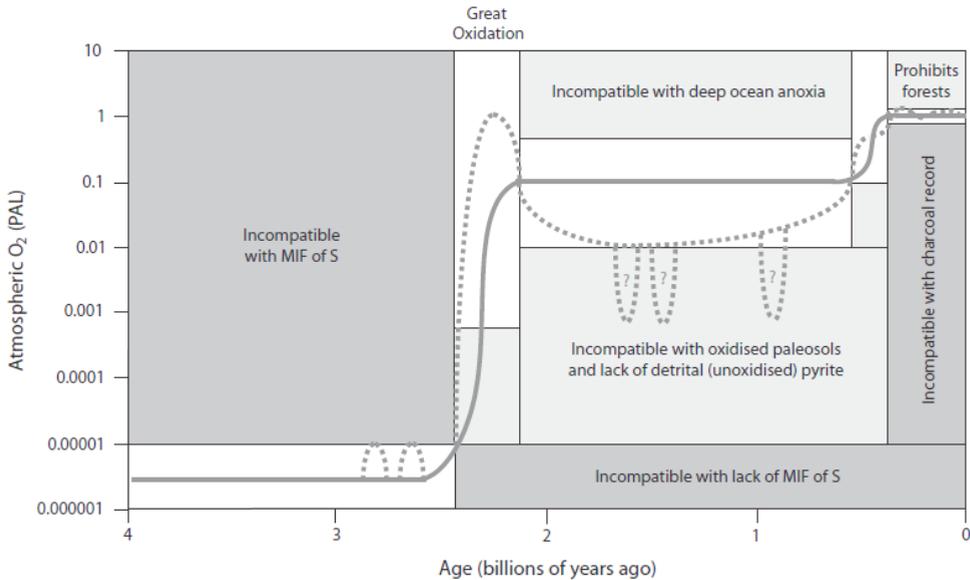


You want to just look at Jim, at the younger Jim and the younger me hanging out having a picnic on the beach. This is the business of being a human being and a scientist at the same time. Another friend of ours who's a great artist, it's his knee in the bottom left of the shot—Peter Horton, but I've inadvertently cut him out. I was inspired by Lovelock's books when I was 18 or 19 years old, and before I took Simon's history and philosophy of science classes, I kind of answered Jim's call to try and be a doctor of planetary medicine, as he put it, and I became fascinated by these convulsive changes that I think have transformed Gaia or whatever you want to call it over its history, so a lot of the work of the last 25 years of my part of Earth system science is to try to understand the coupled evolution of life below the timeline there over 4 and a half billion years and major aspects of the environment above the timeline with some causality crossing over between the living and non-living.



Don't worry if you can't see the details. Out of all of this spaghetti, we would now argue that there are very few fundamental I call them revolutionary changes in the history of Gaia or the Earth which are each contingent on the previous one and each were required to have occurred for us to be here to be discussing this remarkable history. The first one is something around the origin of life and the emergence (oh dear I said it again) of global nutrient cycling and some level of environmental regulation in a world of prokaryotes, of microbes. I call that the inception rather than the conception for obvious reasons. And the second major revolution we would just glibly call the oxygen revolution and this is rooted in the extraordinary biological innovation of a particular kind of photosynthesis which splits water molecules as its source of electrons and chucks out as a waste product O<sub>2</sub>, oxygen. Ultimately that leads to something called the great oxidation that is a fundamental switch in the chemistry of our planet from reducing to an oxidising atmosphere about half way through the planet's history. Now that's a necessary condition for the subsequent evolution of eukaryotic cells which are originally aerobic (oxygen utilising) and certainly oxygen is a precondition for those eukaryotic cells to be able to form a mobile and multicellular animal with cell differentiation, because that requires a lot of free energy from combining oxygen with food. And

that's what's broadly categorised as the complexity revolution that unfolds actually before the famous Cambrian explosion, but is a sort of intermingled rise of the first complex animal forms and some oxygenation of their environment with a sort of circular causality. Now the next revolution might be the one that we're starting now. Anyway that's something I've written about with my dear friend Andy Watson in *Revolutions that made the Earth*, trying to tell that story.

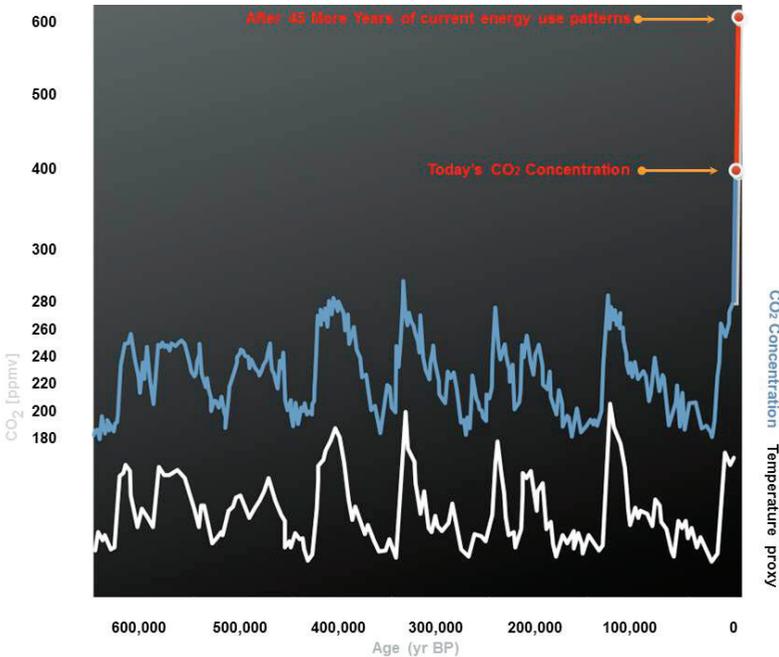
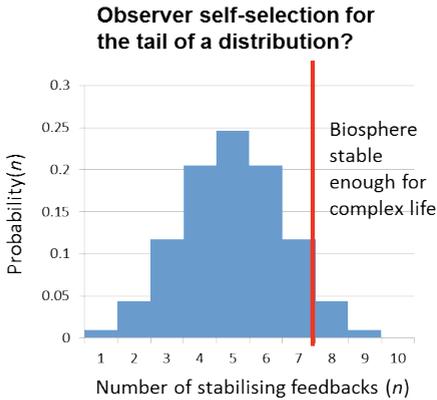


When I reflect on it here it kind of reminds me that, boy doesn't it look like progress when you the self-conscious self-aware ones look back at this remarkable history of the planet and you see variables like the oxygen content of the atmosphere here over four billion years kind of going up in this stepwise fashion, following that pattern of switching between long periods of stability and then periods of change but it kept on going up and it needed to for us to be here to talk about it. So that's going to bring me to the final point that has to be recognised which is our very existence of course biases the kind of history we can see for Gaia or for the Earth and that's what philosophers call the weak anthropic principle, and cosmologists sometimes call 'observer self-selection.' It's simply what I've said: the history of the earth we see has to be consistent with our existence as conscious observers, therefore oxygen has to have got to something like the present atmospheric level, PAL, to support our metabolism including the 20 watts of brain function that's about 20% of our basal metabolic turnover as we sit here and hopefully listen to me. For that to happen that needed these profound increases in biological complex-

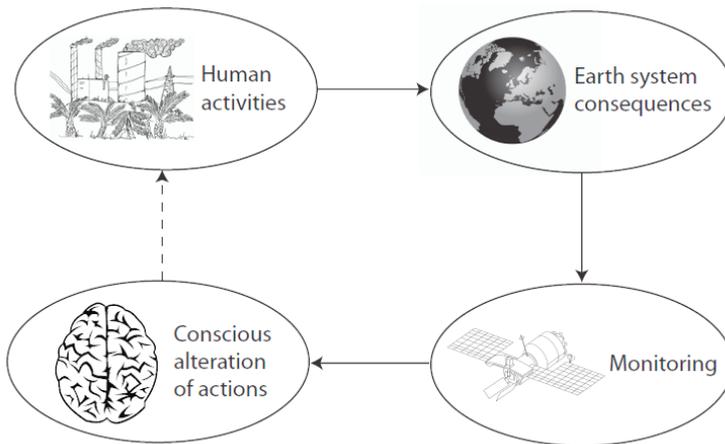
ity without elimination of system group animals in snowball Earth. I would argue it also needed the regulator to get better over time. Indeed the self-regulation of crucial variables—oxygen and carbon dioxide are among them—actually improves over time, I would argue. Now I can't yet give you a bottom up, *a priori* reason why there would be that directionality in any given planet on which life started, which is why I think, whilst I don't like this 'observer self-selection,' we need to be aware of it as a possible rationalisation for our existence. Maybe it's the case in general that a planet needs to have a certain number of stabilising feedbacks for consciousness, self-awareness to persist. You could argue there may be many trillions of planets

out there that have life and it's never got to this stage, many other trillions of experiments.

Where am I going with this? Well, we're here now and we're thinking about the planetary consequences of our action. One vital piece of information is that we have arrived bizarrely when the Earth or Gaia is unusually unstable. This is captured here by the ice-core traces of temperature and carbon dioxide:



If I were to eliminate the numbers on the axes, so you didn't know what the variables were and you gave the plots to either an electrical engineer or possibly a cardiologist and you asked them if the patient was healthy, or the electrical circuit was stable, they would say "no" they would say "blimey, look at those saw-tooth oscillations gaining strength in the system." Anyone who understands cybernetics knows that that's a signal of positive feedback or self-amplifying processes beginning to come to dominate over the bounding self-regulating negative feedback processes. How ironic and/or perhaps causal that we evolved in such an unstable system and then what do we do? We jack the CO<sub>2</sub> level up to there so far and we carry on doing what we're doing and within my lifetime it will be up there. That's why we, or at least why I've come here, why I'm excited that Bruno's *Facing Gaia* just as I am, because that's where we are, we are the self-aware things. I don't know if this is politically unpalatable or whatever, but as far as I'm concerned something qualitatively different is happening in the system now in that we are collectively aware of how we are transforming it—in other words, the Earth system consequences of our collective actions. We know what they are and we're monitoring that all the time. Now are we going to consciously alter our actions in response to that information and in which way are we going to alter our actions? I don't know, but I can clearly see there is the potential for what I'm calling a teleological Gaia or teleological feedback here. The great irony of that is teleology is exactly what Lovelock had to banish from his conception of Gaia prior to humans. The whole point is now we bring undoubtedly that teleology into the system, which is why I would call it Gaia 2.0 and say that there is some kind of qualitative breakpoint happening.



Now let me turn topic. I'm sure I've used my time up. What on earth will we take if anything from all this for a new body politic? The first thing to say is you can't take any politics from the prior history of Gaia. I wouldn't wish to and I understand all the problems of doing so. That said, I think there are some elements you might take from Gaia if your normative intention was to conceive of a long-term happy and sustainable future for our descendants as part of this planet. I said this yesterday, but first of all the body of Gaia is very different to the previous body politic. We're talking about a shift away from a metaphor of a heterotrophic and animal view of society and the technosphere. I mean that in the sense that we're now a society that gets the great majority of its energy from a resource fossil fuels that's buried in the ground and we combust it with oxygen just the way that we metabolise food, right? So our technosphere very much can be made analogous to a heterotrophic animal but it isn't going to carry on like that indefinitely right? If we want our descendants to be here in more than a few generation's time we have to adopt some lessons from the biosphere and what it takes to make a successful autotrophic system that's fed by the free energy from sunlight and closes the cycling of materials out of which it might want to make new stuff. In other words we need to conceive of a technosphere in which we make new things by remaking them out of old things and we use the free energy of sunlight to do that so it's not going to violate the basic laws of thermodynamics. I would describe that as an implicit change in what a cybernetician would call goal function, at least for the technosphere or the anthroposphere—from flourishing on a kind of unsustainable heterotrophic growth fuelled by fossil fuels at the moment, to flourishing as humans on renewable energy and material cycling. To do that I think another looser lesson is that we've seen that the prior Gaia is based on a plurality of 'learning' or selection mechanisms that improve functionality of over time. That would appear to be a very robust recipe given the four-billion year pedigree of Gaia, so we might learn some lessons from that, the benefits of such plurality. I would describe what we see in prior Gaia as distributed rather than hierarchical control. That also seems very robust and effective and I would ask a question: could we—and this may be the most contentious thing—could we consciously design all the catalytic networks and selection mechanisms which support the spread of innovations, to support the transformations that we can all agree are required? They would also select against what we might deem detrimental ways of doing things that exist and persist at present. I don't think this necessarily means the short-term end of growth, which I realise is perhaps a contentious thing to suggest. The amount of free energy from sunlight available to us through solar PV cells and concentrated solar power far exceeds by orders of magnitude what we're currently consuming globally in mostly fossil fuels. I'm not saying we shouldn't and we won't have to end up in a steady state economy.

I'm just saying that this energy use *per se* is not bad and there's a form of free energy from sunlight that we could use to fuel this Gaia 2.0 which fundamentally has to be based on material cycling and the paradigm of what's sometimes called industrial metabolism, industrial ecology—call it what you like. Thank you.

## DEBATE

*Simon Schaffer*

Great. I suggest that we take about 10 minutes or so for what one might rather dangerously call technical questions to Tim. That was a very rich presentation, we might want clarification or development. Those of you want to do that, Bruno?

*Bruno Latour*

I've read lots of Tim's works and maybe I've understood much more, but there's something which is important for the last point on the body politic, the alternative autotrophic metaphor of a body politic. And that is the question of scale. But you passed very quickly on the way innovation in those flasks as well as in the model as well as in the historical version. Sébastien Dutreuil in his study of the history of Lovelock makes the point that life for you and for Lovelock is always excess and flourishing so that from one small innovation it spreads everywhere. This is one of the issue of the new politic metaphors to explore, what you call the autocatalytic innovation. So we need to go a little back on the history of the Earth: why would innovation on life spread? To the point of modifying, not only local environment a little piece here and there, but the whole sort of which is also a nice illustration of William James expression that some of us here like a lot "the name of nature is excess." Why is life bountiful?

*Tim Lenton*

It's a brilliant question, because what I'm trying and failing to convey in my talk is that it's absolutely not a given that innovations are going to spread to the global scale to be globally transformative. Rather, there are all these layers and types of what I call crudely selection mechanism that might block that spread, if you like (I'm not sure that's good language), or select against it. That even sounds very anthropomorphic, but I mean it in a blind Gaia-maker sense. The point is well taken

that, yes, some innovations have ended up transforming the world and that meant they did become global in scale. But many more probably didn't and that's because there are these feedbacks, selection mechanisms cutting in at all sorts of scales. I describe them as supra-organismal scales, but certainly very sub-planetary scales, like ecosystems. I think your point is even better taken with regard to any prognosis for the future of Gaia 2.0 which is we need to have, as somebody put it yesterday, the capacity to experiment without the jeopardy of ruining the whole planet. So experimentation should absolutely be able to start and be realised in the sense of adaptive management, or whatever you like, at much smaller scales. Jonah has talked about ecosystems and communities entwined and trying to find new forms of regulation, or whatever you want to call it. So I don't mean to design, and it would be very dangerous, to design a system that promoted innovation so rapidly to the global scale without any geo-filters or selection mechanisms along the way. I suspect the robustness of the prior Gaia is partly because there are all these filters and checks and balances at smaller scales of space and time that actually, I was tempted to say, police the outcome—but it all sounds very anthropomorphic.

### *David Western*

I'm actually delighted with what Tim has presented, because I think that Gaia was trapped in a debate between geophysicists and the planetary scientists and little effort was made to consult ecologists working on ecosystem. What I've seen since the first rendition of Gaia, and certainly the one that Tim presented, is an evolution of a concept of a complex adaptive system rather than the "grand attractor" drawn from complexity theory. There is no grand attractor to which oscillating planetary processes are drawn. Rather the earth system, like ecosystems, is made up of dozens of sub systems which involve both positive and negative feedbacks. The language Tim is using comes closer to how we understand ecosystems than Lovelock's original conception. Lovelock talking about the planet returning to some optimal state got him into trouble. The word resilience describes the return to some approximation of a prior state better. Small organisms, bacteria, for example, with a short life span and high reproductive rate bounce back fast after a disruption, given sufficient nutrients and energy. Large organisms like red woods take centuries. Now scale up to a planetary level. The carbon cycles circulating through the biosphere, oceans and atmosphere may take thousands of years to readjust after the sort of perturbation humans are causing through fossil fuel emissions. Now imagine the impact of an asteroid impact. Recovery takes millions of years and never returns to the pre-impact state.

*Tim Lenton*

Why don't we cut straight to the chase on that and consider the perturbation we are at present including the perturbation to the carbon cycle, the 10 billion tonnes of carbon per year we're emitting and the cumulative emission of so far 500 billion tonnes of carbon? The point here is that you're quite right, that if we just left it to Gaia 1.0's mechanisms for dealing with that carbon there is negative feedback and around half of the carbon we add to the atmosphere each year, is going straight back into the land and the ocean within that year. But the other half is the problem because some of it is incredibly long-lived, because of these long-time scale feedbacks that the system, sorry I'm imputing it some presence now... or the collective phenomenon, possesses. To drain the last of the anthropogenic carbon out of the atmosphere takes approximately a million years by the process of biologically mediated rock weathering and in between times, there's a series of other biologically mediated feedbacks that get rid of chunks of that carbon, but that last fraction ... that's where a lot of the damage lies.

*Deborah M. Gordon*

Can you say a bit more about the autocatalytic network model that you mentioned at the end? What is that?

*Tim Lenton*

Let's try it in different language. What I'm alluding to there is: could you imagine that right now around the world there are communities of actors from different sectors, conservationists, let's say, working with government people, working with private philanthropists, working with the public sector, to try to regenerate particular social-ecological systems, like degraded coral reefs or collapsed fisheries or perhaps Jonah can give me some brilliant examples in the Serengeti parks. Those things are starting to happen and many of us are involved in our own communities in trying to build or experiment with a model of a more sustainable way of being. What I'm interested in is: can we design or do we even need to design the ways in which positive examples of that, at least at smaller scales, could be seen by others and readily replicated, because then you'd open the recipe for transformative social-ecological change. Person Y in country Z on the Internet with their friends forming their community could say blimey! Look at those people over there and what they've done, we can replicate that. That's what I'm just trying to allude to here, because for me there's a potential for that to happen which we aren't fully realizing.



## The Cultivation of Ways of Overlapping: a Matter of Reclaiming

*Isabelle Stengers*

I will try to be rather short, because we will have to come back to the scientific Gaia. One of the question which was asked from us in the preparation of this encounters was “Against what did you have to fight?” And Tim Lenton was the only one who said but no, no I did not have to fight. And reading his papers I completely understand this answer. Because, yes, Lovelock had adversaries and certainly had to fight, but, and here I would speak about emergence, the Gaia of Lovelock entailed the emergence of new sets of problems and for those who accepted his Gaia, the exploration of those problems, how to tell the story of Gaia, it was no longer question of facing adversaries, it was a question of controversy. One of the great thing I was interested in Lenton papers was that indeed with the appearance of life a new stake appeared. The purely geochemical feedbacks are quite effective in this story, I mean, they can produce a lot of things, but cannot by themselves avoid the Earth finally ending like Venus, a hot inferno. When life appears, habitability becomes a stake and a new kind of story emerges. How to tell the story whereby Gaia escaped till now to Venus’s fate? How to tell the story and not to endow “Gaia with life” some self-stabilization power. And then, even Dawkins and other archenemies were useful, because they complicated the stuff, they said: yes, but you cannot avoid cheats, those who Lenton defines in one of his papers by “anti Gaian” behaviour. Habitability as a stake now is related to this contrast: there is a Gaian behaviour and an anti Gaian behaviour and so this is something which would have no sense in a purely abiotic geochemical planet. And it becomes a true story with stake, with a risk. Habitability could have been destroyed, and the story could have reduced to

what physics and chemistry call evolution, a change indifferent to its consequences. With Gaia, it is a story, not an evolution, it is a story, because there's a risk. There is possibility of anti Gaian behaviour coming to predominate. So I think that here we really have story emerging and this story, the telling of which began with Lovelock and which is now dramatized by people like Lenton is really one of those beautiful scientific events: something which looks simple, needs a story, something which looks stable in fact was risky, could disappear, something which we could explain now is to be narrated. It is typical of science at its best: the emergence of a way of making abnormal what looked like normal until now. But it means also that the name we give today to the being at stake in this story, the name Gaia means two things. There is the scientific event, the whole set of new questions related to the way Gaia has kept existing till now, and there is the present-day situation. The name Gaia is associated to both and I think we should keep the distinction between those two Gaias, because the perspective at the end of Lenton presentation is itself a novelty in the very Gaia story. As Lenton writes, interdependence has "inadvertently" produced robustness against stability-threatening cheats, and it is also "inadvertently" that we have messed with the habitability of the planet. Now with what you call Gaia 2.0, when the time of inadvertence is over, we have to deal with the emergence of questions pertaining with what I would call politics. Before that we were not aware of Gaia instability and we were not aware that we were provoking it. Now, many are aware that we are in a very risky situation, more than risky, but the whole point, the whole political point, is the "we." Who is we who are aware. It is true that some scientists are aware, but the problem with Gaia, and this is why I propose to call her Gaia the intruder, is that there's not one we, there are many we, there are the we of all the living inhabitants of the Earth which are not aware at all of the IPCC modelling, there are the we of literate humans who have heard about it but wonder what they can do about it, there are the we of scientists, there are many kinds of we and what is called awareness is different for each of them. Habitability as a stake, concerns them all but the formulation of the political question, that is also, the kind of "political body" it is addressed to, is really unclear.

So Gaia is the intruder because the realization of what has rightly be named an inconvenient truth may mean that those who have the means to be aware and who have the means maybe to think about an answer, such as the answer you are thinking of, have not the means to formulate this political question, they derive answers from what they know. And an aspect of the inconvenient truth might well be that we are mostly less well-equipped than ever before to generate the political path to what you invoke as a future Gaia 2.0. Here we cross Tim Mitchell's idea: we are not equipped to think another kind of future than the one which was already appropriated by what is called—well—capitalism as it is now everywhere under the

name, “the economy.” Is not the technosphere appropriated by the economy? And the economy might well be defined in terms of an anti-Gaian logic, meaning that it is completely indifferent to the fact that it is destroying habitability, it cannot care less. For it is not a matter of inadvertency; it is its way of being. Yes, becoming aware of Gaia may be described as belonging to the technosphere at its best when we think to the whole array of techniques needed to auscultate what participates in its existence and model its entanglements. But this kind of progress does not equip us politically to face the anti Gaian thing which has emerged. I would recall the parable of the scorpion and the frog. The scorpion asks to the frog to cross the river on its back and the frog tells, “you will kill me, you’re a killer!” The scorpion answers “Oh why would I kill you, we would drown together if I killed you!” and the poor frog says okay, get on, and in the middle of the river the scorpion bites and the frog’s last words are “but why?” And the scorpion, who is also drowning: “I couldn’t do otherwise, it’s in my nature.” What if an anti Gaian constitutive compulsion is in the nature of what we deal with?

So this is the first political problem which makes it important for me to distinguish the two Gaia: the Gaia which was there well before humans, in which we participated whether we knew it or not, and which we now know we have disturbed, and Gaia the intruder. We are quite not ready to progress from the version 1.0 to the 2.0 one, to produce the political, indeed civilizational, consequences of what climatologists made us aware of. I know climatologists were disappointed that when they produced their well-founded argument, politics failed to answer. The idea of intrusion marks that this failure should not be a matter of disappointment as if an active and adequate answer could have been anticipated. Indeed, this anti Gaian being which is called “the economy” is killing politics, is killing our capacity to answer to the question. We have not to do as the frog, trusting that when “they” will understand what is at stake, “they” will help us to progress to a version 2.0. Maybe it is not a matter of progress, rather of what may be called recovering, reclaiming or regenerating. The despot saviour may come and act in the name of the whole, as Bruno fears, but it will not be as a result of a conceptual problem, rather the consequence of the off-ground character of what we call politics. Gaia 2.0 need the regeneration of what I called in my introductory words, the regeneration of the infrastructure of politics.

When Bruno began addressing the question of politics, he made the point: no issue no politics. We gather around an issue and we need an issue to not just talk and babble in general, but to think together. The problem might then be: is Gaia the name for an issue? In his *Facing Gaia*, we find one sentence which might resonate with this question: Gaia is mute, and with her finger she points towards the Earth. Which means that Gaia does not tell us that we have to reduce our gas emis-

sion, or else! Gaia has no message. It is pointing at the Earth. Gaia asks us mutely to turn toward the Earth. This distinction between the Earth and Gaia is important because if we have to answer to Gaia, we have to answer to a creature which we have become aware of, through models which select what it is relevant to work with. We may be moved by the fate of a dying white bear, or shocked by the disarray of Inuit people whose whole way of life is unravelling, who are even killing their dogs, but for the scientific Gaia we are now aware of it is not an issue. However, if this Gaia points to the Earth, asks us to look at the Earth, what we have to look towards is a plurality of inhabitants, an entangled plurality of ways of living which are not to be just defined as inadvertently contributing to the maintaining of Gaia. As the anti Gaian logic is asking us to be indifferent to the unravelling of those entanglements it causes, there is a dangerous proximity between the mute character of the scientific Gaia and the kind of global management a despotic saviour would impose in its name. But this Gaia points to the Gaian entangled interdependency in which we participated and which “inadvertently” generated its robust character. It might be that the political issue which may gather “us,” the many “we” concerned by what is happening, is this unravelling which is devastating all ways of togetherness, from holobionts to what I call the infrastructure of politics.

So my point is now what kind of perspective can be proposed. It is obviously not sufficient to say that maybe we, together with what we are attached to, will perish, but we will be aware of the reasons why we perish. This is satisfactory only for us intellectuals. But one thing we may do, as intellectuals, is to work against the spell which has made us complicit or even spokespersons for many unravelling operations, that is the reference to progress as opposed to regression. We know well this opposition, we hear it when scientists tell those who resist so-called innovation, “if we listen to you, it will be back to the cave.” Today it may become, “we have to trust progress, believe that the power of technosphere will save us, or we will regress to static, closed societies.” I think that we, intellectuals, need to ally and craft the means to identify the relation between what has been called progress and an anti Gaian logic, and debunk all the versions of this “or else, it will be regression.” None should be free to point its ugly head without provoking a loud cry—“we recognize you, here you are again.” Climatologists have done their job, sounding the alarm bell, ours may be to relay them, sounding the resistance bell against all those who promote a one way course, even if it is in the name of the enlightenment or the duty of the critical mind.

This is why I love words in “re,” regeneration, reclaiming, reprise, recuperation, reweaving. None sends back to the past, means regression, walking backwards even if they all point to attempt to revive what has been trampled down as a price to be paid for a walking forward. With the reawakening of Gaia, one cannot walk back to

the past. The political meaning of reclaiming, for instance, conjugates reappropriation against what we have been expropriated from, and healing from the effects of this expropriation. It is knowing that to go on we have to innovate a lot, innovate in the sense of reclaiming the capacity to pay attention to the Earth and not to look at the sky of glorious future. For instance reclaiming the capacity to conserve without defining what is to be conserved as a “patrimonial” good of humanity, without continuing the imperialist story, means the weaving of new imaginative, risky relations with all the concerned parties, against the refrain of “we know better, we are those in charge.”

One of the terms associated to reclaiming since the beginning of this century, is “commoning,” learning, as they say to “think like a commoner.” The reference to the commons first tell about the enclosures, the expropriation which marks the story of England but has been exported in all colonized countries and has become synonymous of modernization against backwards customs. David Western said there is tension between selfishness and cooperativity. It is important to emphasize that it is a tension not an opposition. The point of “reclaiming the commons” is not siding with some harmonious cooperation, a kind of utopia, against greed and selfishness. The old commons were not devoid of conflicts, but they had a culture of self-governance addressed to the question of what contemporary Darwinists call “cheats,” recognizing what we would call greed or selfishness not as the opposite of altruism, but as an immanent problem to be collectively taken care of. The very possibility of this self-governance depends on what I call an infrastructure. To “think like a commoner” is not to entertain off-ground ideals but to take interdependency for granted, to think with consequences as obvious, to accept precarity and fragility as a fact of life.

This culture has been destroyed. The rule of law has expropriated collectives from the charge of caring for what they depend on. Regenerating the commons is not going back to the old commons, but it may well mean reclaiming, cultivating again, the capacity of commoners to collectively think with what their commons demand in order not to be destroyed. Not rules demanding the definition of good and bad, but what Bruno would call the “cultivation of ways of overlapping” and what those concerned claim when they affirm “no commons without commoning.” Commoning is not altruistically forgetting about the “interests of the self.” It is cultivating ways of activating the experience that the selves we are is indeed overlapping with everything which compose the commons. It may be in a difficult, problematic way, but it is the way of the commons: the way which makes the difference between becoming aware that what composes a common are partners or taking for granted principles which identify and divide. This way is not that of a progress but of a regeneration, of a taking less and less for granted and a learning of ourselves as depending on so many other things.

The analogy with the holobiont is obvious but analogy demands interesting contrasts not confusion. I may, now that we know it matters, anticipate analysis of the bacteria populating my digestive track, but it does not mean cultivating partnership: it is my health which interests me. In contrast, peasants who care for the soil may honour it as a life-giving partner which must obtain attention and care in its own right. We cannot define in general what composes a commons, which partners we may be able to recognize at such. What I mean is that the abstract knowledge about all what we depend upon has nothing to do with cultivating ways of overlapping. Such cultivation must rather be considered as a “work in progress,” when the overlap becomes part of our experience and transforms it. Yes, we may speak about progress, here, when it is a question of a healing of anaesthesia, of a reworlding of our imagination and experimenting how collective ways of overlapping may generate and frame the formulation of political issues. So, I think that the culture of overlapping is a way of understanding politics without defining a priori who will be associated in the political process because the question of who is associated is at stake in the process. Political bodies, or rather, collectives, are works in progress.

I will add a last thing. The analogy with holobionts matters because it is not a moral one. It creates an asymmetry which is not moral between a story legitimating greed and selfishness and a story of cultivated interdependence. We may have taken ourselves as individuals but it has meant, and still mean, a long story of formatting, of disciplinary apparatus, of inculcating that reason commands detachment. Enclosure is an ongoing process, and I would add an ontologically violent process. I dare to add this as a Whiteheadian philosopher. Whitehead argued that we have to accept “mutual sensitivity” as what should never be explained because explanation would mean that we start with the hypothesis of isolated, atomic individuals, and if we start like that we will never get out of it. We have to start with mutual sensitivity and this does not mean affirm that everything is sensitive to everything else, but to follow the adventure of the ways mutual sensitivity produces consequences, generates what I have learned to call partial connections, or inflects ways of experiencing. This is why palaver, as I experienced it, is important to me. I understand its constraints as artfully creating a space protected from the confrontation of positions. The point is not to give up positioning but to empower inflection, when we feel that we understand something about the other’s position, which is what the logic of confrontation demands we resist. I would say that palaver may be characterized as an art of transformative encounters cultivating the emergence and intensification of a mutual sensitivity that generates a change in the relationship which each entertains with their own position, their own understanding of the issue that gathers. And again we find the asymmetry between an adventure of mutual sensitivity and the ontological violence which demands that each party holds to their own reasons.

## DEBATE

*Simon Schaffer*

There's an enormous amount of material there: ranging from a kind of post politics of the commons and notions of sympathy, let's not forget the issues that we had to cut off after Tim's intervention.

*Tim Lenton*

Just to express my kind of mutual sensitivity for many of your positions, Isabelle. I mean, I think you beautifully characterized the neoliberal economic thing as anti Gaian and I couldn't agree more. But at the same time we have to look inside ourselves, I know what I do, what I have and I haven't done to divest my investment. I know that I flew here on an airplane, I know I'm a hypocrite at some level. I would ask everybody around the table if we're going to get into the politics, we also have to get into that level of honesty as well, I think, with the situation. So, I really support what you say, and I hope that it was clear from my talk, that I do not want to make this second Gaia really the focal point of "the current political dilemma," absolutely not. All I was trying to suggest is some lessons or learning we might take for some fraction of what we might seek to create together in the future.

And I find it really interesting, I shouldn't preach to those of you expert in metaphor, but the reason I said that I didn't have to fight in science is because I find that a very aggressive and militaristic metaphor to apply to what was undoubtedly a rich set of very strong arguments I would have had over 25 years with colleagues good and bad. But that is, as you all well know, the process of science. So if I was going to pick a fight, I wouldn't see that as the scientific process; on the contrary, the fight is, as Naomi Klein beautifully puts it, and we both agree, it's capitalism vs climate or other vs Gaia at the moment. So, metaphorically speaking, if we're going to go militaristic and aggressive, and into the politics to know our enemy there, well part of the enemy for me is inside myself, I'm afraid, because I'm not a perfect citizen of Gaia either 1.0 or 2.0.

*Bruno Latour*

Great, I think we are at the heart of what we were trying to do in this meeting. It is fitting since we are half way. I'd like to introduce a sort of parable proposition here based on the two talk you've just heard. One of them, and I think there's an

agreement here, is that Gaia.01 and Gaia.02 have different characteristics. Gaia.01 does not deliver, as Isabelle said, any sort of political message. What Isabelle said clarifies the difference between point 1 and point 2. Gaia the intruder is the object that terrifies us. We are terrified to face this intruder and then we turn back to Gaia.01 to begin to see how it differs. So now we can use one of the suggestions that Tim made which is to begin to decipher line after line what is new in the metaphor of politics Gaia.02. One of them, and I'd like to go back, is the notion of autotrophic and heterotrophic because it is one of very important signature of Gaia. Another term is that of "commons" that is coming from law but has clear connections within the notions of holobionts as well. But of course, we don't want to write a new Communist Party manifesto: "innovators of Commons of everywhere unite" because the Gaia.01, that Tim describe has highly specific signatures, one of them is not only complexity but completed heterogeneity of the mechanism by which selection is made. So it's a very enlightening version for the metaphors of Gaia 2.1, which is how many different types of selection can we actually entertain. We learn again from nature what politics should include... Reciprocally, there was something very important in what Isabelle said for me which was the fact that even the description of a primal selfishness and cooperation would be too close and lead too fast to the too famous "tragedy of the common." Here it goes the opposite way, we learn from Gaia.02 what we should look for in Gaia.01.

I propose that we begin each of us to write the list of what signature in our view express best the link between the two instances of Gaia presented today. Could the chairman accept this proposition? It would be useful for me at least if we could move and say "Okay, okay Gaia 1 and Gaia 2 are different but there are lessons from Gaia 1" but we want to re-inject into the Gaia 2 which is a level of complexity of politics which is completely ignored by the capitalist metaphor, but probably ignored also by a large numbers of people working in the theory of the commons. This is just another proposition...

*Simon Schaffer*

Tomorrow part of the homework is going to be thinking up and developing signature concepts—I guess—as potent and as consequential as autotrophism for a reconceptualization of the new body politic. Tim Mitchell is next.

*Timothy Mitchell*

Thank you Isabelle and Tim. It's been a very thought-provoking set of presentations. And I find Tim's presentation of the timescales alone of a Gaia 2.0 is such a

work of putting in perspective some of our own political preoccupations. But I actually want to draw a slightly different conclusion both from the one that Tim suggested—which Bruno has just characterized as “innovators of the world unite”—although not to oppose it, and also in a way slightly different from Isabelle’s, a slightly different political conclusion. Because one of the things, in my own thinking about this thing called the history of capitalism which, I think, helps with this very different temporal perspective, is that I don’t see us up against five hundred years, or a thousand years, of the development of capitalism. That’s not what we’ve got to—that capitalism has reached such a point of strength and forcefulness that we’re almost powerless, other than to turn to small-scale alternatives. And therefore I don’t actually think of the problem as a lack of the spread of an awareness, an awareness one can get reinforced by watching your slides.

And that’s because in my own remarks yesterday I was trying to capture—I would now put it this way—this really very small mutation, you know, in methods of corporate accounting, let’s call it, and in certain legal properties of share ownership and so on, that had an astonishing and devastating effect over a short period of time, very rapidly. But at the same time, the new world of “business” was also extraordinarily unstable. I mean, the railway companies that I referred to were not merely an example. They represented up to 90% of what was being traded on the new stock markets. But within a few decades they were mostly going bankrupt. By the turn of the twentieth century, or soon after, they were either bankrupt or they were being nationalized or reorganized under coordinated forms of management and ownership that eventually became nationalization.

So that new phenomenon called “business” failed. Then of course one can see wave after wave of other attempts to take the same techniques and find some other way in which extracting revenue from the future can operate. The course of that through the next 100 years or so is, I think, too easily seen as the logic of “capitalism” unfolding. It wasn’t seen or understood necessarily that way at the time. By the 1930s a large number of serious intellectuals agreed that capitalism had finished. We were at its end. So Schumpeter, in *Capitalism, Socialism and Democracy*, asks “Can capitalism survive?” and answers no, he does not think it can, it has brought about its own destruction.

Polanyi reached the same conclusion. You know, that’s one example, one can make many others, of the sense that one was dealing with a short-lived, unstable phenomenon that somehow gets stabilized for a while again.

My point is that the kinds of politics that could work on this is not only to try and proliferate small islands of alternatives but to be increasingly attentive to the small mechanisms that can very quickly make unviable the existing things that we’re up against. Just as the business of building massive, unneeded railway

systems very rapidly became unviable. We can think of many other cases of it. I mean, what was it, a couple of days ago? There was a government auction of contracts to build the next generation of offshore wind turbines in the UK, and the price of future offshore wind power has fallen in half in the space of about two years. It took everybody completely by surprise. There are, you know—a part of what produced that future decrease was actually the engineering of the auction system that forced a certain kind of race to the bottom in terms of prices. That system wouldn't have been used before to build power stations. The point is to think about these places where one can intervene not in the alternatives but in the weakening of the existing forces of this world that Isabelle just characterized. The anti-Gaia forces that are not nearly as coherent, as powerful, as indomitable as our accounts of them make them seem.

### *Kyle McGee*

I think it's remarkable that both Isabelle and Bruno had acknowledged taking some relief in the notion of geoscientists becoming political actors—that is, avowed political actors—and I think that Tim's presentation was a really great illustration of how that works. My question really for Isabelle, though, arises out of a quotation from Alfred North Whitehead that is perhaps the best thing he's ever written and is, I think, the clearest statement of the speculative foundation of law. It is, "Every particular actual thing lays upon the universe the obligation of conforming to it." So I secretly view that as the cosmological foundation of jurisprudence, but I'll never write that. It's from *Symbolism*. So, you've done some work in legal theory and you've written briefly about the law of the commons in a piece of research. I suppose my question or my invitation to you would be to say something further about how you see what you may call the obligation to compose the commons, whether you think of that as a response to the familiar "tragedy of the commons," as various strategies or practices of commoning, or as a response to the problems of scale that both Tim and Jonah, and others, have raised from different vantage points. I don't know that I have a suggestion for the contours of the role of legality in this process. You might, if you wish, draw on what Tim said about possibilities of nationalizing utilities and carbon taxes and universal health care and all these different types of sort of technocratic or legalistic responses. I'm not sure that's where you want to go, but that's my invitation to you, so we might benefit from hearing your views on commoning fleshed out a bit further.

### *Isabelle Stengers*

For Whitehead indeed his metaphysical actual entities, when they have obtained their own way of feeling their world lay upon the universe the obligation to conform to it. What is done is done. But the point is that they are also quite powerless to impose the way this obligation will be fulfilled. We cannot just ignore what we inherit from, but the point is always “how” to inherit. This may indeed corresponds to the art of jurisprudence, and more generally of reason, with reasons separated from the power of determining how they will be taken into account. As a philosopher I am not free from the tradition which cultivated the idea of reason, but I can complicate it, separate it from the power to judge and disqualify, as Leibniz and Whitehead already did.

As for the commons, we inherit from a story where the alternative was either to nationalize, or privatize but both ratify what Garrett Hardin has called “the tragedy of the commons,” the demonstration, even mathematical demonstration, that commons were condemned anyway because, as ruled by their short-term interests, they were bound to destroy the common resource. So somebody had to be interested in the long time maintenance of the resource, either private owners or the State. But what he described are not commons but free for all access to a resource, that is a situation where each user is bound to abuse because they know that if they don’t they will be the losers as other will. Since Elinor Ostrom, we have inherited this demonstration by emphasizing “how” it was obtained, by ignoring the self-governance of the commons, which he had to forget but which States also disallow. I cannot ignore the scale problem which what you call legalist or technocratic measures claim to solve, but I am afraid that it may well coincide with the end of politics if it is taken as a solution, that is if it spells out what individuals or legal subjects (including corporations) have to conform to. Corporations know how to cleverly exploit the “how” any conformity communicates with but the regeneration of politics demands that the “how” become a stake in itself, that the question of “customization” with regards to the consequences, to what is endangered or made impossible, be not a matter of tolerated exception but of active commitment implying here again the intensification of mutual sensitivity. The question of scale cannot be answered starting from some global top, neither from some local self-sufficient down. It is messy and demands experimentation, learning from consequences, not clarification, authoritative distribution of responsibilities. Scaling up or down are the kind of political issue which demands the cultivation of an infrastructure of overlapping concerns because whatever the move, its consequences cannot be separated for the way concerned protagonists generate them, do not accept them but learn with them. Which means that messy customary reinventions may proliferate,

which exceed the imagination of designers and desperate people of principles. We need to accept that frontiers and boundaries work as zones of exchange.

*Mike Lynch*

This is mostly a question for Tim, but I think it bears on some of the things all of us have been talking about, Isabelle particularly. What surprises me is—perhaps I’m injecting something that shouldn’t be in the conversation, I don’t know—many people accept the idea of anthropogenic climate change without going through Gaia in order to get there; without adopting the Gaia hypothesis (or whatever you want to call it, ‘theory,’ ‘world picture’) in order to understand climate change or seek solutions for it. And so, I’m wondering, how Gaia makes a difference for understanding climate change. I gather that, because Lovelock made some very dire predictions about what would happen between now and 2040 or so—predictions which are even more dire than the worst of the IPCC’s predictions—it encourages an understanding that is much more urgent and horrible to contemplate. But I’m wondering what it adds to the common view that we read about in popular newspapers, which presents climate change in a rather narrow way as an increase of carbon and methane and some other gases that are produced largely through human activity in the last several decades and centuries. Technocratic solutions can be entertained which would bypass many of the political and moral and ethical transformations of ways of life that we’ve been discussing. Such solutions, if they become possible, would not change the body politic, but would probably retain it, keep neoliberalism in the saddle, and find some device for increasing cloud cover or, you know, doing something to cool the earth or reduce carbon. Even that sort of solution seems to present the formidable political problem of convincing enough people of climate change to begin with, but then to get them to adopt Gaia as a way to seek solutions seems even more formidable. This is what I’m asking about.

*David Western*

I want to address the negative views of metaphors many scientists hold in engaging the public in the complexity of earth and life sciences. If you look at the evolution of any metaphor it starts as positive, because it gives us a placeholder for a complicated idea or process. It allows us to move forward without getting bogged down in endless definitions. Over time metaphors evolve, become richer and more nuanced to reflect the complexity of the phenomenon they simplify. This is the case with the evolution of Lovelock’s original conception of Gaia into the Gaia 2 described by Tim. My question for Tim is whether we should dump Gaia 1 and

find a better metaphor with less baggage, or try to change public and scientific perceptions to fit the new notion. On the positive side Gaia, however deficient, created the new field of earth systems science to probe deeper into Lovelock's Mother Nature metaphor. I've had the good fortune to work with outstanding geomorphologists like Tom Dunne and Bill Dietrich and have seen the field of earth sciences develop and bridge geological and biological sciences. A few years ago Bill Dietrich wrote a cover article in *Science Magazine*, suggesting that if we compared Earth to Mars the big difference is plate tectonics, which he suggests is partly a product of life altering the composition of the earth's upper mantle. There is in other worlds a fusion of earth and life sciences enriching our view of planetary processes. Lovelock was looking for some grand attractor to explain the homeostasis of planetary conditions suitable for life. His homeostatic analogy to mammalian metabolism is wrong because there is no similar integrated system maintaining planetary homeostasis, and of course the earth has veered widely between snowball earth and tropical hot house. But his metaphor resonates with ecologists among others. We talk of the forests as the lungs of the earth. There may be no thermostatic regulator to keep earth within narrow limits as there is in warm-blooded animals, but the metaphor has helped the public see the earth as an integrated system that can be knocked out of kilter and cause rapid climate change if we don't clean up the dirty nest we are creating for ourselves. We now recognize that biological interactions are similar—fractal—at all scales from ecosystem to biosphere, much as the shape of clouds and coastlines are similar at all scales. We also recognize cascade effects apply not only to biological systems—carnivores having a knock-on effect on herbivores and herbivores on plants—but also to the entire planetary system. Gaia has made us aware of the complex interactions of our planet, analogous to the shift in biology from the one gene one action view to the interactions of many genes and environment that create a phenotype. A role of academia, and an increasingly urgent one, is to find common ground among disciplines after arguing differences to death, and Bruno deserves credit for focusing us on the future of our planet. We need to find common ground in language if we are to find common ground in concepts like Gaia. We need simplified analogues and metaphors to explain complex systems and simplify complicated mathematical models—if we are to transmit to the public and decision makers the urgency of moderating human impact on our planet and project the consequences of doing nothing. So I come back to my question about Gaia 2: dump or reinterpret? Retrofit or replace?

*Simon Schaffer*

So, there are two questions. One is what difference does Gaia make to presum-

ably a much more widely distributed acceptance of, that's a rather ironic phrase right there, anthropogenic climate change. Absent Gaia—Mike's point—one might find a very powerful license for geo-engineering, which Gaia 2.0 might rule out completely as anything not only viable, but even vaguely desirable.

Jonah's point is complementary, which is moving to Gaia 2.0 might be the euthanasia of the concept, and that would be telling partly his fortes because of the way metaphors evolve, partly because of the enormous effect, he reminds us, of the whole intervention in the first place on the development of the science you practice.

### *Tim Lenton*

Mike you're very insightful there, I think, because I've wrestled exactly the same question persistently, I mean partly because my own job title extends to being a professor of climate change and a professor of Earth system science. But I'd be ridiculed, and my University would be ridiculed if they called me a professor of Gaia. When I've, in my own institution, postulated that we might call a new institute the Lovelock Institute, for example, my God, the reactions are extremely negative. So there's clearly some kind of—within the narrow confines of my sphere of science—some perceived gap there and I think you were beginning to nail that the problem of the limitations of a pure single-issue approach to anthropogenic climate change is because it misses—I was going to say—the wiring under the board of the interconnections... If you just fixate on anthropogenic climate change and you frame it as sort of a single issue largely around industrial carbon emissions that you can fit into a narrative of how previously there was DDT insect spraying and then there was CFCs and the ozone hole and we knew, we worked out, we could fix those and we know how we fixed those and we know the cultural narrative of that. Then we look at the carbon emission problem, and oh dear this is really about the basis of our entire societies and energy supply so it's in a different class to those problems. But still we want to delude ourselves that it can still be contained, basically, it can still be somehow addressed, or the dominant narrative would like to believe that it can be addressed within the confines of the ongoing neoliberal economic program. I don't think they've articulated how on earth that actually would play out in practice, but we can all live with a lot of cognitive dissonance, that's for sure. So for me why bother going to Gaia is to reinforce a few things: firstly the interconnectedness of the system / problem / phenomenon we're dealing with. Therefore to be able to see that some of the so-called solutions to anthropogenic climate change—and Simon's right to bring geo-engineering into the room, or even what's called these days large-scale greenhouse gas removal or carbon dioxide removal—are enormous technocratic enterprises with huge potential detrimental

side effects on other parts of the phenomenon of Gaia, that we don't fully understand, and on other people's varying power to do anything about it. So I think it's helpful firstly if it just makes us see, even in the present moment in time, a more systemic view of A) the problem, and B) how to assess the myriad or otherwise of supposed solutions. My talk takes the historical narrative for a reason and that's... I'm going to be blunt I think, we collectively talk a lot about climate change and we have a Paris Accord but, and I was about to swear, but in terms of collective action it's minimal, frankly, compared to the scale of the challenge. I think we can debate endlessly the many reasons for that, but I think partly; what is our motivation to act? I believe we've framed the problem essentially negatively and we've been discussing that already this morning—it's about giving up some things that we might in a sort of short term way enjoy. It's framed unfortunately in all of those ways and that isn't getting any collective traction, I'm afraid. It is therefore for me interesting to think about how we have to recover this deep appreciation for the rest of the fellow citizens of Gaia be... they... whatever... microbes or whatever. We need to kind of appreciate what I would call, I'm not religious but I would call, the miracle of our own existence. I think only if you can find something very deep seated in that, speaking personally, can you actually find the motivation to truly change. That's my personal experience. For example, I teach a massive open online course on climate change but I actually use it duplicitously as a vehicle to introduce people to this deeper perspective, because I think that's where some of the log jams are in ourselves both in our personal and in our political action. And as for Lovelock's predictions I mean I obviously love him dearly but they are not to be treated with the same epistemological status as predictions coming from climate models (which also can be readily critiqued). They are Lovelock's intuition, but the great thing about Lovelock's intuition is it has the spectacular ability to be right. So then we come to... am I going to dump Gaia 2.0 as a working title? Maybe I should tell you very briefly that I didn't come up with that, that came out of convening a transdisciplinary group of fellow academics at my university to have a first retreat to gestate this idea of a new Institute which I, for my sins, have a sort of intellectual lead role in. It was walking on the beach on a retreat in Cornwall with a couple of colleagues, one of them a former student and one a bioscientist where they actually proposed the name. I was struck by that, because actually what was going on in that particular retreat was a discourse partly around the role that utopias play in our society and in previous societies. Other people were converging on this idea that what we've really got to articulate is what we want to work towards, and we're going to give that a name. Gaia 2.0 was the name they chose not me, but sitting here and on reflection at the end of this week I might ditch it. I'm a comprehensive school kid and I don't have a good training in the classics so,

I can't remember who Gaia's offspring were other than were they the giganti sons who fought in the war with the gods? If any classical scholars would like to offer some alternative name I'm all ears here.

## For a Juridical Ecology of Ligatures

*Kyle McGee*

I initially had a much longer and more technical version of the talk that I'm about to give, in the interest of clarity and therefore at the risk of misrepresentation, I've spared you some of the riches of legal theory and practice so that I could be certain to address questions that I think are common to all or many of us: my way of conforming to the obligation of the theme, the panel, and the lovely terrain of San Giorgio. I think that at least two demanding jurisprudential problems are summoned into being by what Bruno calls the new climatic regime. One is the speculative demand that legality be transformed in such a way that it becomes possible to establish durable legal bonds attaching deed to doer or act to actor, which is really a conventional Lockean articulation of a liberal mode of legality in the face of a new world of distributed action and network effects in which it isn't exactly clear who is enrolling whom in which course of action, causing a kind of breakdown of our inherited liberal ideas about liability and responsibility and obligation and so on. The other is this basic juridical demand that how we conceive of law as such must be transformed on a far more fundamental level, precisely because it's no longer possible to distribute the *Sein* and the *Sollen*, the is and the ought, the fact and the value, or nature and culture, if you like, in quite the way that the moderns did in building their legal systems which we now inherit with our practices. The sense in which the very notion of law must be transformed is this: the mere construct of a legal system made of rules, of norms enclosing an autonomous rationality must give way to the notion of law as a particular distribution of agency whose purpose is, in fact, to distribute various forms of agency. The reason, in a word, is that the logic of normativity on which the old system is based no longer makes sense once what

is fact and what is value has been problematized and reorganized, cross-contaminated, and fact and value are exchanging properties in all sorts of very interesting ways. I want to start with that second point, which in a way is more fundamental. The economies that I'm alluding to here, fact and value, *Sein* and *Sollen*, are all admirably captured, at least in part, in the Whiteheadian account of the "bifurcation of nature," and I know Didier will be discussing, I imagine, at more length and maybe with more depth—actually certainly with more depth—than I will. As a lawyer, I'm only interested in the surface of things. I'm interested in the way this bifurcation shows up in the law. Oddly enough, this bifurcation isn't exactly a modern phenomenon of law, but a classical one. There are some historians of antiquity who do argue in fact that the Roman Republic marks the birth of modern constitutionalism, because it's the moment when the law triumphs over the political state, and it's with the Roman notion of "Right Order" that the instrumentalist view of law that predominates in the ancient Greek tradition is finally unseated and the relationship of law to politics is inverted. In other words, the bifurcation here may not be a sign necessarily of modernity, it may be a sign of something else—what it is I'm not exactly sure, but it would be a millennium and a half before philosophy and the sciences would catch up to law in this regard.

In any case, I mentioned yesterday, in some of the comments in the exchanges we had, that this splitting gesture, this operation of bifurcation shows up in the dichotomy that was created by the Romans which divides the person from the body. This is, in a way, the heart of all the misconceptions within the law and about the law, a sort of original sin of the law. The way it works is that the Roman law is, according to Gaius, apportioned into three broad regions: the law of persons, the law of things and the law of actions. The law of persons establishes a quite rigid hierarchy at the apex of which is the free citizen possessed of will or *animus*, at the base of which is the slave who thus borders on the category of thing, an object of rights and not a subject of rights, possessed only of a body and not even really capable of possessing that body. Between those poles lies a whole range of possible positions greater than slave but less than free citizen, which would be articulated by a variety of different dimensions such as age, sex, mental competence, previous history as a slave, reputation, nationality and so on. The capacities and incapacities that are available to a person, like the ability to own or alienate property, take on debt, issue credit, enter into contracts, sue and be sued, marry and have heirs to whom property can be left, all these instruments are determined by his or her position in these overlapping hierarchies, which is all within the law of persons. The impression that we get from this order of *status* founded on the law of persons is that it is a distinctive and, in some sense, autonomous reality, quite separate from the experiential manifold of lived reality. Accordingly, there's a fundamental difference between

ownership or holding of title to lands or things on one hand and possessing and using that land or those things on the other, and the former is supposed to be the subject of formal legal roles and modes of reasoning designed to allocate rights and duties in accordance with the Roman sense of Right Order, or *ius*, in the event of a dispute. While the latter, possession and so on, are really just questions of fact. The law of persons and indeed the whole legal order creates a kind of augmented reality in which these strange semantic doubles and discursive doppelgangers of bodies are the real actors, the bodies merely being taken as illusions or fictions or epiphenomena as far the law is concerned. The gesture of bifurcation on which this whole order of *ius* or Right Order depends has multiple steps, but they can be summarized and condensed into just two - the splitting operation and a subsequent operation of suppression. So in the founding gesture of the law of persons, the being is split into an inert material substratum and an active juridical form, and the substratum is subsequently submitted or subordinated to the form. The term *persona*—and if I was really creative, I would have brought the Venetian mask that I bought when I was in town—derives from the Greek *prósōpon*, originally the mask of an actor on stage, the form of representation necessary to present something fundamentally absent, a mute being, an absent being, a fictional being, or a dead being.

In the law, the *persona* is the medium through which a body can act, meaning of course that the agency of bodies is strictly limited by the status-oriented restrictions of the person to which it refers. In this regard, there's an interesting connection to some of Didier's texts where he tells us about possessive subjects and it's fascinating that this notion of *persona* that we're working with in a legal arena suggests strongly that a person is something one *has* as opposed to something one *is*. But I'll leave that alone for the moment. The person serves, in this way, to individualize and to discipline bodies. Of course, it also enables the individualization of groups, and I note that the Roman law recognizes a few different forms of collective personality, the most notable ones being the *collegium* and the *universitas*. All the classical writers rejected the notion that the legal personality of the group corresponds or correlates to a body. (The most radical thinker here, in the classical tradition, is the jurist Ulpian, who argued that the collective legal person corresponds to the aggregate body of the members of the group. The person became a mere semantic artifact when only one member remains. Very intuitive.)

So this is the dominant account that's taken up in the High Middle Ages, when the problem of the body politic resurfaces. For instance, there's the famous story of Pope Innocent IV, who in 1274 was called to decide whether a congregation, a chapter of the church, could be excommunicated. And he held that it couldn't, because the *persona* of this *universitas* was a mere name-in-law. The jurists, known as the glossators and the commentators, took a variety of different positions on

this issue around the same time. A number of theories were worked out, the most expansive being that the body of the group is what we can call an original entity or unity, a reality unto itself, which is a legal translation of the theological notions of *Corpus Christi* or *Corpus Mysticum*. Other writers maintained that there was instead only an aggregation of individual bodies. What is really interesting about this is not whether one or the other is right, it's that there is this continual oscillation of positions on the question whether the *universitas* has a body of its own or is instead many bodies, none of which is its own. And is that body a real organic thing, or is it only something constructed within legal discourse, which we should acknowledge not as a reality, but as a fiction.

There have been a massive number of relevant transformations in law and in political theory and political theology since the Middle Ages, but it's notable that the question regarding collective legal personality and corporeality re-emerges in our discussions of holism and of individualism, it keeps recurring in new contexts. The way this crops up in my daily life as a practicing attorney is really fascinating. In securities fraud cases, for instance, there is always this question of what we call corporate scienter, which is corporate knowledge and intent: did the corporation, as distinguished from its employees, know that its financial reports contained false and misleading statements? Did it intend to mislead the public? How are you, as the lawyer opposing the company, going to prove that it knew of the falsity at the time this statement was made? How do you construct the knowledge and intent of an artificial person? And similar problems arise in consumer protection law: did the company itself install the emissions defeat device in vehicles that it sold? It recurs in environmental law: did the company go out into the field and inject the Oklahoma plains with fracking fluid, multiplying the number of earthquakes and corrupting the groundwater? To make the point that the company itself knew these things, did these things, and intended to do them, and conversely from the defense side to establish that the company knew and did no such thing, that the bad actor here is really some rogue employee off on a frolic and detour, it requires the lawyers to vacillate, and to take what we would consider inconsistent positions. It's very conceivable that you would see multiple lines of argument in a single legal argument, right? One line of argument presupposes that there is a meaningful distinction between the corporate person and the employees or agents representing it, purporting to represent it. And another line of argument in the same legal brief may take the contrary position, or at least make an argument that presupposes the contrary position. And that is not looked upon as intellectually dishonest despite the epistemic dissonance. There's something fundamental about what the law is that generates this kind of oscillation, this need to weave back and forth between what are otherwise considered inconsistent positions.

If I want to argue that the employees are acting for the company, I'm usually going to argue that they're basically the media of corporate knowledge and action, and the other side usually can argue that, in fact, they're not capable of representing the company because they weren't instructed by management or that, as a rule, only those senior managers can act for the company. In the end what's interesting is that, in a doctrinal sense, this question really can't be answered in a permanent way. It's a casuistic, case by case decision, always is and always will be, as long as we have the structures we have. My point now is simply that there's something about the law that seems to *demand* this kind of movement, this kind of vacillation. It's a requirement or a constraint that is grounded in the bifurcation of person and body. We can see in legal doctrine, and even in contemporary legal practice, a repeated shuttling and shifting back and forth between two registers that are thought to exhaust the real: we would say materiality and discourse today, but we could also say naturalism and constructionism or ontology and epistemology or being and thought.

There is a great example in this regard that appears in a book that Mike Lynch recently published. He was an editor, it's a book on ethnomethodology and law. One of the authors, Tim Berard, shows how hate speech law depends upon this kind of to-and-fro movement between organic reality and social construction. The hate crime is obviously a label of deviance that has specific consequences or effects in a particular symbolic system: an act that is classed as a hate crime subjects the accused not only to a stiffer criminal sentence, if convicted, but it brings along a stigma and opprobrium that we reserve for those with an ethnic, racial, sexual or other bias in carrying out their unlawful acts. So, in a strict sense, a hate crime is a legal construct that's quite distinct from the underlying act. Such crimes are labels in the important sense that they capture a mode of deviance which is subject to enhanced punishment and symbolic, moral, or political condemnation which may alter the matrix of relations in which the one that's subject to the label is bound. But if we rigorously maintained that position we would close the doctrinal category in on itself, as there would be no way to conceive of hate crimes other than those already recognized or labeled as hate crimes. Unrecognized acts of violence or discrimination are not hate crimes until they are formally criminalized as such, but they cannot be criminalized as such if they are unrecognized, so it's necessary to address such acts *as* hate crimes in order to accomplish their legal recognition. This breaches the naturalism / constructionism binary. In another words, proponents adopt the constructionist ontology of hate crimes to preserve the efficacy of the label, yet they're constrained to deploy naturalist strategies to argue that the violent act is a hate crime that is *not yet* recognized as a hate crime by the criminal code, that it has some kind of organic existence as a hate crime in the real world and the

law simply needs to catch up and reflect that fact in order to construct the act as a recognized legal offense.

But while Tim Berard's analysis of all these issues, which I'm recounting, is very instructive, it does not pose the elemental question that I think it is nevertheless grappling with, which is "why is this ontological shifting necessary in the first place?" It's a question that applies to the existence of categories like hate crimes, but also to the existence of corporations, individuals, rights and duties, powers, privileges, and liabilities, and so on. For those of you who had a chance to read the *Heathen Earth* book that I wrote, I raised a similar point with respect to the public trust doctrine. This is the notion that the government, in particular the federal government in the United States, is in the position of public trustee and has certain fiduciary or other legal obligations to protect and preserve a variety of ecosystems and public waters, air, and so forth. In order to make that argument, you have to appeal in a naturalist vein to the pre-existence of some type of duty: you, the government, have an obligation, perhaps no court or legislature has said you have the obligation, but I'm saying you have it, and I'm going to try to get this court to agree with me and say that you have that obligation, and that you've fallen short of it, and must do something specific to discharge that duty. Exactly the same kind of dynamics, the same kind of oscillations, come into play there. Indeed, the whole construct of the *ligature*, which is a concept that I begin to lay out in the *Heathen Earth* book, presupposes that legality extends beyond positive law or formal state rule systems due to this constitutive tension and hybridity. The agitation or the uneasiness that Berard detects reveals that our categories, in this case a "nature out there" and a "discourse in here," are inadequate to the reality of the law; that the ontology of law is poorly understood using notions like these, and that its ontology resists these kinds of inside-outside dichotomies entirely.

That's one of the reasons I think that actor-network theory is so useful to the study of law. It helps us, I think, to see that the drama of law plays out entirely within heterogeneous networks of associations and translations that are neither really natural nor social. The undecidable dispute between natural law and positive law, which is a very famous legal-philosophical dispute, would in this light be but an artifact of an interior-versus-exterior topology that has been grafted onto law, but which doesn't necessarily have anything to do with law considered as a distribution of agencies, since the struggle for dominance of naturalism and positivism *is* law. And we can say, I think, much the same thing of the other oppositions and controversies about the make-up of law, such as rule-centric formalism and pragmatic realism, or opposed judicial philosophies like originalism and living constitutionalism. The problem with these kinds of oppositions is that, on one hand, they're competing accounts of what law is, but their oppositional structures conceal

the fact that *controversy about what the law is*, is the law.

That's well and good, but in a sense it only defers the issue. What can we say in an affirmative sense about legal beings, beyond that they are neither natural nor social, and how they relate to the reasons that we're all gathered here?

So, here is my proposition: this pivoting between materiality and discourse, or nature and society, is not so much a to-and-fro across a stable line of division or a reliable threshold, moving between two distinct domains of being. It's more of a constant exchange of perspective within a manifold, and I think we need to understand this manifold. *Within* is not quite the right proposition, or metaphor, because I don't think the manifold is something different or other than the exchange of perspective itself, and "within" tends to suggest an indifferent container into which diverse contents can be poured or that the exchange that I'm interested in here is occurring within some kind of single undivided continuum, as the materialists like to say, like an unbroken "natureculture." I think that all of these constructs tend to suck all forms of agency into a black hole, collapsing them into an undifferentiated mass or else scattered in to pure multiplicity, pure diversity which is just completely intractable.

By manifold I mean a continuous and open sort of multiplicity that must be assembled, and is assembled, in the ordinary circulation and migration of the beings of law. The philosophical challenge is to capture this aspect without enforcing a closure of the essential "whatness" of law, reintroducing a transcendent form of law as such, because that would simply repeat the logic of splitting that has for so long licensed controversies about what the law is while at the same time concealing that the law is those very controversies. It's a deeply theoretical problem with empirical answers, or else an empirical question with a philosophical answer; I'll figure that out eventually.

What I'm suggesting is that the movement of beings like powers and liabilities and rights and obligations and personae and so forth generates a whole juridical ecology of ligatures that orders interactions. That's a controversial statement so I want to be clear: I don't mean that it orders them in a truly deterministic sense, but really by establishing a kind of sequential relay in the form of connections and correlations and correspondences, which can always fail.

Now, legal beings circulate and migrate in the world, not only in legal texts where they can be domesticated and neatly arranged and turned into systems. If they circulate more broadly, it's always at the intersection of multiple regimes of action or modes of being, and that's why I called them *relays*. They prompt action, they catalyze, they sustain different forms of agency, many forms of human and non-human agency that materialize in an ongoing trajectory of action. A good touch point or example is the notion of legal obligations that are encountered in

experience, not only in formal legal arguments. So, not an obligation as a textual or semantic artifact, but an obligation that materializes in a stone wall or in a police taser or film image or a conversation or a market device like the wage standard. These media become means of *diffusing* and *broadcasting* legality. Legal beings don't have the kind of durability that a stone wall has, so it's not that the obligation materializing in a technological artifact is somehow built into the material thing in a permanent way—which is incidentally my favorite way in which some people misunderstand my argument. The obligation is instead generated and regenerated in the interactions that it, in a way, incites in concert with the artifact. It's a step in the trajectory of action, as I said, and it doesn't survive the trajectory that gave rise to it. The trajectory can take any shape: the politics of infrastructure renovation in Paris or Tehran, the production of clinical judgments in mental health care, or the intervention of the snail darter species in the Tennessee Valley Authority's dam project, are each going to yield very different legal bonds, all bound to their generative trajectories, that are incapable of being transported beyond them. This has a somewhat radical consequence.

What it means is that the legal bond forged in a specific, local trajectory of action is only going to subsist during the pendency of that trajectory, so the legal bond only holds *just there, where it occurred*, to speak like Harold Garfinkel. Here I'm virtually an ethnomethodologist, or maybe an Hegelian caught in a bad infinity, because I'm arguing that the bond is not something that can get beyond or outside of the encounter where it's situated. My interaction with a technological delegate, what Bruno calls a *lieu-tenant*, set up by somebody who has claimed the right to exclude me in the form of a wall—a claim that will achieve a kind of performative expression in my duty, or my interpretation of the duty that it imposes on me—establishes a very temporary transient relation. The absent property owner is constituted *as* property owner by that interactive process, but only *for me* and only *just there* and only *just then*. The stone wall may be doing all sorts of other work that is subject to a technological or engineering analysis, but if we are doing a legal analysis in a very empirical way, that's the case. And that is because that's how the force of law operates: *it passes*. It becomes with other beings, learning from them how to feed a trajectory forward into the next step. That is one of the reasons why I argue in the book I circulated ahead of our meeting (*Heathen Earth*) that law is intimately connected to place. But place is not a static or “simple location,” to speak like Didier, it is a taking-place, an occasion, a temporal as much as a spatial phenomenon.

If I'm caught crossing over the wall, the owner could institute a formal proceeding and allege that I've committed a tort: what we call trespass to land. There's an institutional mechanism for reprising this legal bond and transporting it, extending it into the body of law, the *corpus iuris*. Written laws are undoubtedly far more en-

during and better organized than the vast corpus of unwritten law in the ongoing universe of things and interactions. It's in this institutional or formal mechanism that a legal bond, or even a legal persona, can be *prolonged* to support the constitution of an identity, an enduring and accountable "me," through a process of imputation that calls for the reprisal of scattered subject-positions. The legal techniques of imputation are what I want to move to next, and that actually will bring us much closer to Gaia...

The way that imputation concretely works vindicates Didier's Whiteheadian argument that identity is a route or pathway of historic occasions, but we must add that these have to be reassembled. Bruno and I have both written about this issue quite a bit, and Mike Lynch has shown how it works when lawyers forensically reconstruct statements and actions in deposition or courtroom testimony (including a very amusing case of Steve Fuller providing expert testimony in favor of creationism), and I do it to earn my living on most days when I'm not doing things like this. Even when we're dealing with written law and a formal institution, it's still a question of hybridity and ontological interference. The written word is like a stone wall, a technology and a site of *lex animata*, animate law. So, even in legal texts, where purists tend to think they'll find law with a capital L, or as we still say, "black letter law," they're really finding *hybrid legalities*, or conjugations of legal and technological beings that have been black-boxed through repetition and successful historic campaigns to identify a preferred set of statements with the law. There is nowhere we can go to find law in unmediated form, it's hybridization and mediation all the way down.

So, although the obligation is generated in a transient encounter and can't subsist outside of that encounter, it's possible to compare similar encounters in entirely different media ecologies. If we do, we find a different dimension of expression at work. We can see the obligation to refrain from entering an enclosed space expressed not just in writings or in barriers, but also in the market manipulation of a price fixing cartel, for instance, to exclude competitors from a particular market space, or even in a close-up cinematic image displaying a husband's jealousy which transmits to spectators a particular affective or emotional model. By connecting up many disparate expressions which seem to have absolutely nothing in common with one another, it's possible to construct not a legal system made of rules or norms, but a contingent circulation of standards, disclosing aspects of law's unique ontology: an ontology grounded not in a clean inside-outside dichotomy or the purity of the norm but in *more*, not less, heterogeneity, entanglement, and interference. Precisely the same kind of work has to be done to construct the familiar legal system made of rules because, if I'm right about the irreducible hybridity of law and if we agree that where a legal bond attaches, it attaches locally and provisionally in a

specific trajectory, then what's achieved in *any* interaction, whether it is an everyday experience or a formal court proceeding, is always only a fragile, temporary stabilization. The mirage of the pre-given, pre-constituted legal system or "institutional normative order," as legal theorists say, emerges only through the theoretical act of *neglecting* the essential labor necessary to connect up these trajectories. If these things are not *made to* connect, then they don't connect, they don't resonate. One illustration: if you look at any legal brief or judicial opinion, you will see citations to what we think of as precedents, other cases. The point of the citations is not to boast of the author's erudition; it's to establish a connection. So, there's a sort of provisional systematization that works out this way in actual disputes.

One implication of taking this approach to the composition of legality is that law can no longer be understood as confined to a professional legal discourse or to the state organs of law. It disables the bifurcation that yielded the stratum of Roman *status* as a transcendent plane of organization, which is the same bifurcation that divides legality from materiality. It shows that, in at least one crucial sense, this superordinate level of legality is woven deeply in with the subordinate level of corporeality and performativity. The question whether legal beings, from duties and liabilities to corporations and states, are either organic or discursive is shown to be poorly posed. They are *events* inscribed in a circuit of expression that constantly undoes that opposition while, at the same time, constructing the manifold of law's ontology. The result is not a ubiquitous or unlimited law as some materialists proclaim; instead, the effect is to *increase* the differentiation of law from other ontologies, even as it becomes more apparent that such differentiation consists precisely in more heterogeneity, entanglement, and interference. And it means that the legal discourse that these movements authorize—the arguments of lawyers, courts, and academics—are not to be measured for their consistency or integrity, as some legal philosophers claim, but are to be measured by how well they prolong and sustain and transform the traditions of legal argumentation, of what counts as a valid argument, of what counts as falling in with the direction or sense of legality, preserving for future deployment the forms of argument inherited from the classical, medieval, and modern past.

I will close with some remarks about the speculative question that I raised at the outset: can we remodel our constructs of liability and imputation to forge durable bonds between doer and deed in a world of massively distributed action? I think it would require a few innovations. As things stand, state law limits legal personality to individual legal persons, meaning the persona of the solitary human being or the singular corporate entity. What's needed, however, is a mechanism of distributed imputation and collective liability that could sustain a legal action against, for instance, an entire industry or a broad assembly of co-conspirators who act in relative

ignorance of or detachment from one another. In this way, the state and its legal apparatus could become a critical ally in the climate struggle. This becomes thinkable if we can shift out of the paradigm of the person, but I confess I'm still fumbling for a concept that can capture the network effects of distributed action in a model of collective liability. It might not be possible without a serious overhaul of the legal apparatus of the state. We are also in need of a new notion of injury. Injury is etymologically *iniurius* which means out of accord with the order of *ius* or right. The one who has suffered injury is the one with standing to institute formal proceedings; with a radical reorganization of injury, we could perhaps envision a new mode of formal proceeding to redress collective ecological injuries. The classical Roman doctrine of *actio popularis* is an important precedent: it's a doctrine that permits a kind of civil arrest made not to redress a private injury but to redress a *public* injury. Finally, there's a problem of scale associated with the notion of what Bruno called *jus publicum telluris*. As this proposition shows, we need some sort of institutional re-imagining of our legal orders and the question is: How do we get there? I think that if we take the notion of ligature seriously—that legality is inscribed in interactions—it doesn't seem to be a problem of scale any longer, but rather more of a problem of extension, of extending the network of translations to bring in more and more actors, more attachments. Unfortunately, this means, in my view, that nothing short of a transformation at the level of doing or performance is going to be adequate. We have to bear in mind that constitutions, legislation, and policy materials will only be one actor among many, with their efficacy constricted by the things that their successors and interpreters do with them, as Isabelle has shown in her own way. But maybe it helps, in formulating such documents, to think of legality not as a top-down enterprise, but more as a living, breathing, spreading transversal rhizome.



# Scaling up the Governance of the Commons to Sustaining our Planet

*David Western*

It's a privilege to join the company of philosophers. I've never had anything to contribute to philosophy, but I'm delighted to find out that there's such a thing as Western Philosophy.

I'm going to turn to an Africa long before advent of cities, market economies, sciences, philosophy and the body politic. How did we, a puny species, manage to survive and thrive in the savannas against a formidable array of large herbivores and carnivore competitors? How did we come to be so dominant a species ecologically as to eliminate our competitors, reengineer the landscape, create empires, modern nation states, megacities, reshape the biosphere and change the earth's climate? And, yet how is it that one group of people at least--those who remained in Africa--managed to coexist with wildlife? As a conservationist dedicated to saving wildlife and an ecologist concerned about the future of all life, our own included, in a human-dominated world, these are questions I've spend decades pursuing.

I chose as my study area Amboseli, an area of woodlands, plains and swamps on the foot slopes of Kilimanjaro where people and wildlife still coexisted and moved freely with the seasons as they had for millennia. Having grown up in Tanzania, to me the coexistence of people and wildlife, not the national parks where people had recently been removed, was the natural state. I had to discard my ecological injunction at a European University that I should study natural ecosystems if I were to understand nature, natural meaning pristine places free of humans. At the University of Nairobi where I enrolled for my PhD, I was particularly intrigued by how the pastoralists had sustained the productivity of the grasslands and an abun-

dance of wildlife, despite the prevailing views epitomized by Garrett Hardin (1), that freedom of the commons brings tragedy to all. Hardin cited pastoralism as his *prima facie* evidence that open access use of natural resources results in overuse and destruction of the land because it is in no individual's interest to regulate his exploitation.

What lessons do local communities with strong sense of identity and history of living within limits of ecosystems have to offer us as disparate cultures merging into a global society approaching planetary limits?

"If you wish to understand Amboseli, you have to understand it through the eyes of a cow," I was told by a Maasai friend who gave me two cattle to tend. I learned far more about pastoralism and Amboseli out herding cattle than I did from my scientific research, but both would go hand in hand in my understanding of the savannas (2).

In tending my cattle with the herds of my Maasai mentors, I began to grasp an indivisible link between family, herd, society, culture and environment among subsistence peoples tied to the natural productivity of the land. Russian agronomist Nikolai Vavilov called peoples so intimately linked to the land *biocultures* (3). The Maasai refer to the interlocking relationship between wellbeing of their family, welfare of their herds, health of the land and prosperity of the tribe as *erematere*. Over-milk the cows and the calves die and the herd shrinks. Deplete the grasslands and the entire herd and family suffers. Destroy the land itself in a free-for-all competition with neighbors and the whole community faces a tragedy of the commons.

The key to the productivity of the herd is mobility. There is an energy bonus to migration that comes of keeping herds up with the youngest and most digestible grasses which track the erratic rainstorms. Migratory herds hold better condition and produce more milk and calves than sedentary herds trapped on poor pastures. A herder also has to ensure that he has sufficient pasture set aside to see his animals through the dry season and droughts, and that other herders won't rush in and use it up before he does. Up against harsh seasons, ephemeral pastures, wild animal competitors and hostile neighbors, no individual herder can survive alone in the savannas. The large ecological scale a herder needs to be productive, resilient and safe can be achieved only by relying on a social network of family, friends and clan associates identified by a common name, affiliation, husbandry practices, customs and regulations, agreed and enforced by common consent. The grasslands are managed collectively to mutual benefit to see families through the worse times and avoid destroying the land (4).

The survival and productivity of the herd is the bedrock of Maasai success. Livestock holdings govern how many wives a herder can afford, using his animals as bride price. A herder must have a refined knowledge of the savannas and expert

husbandry skills to keep his herd safe and healthy and his family supplied with milk and meat. Children add extra hands for splitting the herds and grazing them more efficiently in the dry season. The cow's udder is a barometer of a herder's success. How he grazes his animals, how far he walks them, how often he rests, shades and waters them, are among the myriad of decisions that affect how much milk his wife collects in her gourd to feed the family. If reciprocity is the glue that binds together the Maasai peoples, ecological savvy is the bedrock of their survival and adaptation to the savannas.

Selfish herders are ostracized by their neighbors. A tribe of selfish individuals falls prey to tribal neighbors who manage their grassland better and are more collaborative and cohesive as a society. The social networks, common identity and cohesion is not built around the body politic in the Western philosophical sense, for mobile pastoral societies have no central seat of government or political representatives. Social networks are built instead around a body of the cow. The cow is the economic and ecological thread and social epicenter of life that binds and bonds the Maasai to work cooperatively for greater collective gain. Cooperation, built on reciprocity, is key to Maasai success in exploiting the savannas, surviving hard times and staving off war-faring competitors is based on the physical tie between mother and calf. Maasai bonds are tied figurative by the cow-calf umbilical cord. An exchange of sheep is the first bond of friendship and reciprocity. An exchange of cattle is a far closer bond obligating partners to help each other out, come what may. Other forms of reciprocation range from lending cattle to someone in need and being paid back when his luck improves, to putting animals in an associates herd (*enктаaroto*) for safe keeping. A herder may lend a milking cow (*ketaaro*) or breeding bull (*aitogaroo*) to a friend worse off than himself. In hard times when his herd is too small to feed his family, he may offer his own children to tend the herd of neighbors better off and in need of help managing a big herd. *Oсотua* is the most altruistic act of all, the ultimate generosity of giving cattle to a hard-up person in your network without expectation of a return (5).

How though, can the pastoralist's coexistence with wildlife be explained when wildebeest, zebra, buffalo and other large herbivores compete with his livestock for grazing, and large carnivores like lion and hyena kill his cattle, sheep and goats? The answer lies in the mobility of the Maasai allowing sufficient space to evade close competition, in knowing how to avoid and ward off dangerous animals, and in having many cultural values for wild animals, including seeing them as "second cattle" to see herders through harsh times when their own livestock succumb to disease and drought (3).

I could go on about the social and ecological connections which bind pastoral societies and give them a common sense of purpose, identity and culture, but there

is another feature of their success that bears on how we can avoid breaching global limits as we reach peak population, consumption and waste: the feedback link between knowledge and ecologically sound action. In traditional societies young men are deployed as scouts to reconnoiter the best grazing grounds, water sources, settlement sites and the risk of diseases. The information is relayed back to elders who probe the scouts on the veracity of their reports and collectively decide on when and where to move their herds, and when to sanction the use of the dry season grass banks. Information is continually collected and sifted and, in time, builds up a body of knowledge of the best husbandry practices, and ways to avoid hazards and minimize risks to herds and people. Knowledge informs action and is continually improved and refined by in a tight feedback process akin to natural selection.

How valid are the lessons from traditional subsistence societies in the face of faltering customs, rising land pressures and shrinking space? The steps I took with collaborators, Maasai community leaders in particular, laid the ground for developing new values for wildlife, including ecotourism enterprises on community lands. Where the benefits fell short of covering livestock losses due to wildlife migrants from park, an annual fee (now called payment for ecological services) was paid to offset the herders' losses. The community-based conservation initiative in Amboseli, supported by the government and the Wildlife Conservation Society, led to a new wildlife policy, legislation and a national wildlife and tourism program funded by the World Bank. The Amboseli community-based conservation initiative was used as a case study at the World Parks Congress in 1984 to expand the concept and ambit of national parks to conserve the surrounding ecosystem and support sustainable development (6). In 2014 the Kenya experience of winning space and a place for wildlife beyond parks through community engagement contributed to the World Parks Congress mission of widening the purview of parks yet further to include the improvement of human wellbeing. The expanding mission and scope of a national park from its roots in American monumentalism to ecosystem conservation, biodiversity and human betterment reflects the evolving views of conservation in response to our deepening knowledge of our planet and our sensibilities of nature (7).

It is one thing to test, validate and promote the possibilities of community-based conservation in a pilot program like Amboseli, quite another to have it grow and spread of its own momentum. To do so, CBC it must cut across many disciplines, sectors, interest groups and jurisdictions and, in the process build up networks, coalitions and institutions. In the Kenya case we devolved wildlife conservation and management from a highly centralized government institution to legally constituted communities of land owners given the rights and responsibilities for wildlife conservation on their lands. The initiative was launched as a national program,

bolstered by funds to help build community capacity for conservation and tourism enterprises. In the last twenty years, over 150 private and community associations across Kenya have set up conservancies covering more area, tourism enterprises and wildlife than all national parks combined. The associations also employ local scouts and resources assessors to protect and monitor their natural resources (8).

Researching and promoting community coexistence with wildlife took me well beyond my academic and conservation skills, from researcher, to planner, to director of national wildlife agency and international NGO programs. The experience in breaking down disciplinary barriers, bringing together various interest groups and creating enabling policies and institutions proved invaluable in convening an international workshop in 1993 at Airlie House in Virginia, aimed at exploring and advancing the notion of community-based conservation. The gathering drew together examples of successful community fishing, farming and wildlife initiatives from around the world, along with donor agencies, NGOs and scholars. Each community had a unique combination of practices, customs and institutions, but a common identity, rules of collaboration, ecological savvy and the ability to use its natural resources sustainably. The proceedings compiled in *Natural Connections: Perspectives in Community-based Conservation* (9), helped consolidate and precipitate the community-based conservation movement.

So much for cohesive communities showing that with close social and ecological connections it is possible to solve a local tragedy of the commons. What of curbing insidious greenhouse gases emitted out of sight and mind in the global commons and beyond the jurisdiction of the nation state?

The breakthrough in showing that similar rules apply to managing the commons from a local to global scale—from parking lots to air traffic lanes and open water fisheries to air quality—came from Elinor Ostrom in her ground breaking book, *Governing the Commons: The Evolution of Institutions for Collective Action* (10). Ostrom, a political economist at the University of Indiana, showed how communities can solve the Tragedy of the Commons without the strong regulating and enforcing hand of government or the privatization that Hardin insisted were the only solutions. Ostrom's drew on examples from around the world where communities have sustained common property resources for generations, including Swiss grazing pastures, Spanish irrigation systems, Italian communal fisheries and Japanese public forests. She identified eight key ingredients of success: a strong group identity, a need for collective management and defined boundaries; agreed benefits for a member's contribution; agreed rules of reaching fair decisions; monitoring resources and how they are used; punishment proportional to an offense; agreements for broad participation in decisions; and ways of resolving disputes. The rules echo those of the Maasai in managing the savanna grasslands. Ostrom went on to show

that with a more centralized government, the greatest success in conserving common property resources comes when communities devise their own rules within the larger shared goals of the society.

Conservation centered on community and localized common interests highlights the intimate link between individual, society, culture and institutions needed for successful environmental custodianship. Proximity to neighbors and intimacy with the environment provide the feedback essential for reinforcing positive and punishing negative social behavior and husbandry practices. Further, the universal common rules and social cohesion point to evolutionary selection for the cooperation needed to overcome the tragedy of the commons and expand a society's horizons beyond here and now to long-term survival and sustainability.

Can the rules and social arrangements built around the management of the local commons be scaled up to the global commons and planetary sustainability. Can they transcend disparate cultures, moral codes and aspirations? How can the rules work when the intimate link between producer and consumer in biocultures stretches around the world in modern market economies and the feedbacks break down?

The tragedy of the global commons in the 21<sup>st</sup> century can't be solved by a big government regulations, or by the free-market tools such as cap-and-trade that cut pollution in the advanced industrial nations in the 20<sup>th</sup> century. The global threats lie beyond the jurisdiction and funding capacity of national governments. Further, pollution has shifted from a relatively few concentrated factories in the 19<sup>th</sup> century Industrial Revolution to millions of small enterprises and billions of households in post-industrial economies of the 21<sup>st</sup> century. More problematically, capital markets focus on short-term profits and share-holder dividends that ignore the future costs. Reconnecting the social and environmental dislocation—recreating the proximity effects that make us responsive to the social and ecological harm we do—is the first step in a radical shift to 21<sup>st</sup> century policies for solving the global tragedy of the commons (4).

A critical ingredient in reconnecting people socially and environmentally lies in changing the relationships between technology, society, and environment that characterized practices in the 20<sup>th</sup> century. In the global age the Maasai notion of *erematere* is a useful metaphor for fixing the broken connections between our actions and their consequences, and making such consequences visible and consequential at a global scale. I say metaphor because the natural connections between people and environment in traditional subsistence societies that forged *erematere*-like stewardship in biocultures can't work on a global scale. The natural connections have been ruptured by the benefits we reap from the global economies of scale offering us cheaper goods and a comfortable life, but ignore the external and future costs

of sweat shops in Asian garment factories and toxic chemicals vented in the atmosphere and rivers.

The challenge of the global commons hinges on replicating at a distance our natural human responses to the local concerns, by engaging our sensory, cognitive, emotional, and social skills to see, feel, track, imagine, and project how our actions will benefit or hurt us, future generations and life on Earth. In keeping with the original meaning of ecology—the science of the home—we need to manage the earth as if it were a household, which of course in a way it is.

The World Wide Web offers in many ways a scaled-up facsimile of human nature that evolved in small communities. The web is forging new social networks by shortening the communication links severed by the sheer scale and reach of human activity in the 21<sup>st</sup> century, and the fragmentation of knowledge into dozens of specialized disciplines. Humans throughout history have used new technologies and social forums to reconnect our fragmented activities as we scale up from local communities to a global marketplace. These include the steam engine, car, plane, telegraph, radio, telephone, internet, common currencies, laws, governance, regulations, and international agreements such as the World Trade Organization, the Paris Climate Accord, CITES.

Communications specialist Howard Rheingold in *Smart Mobs: The Next Social Revolution* (11), attaches great importance to trust and reputation established by the web. The same human traits creating social capital in close-knit communities are mirrored in large-scale networks. People show more generosity than rational self-interest predicts: they penalize cheats even at their own expense. The emotions driving punishment influence individuals to act in ways that benefit the group. Though vulnerable to manipulation (as evidenced in the Russian meddling in the 2016 US election through Facebook), smart mobs create flatter and more democratic networks than nationally governed institutions do. They do so by pooling millions of individuals around the world, each equal in standing and with an unrestrained voice.

What of the environmental connections? What can we learn from traditional subsistence societies living within local limits? Does the notion of how ecosystem functions have any valence for understanding and husbanding planetary health and sustainably?

Studying Amboseli I began by delving into the processes accounting for the properties of the ecosystem. At first the sheer number of factors, all changing in a seemingly chaotic fashion, were too complicated to make sense of. In time, and with repeated monitoring, the linkages between wildlife, livestock, plants, environment and climate began to emerge. So, for example, wildlife and livestock moved in lockstep through the seasons. The big animals needing more forage and able to manage on a coarser diet moved from richer sparser pastures in rains to

poor more abundant pastures in dry season, followed by smaller species needing less food and a richer diet (2).

The sequence of species moving across the pastures through the season eventually pointed to an underlying driving factor, the rate of energy acquisition and processing by a species related to its size. All species are built up from a common cellular design and are limited by the same anatomical, physiological and energetic constraints. Large animals are scaled up versions of small animals. How fast a species grows, reproduces and how long it lives, is a function of its metabolic rate. Double the size of a species and its metabolism decreases by a quarter and slows the pace of life. The upshot of this allometric scaling, as it is called, is that all mammals have roughly the same number of heart and offspring in a lifetime, allowing for differences in litter size. Large animals simply run through life at a faster pass than small (12).

Allometric scaling laws are an extraordinary unifying property of life. Because the life history traits of all species are determined by the same design principles, and since an ecosystem is the product of the activity of all its constituent plants, animals and microorganisms, it follows that the assemblage of life defines the properties of an ecosystem. On a fine scale over a short time span, life seems chaotic. Scale up from studying the populations of rodents in a few hectares of woodland in Amboseli to monitoring the total energy flow and nutrient turnover of all species combined in the 8,500 square kilometer ecosystem and a broader patterns emerges. The variations dampen out and gyrate slowly around yearly variations in rainfall. Take a far longer time frame and a global perspective and the energy and nutrient fluxes gyrate around planetary scale oscillations such as El Niño.

The biosphere is comprised of the same cast of characters that make up ecosystems and biomes ranging from the tundra to tropical forests. It follows that the same scaling laws and assembly rules operate at all scales. The difference is that, unlike ecosystems, the planet is a closed system driven by large scale physical forces and motions of the earth relative to sun and moon that govern the climate and geochemical processes. The long slow-acting feedbacks give the illusion of a homeostatic self-regulating system analogous to metabolic homeostasis in mammals.

What lessons from biocultures and ecosystem can we apply to staying within boundary limits in the Anthropocene as we approach peak populations, consumption and effluent?

Fifty years on from Garrett Hardin's dismal rendition of "The Tragedy of the Commons," we know that Elinor Ostrom's principles do work where the governance rules are well established, monitored and enforced, but fail to prevent overfishing in the open ocean and greenhouse gas emissions in the atmosphere where they are lacking. Managing the global commons calls for unprecedented levels of

collaboration and knowledge far beyond the political reach and election cycles of any nation. Several global agreements reached in the 20<sup>th</sup> century have shown some success in, for example, closing the ozone hole under the Montreal Protocol, and in saving crocodiles and spotted cats from the international wildlife trade under the Conventional of Trade in Endangered Species (CITES). So why have we failed so dismally to curb greenhouse gas emissions which have far more dire global consequences?

The reason is that we don't feel the consequences of the slow warming of the planet, acidifying of the oceans and melting of the glaciers in the way we do the city smog and fouled rivers that directly affect our health and quality of life. The home-grown polluted rivers and skies of the US in the 1960s sparked the environmental movement, street marches and public condemnation of the biggest polluters, leading to the establishment of the Environmental Protection Agency in 1970. Similar movements are growing in China, India and other nations as the polluted skies and rivers make life unbearable for the rich as well as the poor in the industrializing heartlands and congested cities of the emerging economic powers.

We have also yet to establish the trust and institutional governance mechanisms internationally to manage the remoter but ultimately more catastrophic global disruptions that nation states have solved to varying degrees within their boundaries. The lengthy negotiations following the Kyoto Protocol on reducing greenhouse gases adopted in 1997 illustrate the problems. After a decade of negotiations, talks broke down acrimoniously at the Copenhagen Conference of Parties in 2009. Several factors contributed to wrangling, among them the blame game over the historical role of the West as the biggest greenhouse gas emitter, its responsibility for compensating the rest of the world now suffering the consequences, the level of reductions called for, the share burden of each nation, whether the targets should be based on total emissions or emissions per capita, the need for technological transfer, and the like. The sluggish global economy in the wake of the Great Recession of 2008, falling emission levels, and plunging oil prices also played a role.

The contrasting success of the Paris Accord reached in 2016 was credited to a new IPCC climate-change report giving stronger evidence of global warming, and growing public concern over climate change triggered by the spate of fierce hurricanes, floods, and heat waves, the rapid breaking up of Greenland glaciers and sea level rises flooding low-lying Pacific islands. NGO and public pressure groups, an Encyclical on environmental stewardship issued by Pope Francis, and a bilateral agreement between presidents Barack Obama of the United States and president Xi Jinping of China pledging to reduce the emissions of the two countries, all added to a groundswell for an accord. The combined pressure led to lengthy dialogue and voluntary yet audited measures to cut emissions to keep global temperature rises within two degrees Centigrade.

William Nordhaus of Yale University calls for climate clubs—companies and groups sharing a common commitment and values, creating incentives to voluntarily reduce carbon emissions, and imposing penalties and trade barriers on defiant nations and companies (13). Nordhaus sees climate clubs as creating a virtuous cycle, drawing in more players who benefit from cleaner air and lower energy consumption brought about by greater efficiency in resource use. The moratorium on whaling, issued by International Whaling Commission in 1962, and the ivory trading ban by CITES in 1989, resulted from just such public lobbying and peer pressure, sparked by the outpouring of empathy for harpooned whales thrashing around in bloodied seas and elephants with their faces hacked off by ivory poachers.

Greenhouse gas emissions lack the emotional valence of slaughtered whales and elephants though, and seem far too remote and nebulous as a rallying point for public pressure or climate clubs. Yet just such a coalition of hundreds of mayors from cities across the continents claiming to represent half the world's population played a pivotal role in steering the Paris Accord to a final agreement in 2016. Why should cities of all places become a rallying point for curbing climate change, and what role can they continue to play?

The city is the final destination of our African diaspora rooted in small scattered bands moving in response to the rhythm of the seasons. Oddly, despite being as different from the savanna ecosystem of our origins as can be, the city is our new ecosystem, amplifying the conditions that made us so remarkably adaptive and successful as a species. Over half the world's population now lives in cities, up from 30 percent in 1950. More than three quarters will crowd into cities and occupy less than 5 percent of the earth's surface by 2050. By then, the lure of the city will have drained the rural areas of a third of their present populations worldwide, recapitulating the rural to urban migration that created the megacities and sparsely populated rural countryside of Europe and America over the last two centuries. China, in the greatest migration in human history, has grown from 20 to 50 percent urban in thirty five years. Most of Asia and Africa will follow suit in the next fifty years.

Cities defy the tendency in other species for crowded conditions to slow down growth through the negative feedbacks arising from shrinking food supplies and the spread of diseases. Cities are the origins of our civilizations, the centers of power, the emergence of modern industrial states and the epicentre of innovations. Despite their higher crime rates and stress, cities are the magnets of modern economies, drawing in rural communities who seek a richer life—and countless others forced by poverty and necessity to abandon the countryside.

In a surprising twist, cities follow Kleiber's law of metabolic rate in relation to body size: for every doubling in size, energy efficiency increases by 15 percent (14), and for much the same reason. Just as the length of arteries, veins and capillaries

needed to supply energy to animal cells decrease in proportion to body size, so the length of roads, electricity cables, water and sewage pipelines in cities decrease per capita with city size. This makes it cheaper to install and maintain utilities, provide public services, including schools, hospitals, libraries, and forge communications networks (15). The majority of city dwellers use public rather than private transport, water and trash is recycled more efficiently than in small towns, and energy used per unit of economic production is less.

The greater efficiency and concentration of amenities and services results in businesses, jobs, wages, wealth, IT networks, innovations and patent filings increasing at a super-linear rate of 1.15. This means that doubling the size of city more than doubles the social and economic opportunities. The pace of life is altogether faster and more productive in big cities.

In one fundamental respect, though, the metabolic power law of cities differs from that of organisms. As a species we burn the equivalent of a 90 watt lightbulb of energy each day, about half as much again as a baboon. Yet the total energy we burn in warming our houses in winter and cooling them in summer—in building our homes and cities, driving our vehicles, growing our crops, feeding our animals and transporting commodities around the world—amounts to 11,000 watts. This is the same amount of energy an elephant burns each day (15). Multiply our individual energy output by the total world population of humans and the energy consumption amounts to nearly 100 billion elephants. This astonishing figure gives a graphic illustration of our global ecological footprint, most of it due to cities. If elephants rose to global dominance, there would be no forests left, biodiversity would be trashed and carbon emissions would be sky high, literally.

Unlike an organism, though, cities are not closed systems limited by energy. They draw in more people and use ever more energy, feeding on innovations that improve our economic productivity and efficiency. The super-linear growth of cities will keep on sucking in more people and producing additional effluents. Fossil fuels have given us the illusion that we can keep on growing without check, but the global warming has brought us back to earth. The limitations are not so much the energy we can extract and produce, but how much the earth can absorb of the pollutants we emit and how many ecological and planetary processes we destroy.

Cities are the engines of the 21<sup>st</sup> century economy, innovations, and global connectivity, speeding up the demographic transition, the development of renewable energy technologies, and the environmental sensibilities needed to sustain peak numbers and our materialism with any hope of staying within planetary boundaries. Cities are also uniquely cosmopolitan, bridging the deep divides between Us and Them brought about by millennia of divergence and converging on common interests and concerns.

Cities, then, one way or another, will define the future more than any other of our creations. They reflect the best of us and the worse of us. In one respect they take us back to our roots, replicating the close-knit communities responsive to their social and ecological actions. Cities alert us aware to our dirty nesting habits. The environmental movement in the West began in the polluted cities and is re-emerging in the suffocating cities of China and India. Is it any surprise, then, that mayors around the world are forming a global coalition to make the city a cleaner, more productive and efficient place to live and do business? The US Environmental Protection Agency has moved away from centralized government control policies of combat pollution to an array of new tools fitting the global age, according to a report by the National Research Council of Washington (16). The tools include education, incentives, reputation, and voluntary action. What I found most revealing in the NRC report is a statement that the new EPA tools hark back to successful community responses.

The planetary scale of our impact in the Anthropocene calls for a shift from the body politic of the nation state to distributed action at every level, from individual household to village, province, nation and global bodies. It also calls for a breakdown of disciplinary boundaries we have built in the construction of modern knowledge. As Manfred Steger (17) notes, the task is to synthesize the strands of knowledge in a way that allows us to grasp the big picture in a fast-changing world. In the process, as Steger hopes, “Such a trans-disciplinary enterprise may well lead to the rehabilitation of the academic generalist whose prestige, for too long, has been overshadowed by the specialist.”

## DEBATE

*Bruno Latour*

I like as usual to link the two talks, because the link, I think, is very important in this presentation. Kyle talked of the possibility of the extension of law, which is not, as we understood perfectly clearly, about extending rules and courts and state, but on a certain oscillation which allows the vector of law to spread everywhere. But he did not give us example. The way I heard the two talks, it seems that Jonah offered us in an interpretation of Elinor Ostrom’s many examples of a situation where obligation was actually activated in a non-state, non-judicial, non-officially juridical, system. Since the theme of the afternoon is the notion of “ligatures” to use Kyle’s word, I’d be interested in hearing Jonah’s develop his theme: “Human nature

will save nature.” Was it an appeal to a sort of natural law? Not for Kyle, obviously, since your argument about oscillation between constructivism and natural law was the way law extends itself. So I’d be interested in hearing both of you react to the quasi legal extension of this redressing of injury, because this is exactly where we could imagine to develop the impossible solution that Jonah offered: that is, the scalability of a actions of care which are adapted to every situation and by definition, non-scalable.

### *Kyle McGee*

One point that jumped out to me in Jonah’s talk was on precisely this question of legality and obligations, just because that’s my own sphere. So I would suggest as a proposition that, in searching for what Jonah calls “the mechanism to scale up,” I wonder if there are some benefits to thinking in terms of the subjects who will enjoy the rights that you’re looking at, which also come with responsibilities: I wonder, in other words, if those communities or groups can be enticed to claim those rights, as opposed to them being allocated and distributed in a top-down manner. I’ve looked at Jonah’s *In the Dust of Kilimanjaro* book and we talked a little bit about that beforehand, and another one of the mechanisms that you discuss there, and you addressed in your talk, is, as I would say, the use of “market devices” to interest them. So you’re distributing this right to enjoy the profits of the use of the land as an enticement, so that they’ll take care of the land. It remains, as you said, a national park with the national interest at the government level, but there’s now a profit motive. And so, I guess, it’s interesting as just a pure legal and ecological phenomenon, it’s very interesting, but I think it also moves into the other kinds of discussions we’ve been having about using market solutions and things to carry out the functions of conservation, in this case, and responsible land use and land use planning and things like that, which are all very terrestrial things that don’t necessarily get the attention of the philosophers, but are very material, very important in thinking through how to respond to Gaia’s intrusion, in a very empirical way.

### *Bruno Latour*

Just because, I mean, just to follow up on what Kyle says about the biographical trajectory implies probably an enormous mass of treaties, palavers, discussion between the World Bank and the donors, state intervention of some sort, probably some surveying and policing and so on and I’d like you to reflect on... Jonah, is it a good case of the extension of a sort of legal systems that Kyle mentioned that could precisely be one of the possible solution to the body politic that we are looking for?

*David Western*

What I took from Kyle's presentation is a moving target. When incorporating more views and people, we cross jurisdictional boundaries and different histories of legality. In Kenya we have the pre-literate societies with their own norms and regulations deeply embedded in culture. In our new constitution of 2010 what we adopted the US political system in separating power between the legislative, judicial and executive arms of government. But we had to recognize that there are different prior states among the 43 ethnic groups, give traditional norms some recognition and authority, yet also forge a common law. In the case of environment, for example, different concepts and uses of nature are recognized and traditional knowledge conceded. Such knowledge and practices can be described and registered under law and incorporated into land use planning and natural resource use. But there are universals that trump traditional practices because Kenya is party to and domesticates international conventions. Elephants and rhinos are listed as endangered species under the Convention on International Trade in Endangered Species. As such, they are placed on Schedule 1 under Kenya law, meaning they cannot be killed or traded despite traditional practices that may entail the use of ivory and horn. Killing an endangered species entails heavy fines and imprisonment. Other more common species—cockroaches and rats—for example, are exempt from legislation. If they weren't, the state would be responsible for eradicating pests that do damage to property. This makes the point that legally some species are more valuable than others, some are covered by international agreements and law, and others by domestic or traditional statutes and practices. We live in a pluralistic world of interests, jurisdiction, laws and regulations, trying to find a balance. I was involved with environmental and constitutional lawyers in rewriting our Environmental Management and Coordination Act in line with the new constitution. It was no easy task balancing traditional, national and international interests. Markets play an important role, increasingly so, if we broaden consideration to include the ecological services nature provides us. Who bears the costs and benefits of nature's services, and how should they be apportioned? If one community bears the cost of conserving an endangered species, should it not be paid for its service to the larger national and international community. Whose rights are superior when it comes to sustaining strategic resources reserves like forest catchments? The nation or the community? How should they be balanced? The broader we cast our net of consideration of the environment from the local to global commons, the more inclusive, pluralistic and complex these considerations become.

*Deborah M. Gordon*

Just to follow up on that. You're talking about regulations that you put in place but you did that in agreement with the Maasai, right? So they had to agree among themselves about whether to come to that agreement with you. We could talk about the analogy between the definition of a corporation as a person. How did the Maasai say, "we all agree that we're going to abide by these regulations" and is that anything like what happens when you persuade a court that a corporation acted as a person?

*Kyle McGee*

I guess I have to know a little bit more about the Maasai piece of the question before I can really answer how similar it is to my own day-to-day kind of work of convincing a court that a corporation has scienter, possesses the requisite knowledge or did the thing that I'm accusing them of having done.

*Deborah M. Gordon*

I imagine it's really different but I don't know...

*David Western*

Well, yes and no, because if you're going to use the traditional existing system, you have entities already in place—such as the grazing committees that regulate livestock movements to avoid a free-for-all. But then who owns the land? If the traditional communal system is no longer recognized, it must be replaced by some legally registered group—in the Kenya case under the Group Ranch Act. The same balance of individual and group interests applies widely to common property resources. The rights of access, conditions of use and regulations governing infractions need to be defined legally, even if based on traditional tenure and customs.

*Kyle McGee*

I suppose one point of clarification is, in my account of legality, it's focused on the operationalization or mobilization of these various elements—we refer to structures, we refer to systems, we refer to constitutions and these lofty legal constructs, but the reality is that they are actors that I mobilize or that a court mobilizes. We

refer to them as structures and systems in order to convince ourselves that there's some uniformity and stability to our universe, but it's really the case that these things are fed into "the system" over and over again and that in itself is the only systematic aspect of the legal order—the fact that we continually repeat this process of feeding it back into itself, and that's not exactly as comforting, I think.

*Deborah M. Gordon*

I think I'm asking a much simpler question. You said that the Maasai have this large area of land that they move around in and that they come to some kind of agreement about where they're going to go. So, how do they do that? I'm curious about how does that work.

*David Western*

Group ranches given legal title to the land set up of grazing committees which, by tradition, are fully recognized and authorized to deliberate and decide on communal pasture use and management. The decisions rest heavily on young men who scout and monitor the rangeland conditions and report back to the grazing committees. The elders are responsible for levying fines for any infractions. Traditionally the fines involved livestock payments. Now they can include cash fines paid by Mpesa—digital money transacted by cell phone. Having to pay a cattle is still far more shameful and consequential than pay a cash fine because it denotes a person's worth in society. But could I raise a legal paradox while I have the floor. There is in many countries today a difference between the legal recognition of animals and plants. Wildlife is afforded legal protection. Forage crops are not. The landowner cannot kill an endangered species using his pasture, but he can starve it to death by fencing it out or harvesting the pasture for his livestock and denying it to the gazelle. How come we have different standards extermination?

*Kyle McGee*

As you say, it's a complicated balancing act. There are a host of competing rights and duties at play: for instance, private property rights (the landowner's title to the plot he wants to fence) and public rights that require the government to take steps to preserve wildlife and other natural resources for the common good. The balance reached in your example permits the landowner to fence an area he owns without taking account of the gazelles' dependence on the forage crops it contains because

he enjoys title, but it's important to note that that reflects a value judgment about the hierarchy of these legal relations. The private property right is prevailing over the public right in things coded as natural resources (wildlife, here, but it could just as well be the way a river flows, for example). One could imagine many justifications for that decision: perhaps it has been argued that the common good is best served by the vigilant protection of private property, for instance. But this balance can change and legal techniques may be devised to amend these legal relations. We see an Indian Court granting legal personhood to a glacier, we see a New Zealand Court granting legal personhood to a river. Would a private property owner intending to install an enormous facility that has the effect of reshaping the Ganges or the Nile or the Mississippi be permitted to move forward with such a project? At what point does the private/public balancing act falter, and the poles reverse? So, these forms of recognition are becoming more and more common or more conventional, and they don't require any overhaul per se of the traditional forms of reasoning. That is their appeal: they just continue with existing forms of recognition. But the problem this raises—just revisiting some of the points I raised earlier—is that, if there is an effort to gradually clothe “nature” in the garb of the person, something is going to be left out each time. A representative, or a court or assembly, who is working through the rights and duties of a river is likely to overlook some factor, perhaps due to negligence but more likely due to unresolved scientific awareness, and significant negative consequences to the river will result. But the humans will excuse these, because we tried in good faith to balance its interests against neighboring property owners and so on, and that's good enough. It seems like a recipe for sanctioning abuse. Ultimately this is why I think it makes more sense to start thinking about a new model of collective imputation, distributed imputation, not predicated on the person. When we're talking about ecological injuries, it's a lot more complex, the injuries aren't traceable to one single actor or one set of competing interests to be balanced; there's not really a model to do that now.

### *Bruno Latour*

You know, the positive aspect, the good news of Kyle's version is that everything can be absorbed by law. The bad news of this is that there's still a difference between what is not yet articulated by a lawyer, and included in some sort of sense in positive law, and what remains a set of wishes that are enforced not by law but all other sets of older form of obligations like shame. So, the question is, which is the reason why we are here, what would be the *Gaia body of law*? This is no longer a silly question. As we heard on the concert the first night, the authors of those

ancient texts had no qualms in establishing connections between the cosmic order, the organization of the body and the body of law necessary for a republic. Can we do the same or not? What would be the legal order of Gaia?

### *Isabelle Stengers*

The description of the Kenya situation recalls me the work of David Bollier, a theorician of the commoning movement. Bollier demands that the State, which since the advent of modernity, has been a friend to private enterprise, now become also a friend to the commons, favoring their development, helping them. But I wonder about the kind of reequilibration he pleads for. All the more so as, contrary to the Kenya situation, what he calls commons does not designate traditional customary rights to recognize and protect, but the resurgence of what had been eradicated, not a very orderly development, often challenging proprietary laws and rather hostile to scalability, general rules applying to all concerned, whatever their scale. Also the problem is that of the famous wolf and sheep sleeping together of the prophecy. What is sleep for those who define themselves as entrepreneurs, on the lookout for any opportunity, quite ready to seduce, corrupt and divide? We hear about massive land grabs in Africa. Has Kenya created ways to protect commonality against that?

### *Kyle McGee*

I will respond first; not so much to Isabelle's question about Kenya but to Bruno's question about the legal order of Gaia. So I actually do think that I talked about this a bit so it's an opportunity to tease it out further. I think that the *corpus iuris* that I'm interested in, with respect to Gaia, is what I referred to as the unwritten law of the universe of things, the ongoing universe of interactions and stories, narratives, and trajectories through which our ligatures are created, and so I think it's problematic to talk about laws as if they were confined to the positive state law. So, while I'm certainly looking for mechanisms of distributed imputation, for instance, to improve the positive law, what has to be grasped, I think, is that that formal procedural question is a very small part of legality, which is something lived, something encountered, something that's iterative and interactive and embodied. And we only genuinely start to appreciate this in particular thanks to the kind of ecological catastrophe that we're faced with, because we start paying attention to the body of things and the agency of non-human actors and the limitations of knowledge and action at the human scale. So, to the extent that we're inventing new legal relationships, new obligations, new bonds and trajectories that are localized and situated, I

think we're doing law. The law of Gaia, if you will, is not something that is required to be written and established in a state or in an international institution, and if it were, as I mentioned, it would be just another actor among actors clamoring for a place in the next legal trajectory.

*David Western*

I didn't intend to touch on the issue of sovereignty, but it is very important in post-colonial Africa because traditional rights—customary right—were well established before colonial law. But colonial law is borrowed from Europe and imposed by fiat. The imposition alienated customary and the many values and uses of wildlife. In some cases traditional rights are being reinstated, as in the Campfire program in Zimbabwe. In other case, as in Ethiopia, the state alone has prerogative over wildlife. Finding a balance between customary and legal rights over resources is a thorny issue throughout Africa.

*Bruno Latour*

I don't want Kyle to get off the hook so easily. He just says well, unwritten law, because of my own strange ways of understanding law away and ahead and far away from the positive law, is already law. I mean, this is a cop-out, we want, because...

*Kyle McGee*

It's not a cop-out.

*Bruno Latour*

Is there a meaning in the expression of "unwritten law?" You need to have some sort of channel so that tort, dispute, lawyers, written law etc. can be used. If not appealing to unwritten law lead us straight back to an appeal to the cosmic order, to the appeal of Antigone to the gods etc. That's what I am asking.

*Kyle McGee*

There's a tradition that I have to invoke (in a manner that is only partly ironic) in order to dispute you, which is the common law tradition, the entire ancient constitution of the British Empire. The genius of the common law tradition is that it

is already interactive, responsive, evolving, and changing constantly: it is processual and that is more appropriate to the kind of entity that Gaia is. It has defects, to be sure, and possibly fatal defects. But it seems to me, in the first instance, that the resources of the common law approach lend themselves more readily than those of the civilian tradition to the kind of transformation necessary to establish a commoning of law. I certainly concede that this is an open question.

*Tim Lenton*

Ok. So, I am going to precede this by saying this may just advertise spectacular ignorance on my part and I want to start with a little procedural reflection. There is no time for technical clarification after your talk, Kyle, but I want to confess, I've understood perhaps half of it at most and it wasn't for want of trying. So this is why I approach with trepidation any further remarks but I want to try and join back to this morning's conversation, when we were having an interesting discussion characterizing, let's say, the neoliberal capitalist project as an anti-Gaia, as some kind of theme and I want to try and connect that to legal matters, because, despite my spectacular ignorance, I'm aware that, for example, the World Trade Organization has legal enforcement that has considerable power—as written about beautifully by Naomi Klein actually in the book that several of us admire. This has been used to suppress what some of us would see as efforts towards collective action that was more Gaian, if I can say that. Naomi uses case studies where in Canada, her home nation, the WTO were slamming down on efforts to incentivize the development of some renewable energy technologies, for example. I'm sure there's a zillion other examples we can cite and I'm not the right person to give chapter and verse on this, but the interesting point for me, sat here at least is that law has been used to support a particular power structure, a particular way of doing things in a way that I object to. I have no idea how to connect that to the fascinating ideas that I half understood that you were suggesting earlier, but I feel like I have to bring this into the room because I meditated like Bruno, I think, because it all sounds kind of intellectually fascinating, even though I only half understand it but there's a politics, right?, that's why we're around the table and so, how is this new law going to help us with this political problem that we face?, and by god we need some help.

*Kyle McGee*

So, one of the problems with the kind of the narrow conception of law that we're inheriting, which is a largely positivist conception, is that it's subject to corruption in just the fashion you pointed to with the WTO, it's subject to appropriation by

powerful interests. So, the political valence of the argument about ligatures is that we're going outside of those structures to show how there is a generative process; the positivization of the law is a step down the line. It's not the origin, it's not the heart of it, as Tim Mitchell has said it's an "apparatus of capture," an apparatus of capture of the law. But the law is something else, the law is something we do, something that we're doing all the time, working out obligations in practice—and you can look at indigenous practices in the anthropology of law as a great source of material for all sorts of different ways of structuring "social life," as they say, without recourse to texts per se. But the reality is that we are doing this all the time, constantly, and my political motivation, in the text I circulated, is that we need to find ways to amplify the voices of those who are making demands to be heard, making demands to exist. They don't exist at the institutional level. I'm talking in particular about those who are most subject to the calamities of global warming and the sort of catastrophes that will be seen with climate change, with migration and with the inverted land grab, in Bruno's brilliant analysis in *Facing Gaia*, when the seas return to claim their sovereignty and swallow the nations. So, the people most subject to these risks are the ones that are not being heard, they don't have any real representation at the institutional level, at the level of positive law, and my argument at the intersection of law and politics is that there are ways that we can amplify those voices, in fact it's kind of a responsibility or obligation that we do so.

### *Tim Lenton*

Yeah, absolutely for that, I understand that. So, that was great to hear, but I'm still vexed by the powerful anti-Gaians using the law to further their own devices. What I'm unclear about is how we can then use the law to fight back against them.

### *Mike Lynch*

There is a bumper sticker that I've seen from time to time that says "Gravity—It's not just a good idea. It's the law!" And, of course, it is a joke. Well, we can make it serious, as it leads me to reflect on whether the establishment of Gaia as a law is working through the scientific register. Nobody calls it a law, as opposed to a hypothesis, or theory. Probably it would be many laws, a network, a ligature of laws. So, I'm wondering if the idea of declaring Gaia as a legal person is the direction to take, rather than almost the exact opposite, in the sense that you take a common understanding of science that a scientific law like gravity, however you articulate it (which can be difficult), is powerful because of its impersonality, its obligatory quality, its objectivity, to use that horrible word. And the work of establishing that

understanding we've seen quite a lot of here—of trying to establish that it's a compelling idea for humans to understand, that if we ignore what Gaia makes apparent we face a predictable future. This sort of law-like understanding seems to be the trajectory that Gaia envisions, rather than enforcing a legal apparatus that would very likely be perceived by many people as oppressive, fascistic or worse, if it were imposed on them. Actually, Isabelle made some comments on it in her written commentary. I wonder if that connection is something we could discuss, maybe there's not a fruitful way of discussing that here, but there is this idea that law may not be the right way of describing what climate change would be as a compelling scientific 'object' that is just widely accepted and treated as a reality; a reality that we must confront as soon as possible, in contrast to imposing a legal structure, with definitions and means of enforcement; something like a declaration of universal human rights which nobody pays much attention to.

*Simon Schaffer*

There is irony there and Lovelock six years ago in an interview in *The Guardian* pointed out that the matters have reached such an emergency condition that we're now essentially—Bruno's picked up on this brilliantly—in a state of war, and he points out that in states of war legal rights tend to be suspended and this is precisely such a conjunction and that the right to dissent, for example, should be suspended because of the state of emergency in which we find ourselves. So that the exchanges we've had about legal persons, Gaia and rights, especially universal rights, are so incredibly interesting from that point of view, because they tend in exactly the opposite direction to a kind of what I take to be a Smithian notion of the legal exception of the state of emergency.

*Scott F. Gilbert*

I think that amplifying the voices of the powerless is one very important part of the solution. But how can a people or a family or a tribe get redressed if, first of all, global climate change is not recognized as a crime, at least in one backward nation. And since there is so much distributed guilt, responsibility, how can redress possibly be made?

*Kyle McGee*

So, I hear your concern to be that, in a way, we're all responsible for climate change and if we are looking at a mechanism of distributed imputation, we're look-

ing at ourselves. It's really the question of institutional reality, of institutional redesign. So, if you are thinking of how to reassemble the mechanism of legal imputability or legal causation, you'll be obliged to make a decision somewhere along this line as to what constitutes agency—culpable agency, if you will. And that is exactly the place where you would take account of the item that you address, which is the notion that “we're all guilty,” in a sense. Yes, but where should liability rest? Perhaps some reworking of the concept of liability could help shape such a mechanism of distributed imputation.

*Scott F. Gilbert*

I wouldn't say we're all guilty. I would say that there are some who are much more guilty than others.

*Tim Lenton*

Just to say the United Nations framework convention on climate change phrase “common but differentiated responsibility.”

*Kyle McGee*

So, under the model we've been looking at, you'd have to take account of the relative roles of the producer and the consumer, to begin with. You have to draw some further distinctions in order to cabin responsibility in a way that's acceptable to the people who are going to be governed in this way. I understand Mike's concern to be that maybe the law is not the right instrument, not the right kind of discourse for enforcing a response to the intrusion of Gaia, if you will... That is a viewpoint that I credit, I think it has merit, that this is a question basically of practices above all else, but I also see some value in recognizing the legal personhood of non-human entities because it allows the state apparatus to become enrolled in their interest, to issue an injunction, for instance, that says “this actor is to be protected, you can't drill here,” for instance. It's not a long-term solution for reasons I already mentioned. But such a court order could be very useful for preserving that particular site and limiting extraction. So, just in a very pragmatic sense, it's not something I would reject, but I understand your concern for a broader solution, and it's one that I also share.

*Timothy Mitchell*

Just very quickly, because it was provoked by Mike's question about whether Gaia could become a legal person. There are ways in which that already happens. As I mentioned to you the other day, there is law firm based in England called Client Earth that brings cases, as it were, on behalf of Gaia. It has had significant success, in cases where the British government has been found in violation of legal obligations regarding clean air standards and has been forced to much more rapidly adopt measures to address the level of air pollution in cities. And then in the US there's the lawsuit, one of many cases around the world, brought by people under the age of 18 whose future is being taken away from them by the refusal of the U.S. government to address threats to the future of the planet. One of the plaintiffs is James Hanson's granddaughter, I believe, and they are claiming a constitutional right to a viable planet. That seems to me exactly what you're talking about, which is indeed making either Gaia, in one case, or a future generation in another case, the client who claims to be a new kind of legal person or to have a set of legal rights that were not recognized before. We don't know how far this is going to go, but such cases do seem to me imaginative uses or transformations of an existing understanding of the law.

I would make a parallel argument in some ways about the case for scaling up the idea of parks. Under the EU farm payments scheme, most farms are now parks, in the sense that farmers are entitled to the support payments on the basis of following a whole set of ecological rules for stewardship of the land. You must maintain an uncultivated green buffer within two meters of the boundary of a field, a field over a certain acreage has to have a mound across the middle to allow beetles to exist that will feed on pests, and so on. There's an enormous range of these rules, which are differently implemented in each country of the EU. But turning communities into "parks" that have to manage the demands and needs of multiple species is widespread. It is on a very limited scale compared to the challenge ahead. But techniques for challenging existing forms of living are already there, as both of these examples show.

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DAY THREE  
(FRIDAY 15<sup>TH</sup> SEPTEMBER 2017)

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## Feedback on Day Two

*Simon Schaffer*

Welcome to session 7 of the Last Supper. Very unfortunately, we've reached the last day of our meeting, this could go on and on, but it can't really. So, as you're aware, from what we thought about yesterday, we reckon that we should devote this morning session, as much of it as you want, to hearing interventions or questions from the audience, from you. I've proposed, just in terms of the bureaucracy, that we take questions in small groups, otherwise I think we probably won't get through many questions. I'll try to summarize at the end of two or three questions, depending on how it goes. It's going to be extremely interesting to do the triage that links together the questions with those people sitting at the table who then respond, unless you stipulate who you wish to interrogate. It will also be very helpful for us, I think, if you gave your name when you ask a question or make an intervention, so without further ado, let's start.

*Gerard de Vries*

Good morning. My name is Gerard. The body politic discourse focuses on what should be defended of this earth and I think it may help to articulate a political orientation, but politics is more than orientation and more than input. It's also process, a sort of institutions to mediate or mitigate conflicts, internal conflicts. So to articulate the how of politics, which institutions should be abolished and which ones should be added. Thank you.

*Jean-Michel Forneau*

Thank you. My name is Jean-Michel Forneau. My question is that I was a bit puzzled during these previous days, especially yesterday morning that there was not a word, if I'm not wrong, about demography and that it hasn't been acknowledged that maybe the fact that there are 7.5 billion people living on this planet is an issue which should be taken in account thinking about how we would manage to react with the presence of Gaia and the being of Gaia and if all this very many optimistic things which has been said, do include, maybe the slaughtering of 2 billion human beings to go back to a certain balance of presence on this earth and I believe it should be appearing somewhere in your discussion.

*Emanuele Coccia*

My name is Emanuele Coccia and I have perhaps a general question about the title and the general proposal of the seminar, in the sense that should we really look for a new body politic, should we really invent a new body for the new politics or should we simply abandon the concept of body? I mean, just from a political point of view we are witnessing the dematerialization of politics and finance, this kind of disappearing of bodies from the political scene and the political theatre. And should we really oppose to this dematerialization a new body politics that is the ancient modern, classical modern, type of politics or should we perhaps invent a politics that doesn't need a body? I'm asking that because, perhaps, all these kind of discussions about holism and organicism and neo liberalism is really into the concept of body, which is too much from an historical point of view to do this kind of discussions. And also hearing the contribution of Deborah M. Gordon she really... I mean, I was asking to me do ants really form a body? They have a politics, they have something that we can consider as a political life, but they do not have a body, they do not form a body in a way.

*Simon Schaffer*

That's already more than enough, isn't it? Gerard reminds us that politics is also process, that one of its aims, presumably, is conflict mitigation and therefore there are pressing questions about institution-building but also institution-suppression, actually. Jean-Michel reminds us that demographic pressure, demographic growth is presumably one of the fundamental parameters of the new climate regime. Just to interject, it's true that we now know how much humans weigh in comparison with the technosphere, but we haven't really done more than weigh them, so far

although one might not want to go down the eugenic path, taking something off the balance pan might be a good idea or not. And Emanuele, in ways that clearly speak to what Jean-Michel and Gerard are talking about, points out what for him is the fabulous, in both senses, legacy of body politics, it's a fable that we've inherited and it's fabulous and it's completely, so one might think, out of date, because and it fits with the Jean-Michel's thought in a very interesting way, precisely because of the dematerialization, as one might say "the undemographic quality of politics" as it is now, what he called the dematerialization of politics. So there's all that to work on and then there was Emanuele's cunning subsidiary question, which is: "hey wait a minute, do you social insects form bodies anyway?" I have to say is a Hobbesian question and he asks that question, alright? As we know. So who would like to comment on any or all of those?

### *Tim Lenton*

I'm happy to come in on the demography, Jean-Michel. I felt that yesterday in the discussion as well that population and its numbers were not as explicit as they could be. So I touched right at the end on an alternative model of release of the energy and material basis of societies and that was partly for the reason that wasn't voiced, which is the knowledge that there is an almost inevitability to get to around 9 billion people by the middle of the century and the central projection, as you know, goes to 11.2 billion at the end of the century. It could be different to the end of the century, but at least 9 billion is unavoidable and we're all, I hope, aware of the persistent inequalities across the current 7 point something billion and my take, my sub-text here, really, was that we've demonized energy because we're deriving it from fossil fuels to generate electricity etc. but energy per se is certainly not a bad thing and electricity is particularly great stuff, if you haven't had it and you suddenly get it, and of course there are ways that we can provide, now, more sustainable electricity to people who've never had that access to energy. I think that's a great thing and we can all think probably of examples where that's beginning to happen. In some of the non-round table discussions we've been talking about new modes of relationship with energy and materials in communities in parts of the world that are, we would say, off-grid, but are now getting their autonomy from a solar energy supply or many other public good things that they can do with that. So that's rather long indeed, but the bottom line for me is as a human I can't build a vision of the near future of Gaia or its body politic that doesn't try to create a better life for some of that 9 point whatever billion. I have to try and mentally square the circle and try and work out, at least in the narrow scientific technological way, can 9 something billion people live happy and sustainable lives on a finite planet as part of a Gaia

2.0. That's obviously not an easy or trivial question to answer, but being obviously of an optimistic bent I think it is conceivable to achieve that. It does require a radical change in the metabolism of our societies, it certainly requires much more materially cyclic systems, as I probably talked more than enough about yesterday, but I think you can imagine, at least in energy and material terms, that it is possible to have many people flourishing whilst the rest of Gaia also flourishes and I think it's for the political reasons that you hint at, it's good to try and work out how that could work.

### *Bruno Latour*

I have had bad sleep since Emanuele Coccia yesterday told us at dinner that he was going to ask this question! It's always slightly embarrassing for the organizer of a meeting on the new body politic, to have to recognize "yes body is a terribly bad metaphor." There are a number of things we discuss that did not fit within any image, whatever its history, of the body. One of them of course is what I called the flatness of all these things we heard about baboons, ants and cells. The other thing which is very difficult to reconcile with the notion of body is, as Deborah M. Gordon showed us in the case of colonies, the whole conceived as just a slight superposition and circulation inside this flat networks of connection, a model which is extremely useful for cells as well, as I've shown many times, as for humans. This is always the difficulty with actor-network-theory: it does not fit in any preexisting representation of an organism. And this is even truer of Gaia, as Lenton has shown.

So we should shift our discussion and concentrate on what has been Gaia 2.0, I mean, okay we faced Gaia 1, I remind you, and we now look at the earth and we say okay what sort of features, properties does it have? And then we will see whether or not we could reconcile such a list with the image, metaphor or representation we have of bodies. One of those features is that it does not have a border than the limits of the zone, which is why I call it "critical zone politics." The Globe as it is drawn by cartography is not a good way to give a face, a figure to Gaia anyway. But Gaia is not a globe, it's a pedicle, it's a skin, it's a very, very thin skin and it's very difficult to visualize it if we use the Blue Planet as a template. Life forms and Gaia are invisible if we project it on a globe. It's not a metaphor of the body which is wrong, it's any metaphor of a critical zone which renders politics impossible and that of course has consequence in what was raised by Gerard's question. So we had this discussion thirteen years ago when we were doing the dialogue on the "atmospheres of democracy." We looked very carefully at the painting of the good and bad government in Siena. The images of the body politic benefitted from a rich vocabulary of microcosmos macrocosmos analogies—and great painters as well. We

have neither of those. My solution would be to resist getting rid of the notion of body and to make the list of features we would like to see painted, so to speak, in a new fresco of the Good and Bad Government. The Good and Bad Government of Gaia. That is not very terribly helpful, I'm sorry.

### *Didier Debaise*

I come back to the question of the body. I had also the feeling, when I was invited, that maybe the title was a bit confusing and I didn't know what to do with it. But I think we are facing a question of method, a way of addressing question. The body is what we inherited as an object of investigation. And it was in the middle of a lot of debates all during modern history: the constitution of the natural body, the distinction between physical and living bodies, the relation between physical and political bodies, etc. So I'm not sure that the solution would be to just change the word. I don't think that using the word body means that we repeat something, it means that we are introducing some other components inside this concept that will change the scene. I'm all the time suspicious about the fact that we should change the word, because there is also something coming with it that we might miss with another word. If I'm now more convinced by the re-use of the word "body" it is because when we talk about immateriality and general forms of reality etc., we lose the fact that politics is all the time a very situated operation, next to next. It's never a general question. There is never something like an immaterial logic, it's all the time embodied somewhere. The question of the body changed and became the question of what Deleuze and Guattari called the «consistency», which is another way to think the relation of the wholes and the parts.

### *David Western*

I would like to connect the numbers of people on the planet to political institutions. The issue of population has been of concern since Thomas Malthus claimed in the late 1700s that humans increase faster than food production, leading to a permanent state of poverty. Ever since, we have fretted about the limits to growth. The question is: can we produce it fast enough to keep the population growing? We can, if our population levels out at 9 to 12 billion by the end of the 21st century. The demographic transition is already well advanced in the developed nations and China. Asia is on the same course and Africa is heading down the same road. Paul Ehrlich's predictions of mass starvation in Asia by the 1980s failed due to the Green Revolution. We have the science and technology to produce food sufficiency for the projected peak population, if we steer clear of wars and calamities.

The bigger emerging problem for the majority of the world is too much food and the non-communicable diseases obesity causes. So we need to shift from worrying about numbers to our growing impact on our planet, regardless of numbers. How can the earth absorb the impact of the US effluent repeated for all nations as they approach the same level of GDP? Economist pointed to the answer in the environmental Kuznets curve. Development will lead to greater concerns over health and a clean environment, so fast track development and worry about the environment later. Well, that didn't happen. The US population accounts for less than 5 percent of the world total, consumes over 20 percent of all resources and has the largest ecological footprint per capita of any nation. For a while smoke stacks got taller and taller to vent pollution further from home and into the global commons where there was no governance and Gaia alone suffered. The challenge of the 21<sup>st</sup> century lies in containing our emissions within safe boundary limits. This can only be achieved by international agreements and governance of the global commons. We can't wait for Kuznet's feedback when the developing countries are all entering rapid growth, intent on catching up with the West. Global governance has begun to emerge to close the ozone hole, regulate trade in endangered species and the like. Can we institute global governance mechanisms fast enough to contain our impact within safe planetary limits? This is the challenge we face most obviously in the case of greenhouse gas emissions and global warming, a threat that will affect all humanity. Effective governance at a global levels calls for the same feedbacks that regulate our actions effectively at a local level. The impact of our actions must be visible, monitored and the consequences tangible. Think about the International Law of the Sea. Only when oil discharges caused by oil tankers cleaning out their ballast could be traced back to individual ships and fines levied against them did the discharges abate. The same applies to the international trade in wildlife products. With DNA analysis we can trace ivory back to its point of origin and take action through the CITES convention, and more effectively through the media and public pressure. If we know the source, sink and impact of an externality—the distant impact—we can assign responsibilities and institute systems of governance that regulate the consequences of our action in the global commons. In addition to global governance, we must shift to green economies if we are to limit our impact within safe boundary limits. The best hope for doing so lies in cities where we feel the consequences of action directly. The more urbanized we become, the greater our energy efficiency, the smaller our ecological footprint and the more we take action to avoid suffocating in our own exhaust. My question is: how do we domesticate our global impact as if the global commons were our own household. It comes down to the same thing—husbanding our home and resources.

*Bruno Latour*

Sorry, this is the second time you mentioned city efficiency and I'm not sure everyone is aware of this thing you mentioned, that it was exactly in line with the metabolism rate of all other organisms, but I think it's a crucial point of your optimistic argument, so we need to understand exactly what you mean, I think, if you allow me.

*David Western*

It goes back to network theory, the rate at which you can deliver energy and nutrients to a population. In rural areas populations are very dispersed and it's expensive to deliver services and commodities. In cities, the density of population makes delivery far cheaper. This is not only a matter of economy of scale, but also proximity and connectivity. Cities are also magnets for learning, innovation and new technologies and development. Per capita incomes are higher than in rural areas and services far richer. In terms of energy consumption, cities are far more efficient than scattered rural populations. Double the size of a city and the consumption of energy, per capita decreases by 15 percent. Just as the length of arteries, veins and capillaries needed to supply energy to animal cells decreases in proportion to body size, so the length of roads, electricity cables, water and sewage pipelines in cities decreases per capita with city size, making it cheaper to install and maintain utilities, and provide public services, including schools, hospitals, libraries and communications networks. The majority of city dwellers use public rather than private transport, water and trash is recycled more efficiently than in small towns, and energy used per unit of economic production is far higher.

The greater efficiency and concentration of amenities and services results in businesses, jobs, wages, wealth, IT networks, innovations and patent filings increasing at a super-linear rate of 1.15, meaning that doubling the size of city more than doubles the social and economic opportunities. The pace of life is altogether faster and more productive in big cities. Urban areas are more efficient than rural in using resources and recycling material. They are where the Fourth Industrial Revolution—green economies—are incubating. Geoffrey West's book *Scale* lays out a theory of growth as it relates to organisms, plants, economies, companies and cities worth reading.

*Timothy Mitchell*

Can I just ask? Because when you introduced that point yesterday, you also

added another point that, while in the way you have just described, as you put it, this scales to 0.75, but there was another aspect of cities that didn't scale to 1.15. I didn't understand that bit.

### *David Western*

Scaling to 1.15 is called "super linear scaling." In other words, if a city doubles in size, you'd expect the productivity economically to more than double and so keep on attracting more investment and opportunity. Hence the growth of megacities. All the things we're enjoying here in Venice, museums, art, entertainment, increase by 15 percent with a doubling of city size. So cities are a grand attractor, drawing in more people and growth, despite the higher crime rates.

### *Kyle McGee*

I'd like to take up some of the notions that have been passed around just now and also respond to Gerard's question about institutional innovation. I think that a lot of these notions have an aristocratic and technocratic kind of tinge to them, and I think it's essential to remember that we are locked in a climate struggle, and that this is a very contentious political set of problems that we're dealing with. I worry that when we talk about global governance, that we're talking about passing the baton off to powerful western nation-states, who have their own self-interest, and powerful capitalists who are after their own self-interest. We should remember that the body politic in the United States is the nationalistic "body of the despot" at the moment. And with the resurgence of national borders as a response to the placelessness of globalization and the landlessness of the climate catastrophe, I think it's essential we recognize that we're locked in a political struggle. So, I'm skeptical and I want to take up something Mike said at the end of yesterday's session, which is: "Are we perhaps putting too much stock in law? Is this a problem that international or global law, or state law, or any level of law, is really equipped to handle?" It's a great question; part of the strategy, in the somewhat more philosophical approach to law that I've developed, is precisely to subtract the state from legality, in the sense of repositioning the state no longer as the heart, or the center of the universe of law, but simply one source or institution among others, which is up for grabs. It's been grabbed at the moment, and it could be grabbed by another political force, as well, and the way that that could play out has something to do with the concrete, interactive, local ligatures I've discussed, with the local legal relationships we establish in our performances, in our interactions, in our practices, in our embedded, embodied, material lives. So, in other words, that's part of the larger picture of the revised

account of legality that I'm developing and how it ties in with politics. I think what it leads to is a problem of, to take up something that Isabelle said, translating the intrusion of Gaia in a way that is adequate to the problem it poses. And I think that one way to do that is to think of our legal and political institutions along the lines of not just a *common law* but a *law of commoning*. We need such a speculative proposal about how to re-engage legality in a way that does not transfer despotic authority to a state apparatus.

### *Nicola Manghi*

My name is Nicola Manghi. I would like to go back to the body metaphor, because I'm just wondering that the body politic was a metaphor for politics at a national level or at a state level and, I mean, bodies were those entities which, as Michel Serres put it in the natural contract, were able to fight without caring about the battlefield, but nowadays we see that, as we fight—like—the side effect of politics, is ecological crisis; and so we have to care about the battlefield on which we fight. And to go back to what Tim Lenton yesterday was saying about the specificity of the planetary scale and I would say that, from the political point of view, the specificity of the planetary scale is that there is no battlefield for politics. I mean, battlefield is politics, I mean, there's no distinction. And so, maybe, even if you want to keep the metaphor of the body politic, the right question would be: Is it really scalable up to the planetary level? Should we really think of a body politic for the planetary level? Or should we think, maybe Latour's metaphor of the parliament of things or maybe the metaphor of an assembly is better for this planetary level because what we have to think of is a new way of dealing with each other without a battlefield as a ground.

### *Lynn Chiu*

My name is Lynn Chiu, I'm a philosopher of biology situated at Bordeaux, France, right now and my question is about the environment of the body politics. So, the discussion so far it seems to either treat environment as part of the body, as the Gaia case or the holobiont case. In the beginning Bruno mentioned two dichotomies economies that we're trying to overcome, one is between the hierarchy of things vs the autonomy of things, the other is between the collective and the individual, but in both cases we're talking about individuals, whether individuals are put together, how they're put together, in what order, how many layers, but what about the environment? Is there a meaning for the construct of the environment

and your point of view? Or should we just abandon the idea of an environment, just look at everything as bodies that are interacting with each other?

### *Baptiste Morizot*

I'm Baptiste Morizot and I'd like to share Emanuele's skepticism about the metaphor of the body. I think there are a lot of visual constraints in the term, in the word, like Bruno said. It's not an innocent metaphor, even about its biological dimension. Any biological being doesn't have a body. Tree doesn't have a body, we don't use that term for a tree. The body begins with the animals and it begins with this kind of beings which have a head. It's head-oriented. So it's all over the images of the picture, when you talk about a body, one part of your theoretical unconscious looks for the head. That's the first thing for me. The other thing is that when you talk about the body you're outside of it. What's the body of the body politic is an answer you ask when you are outside and you're trying to delimitate the anatomical figure of the body politic and I think the true problem of that is we are not outside of the body politic; we are deeply inside the kinds of the body politic we are trying to define. So, it's not very elegant to say that the title of the symposium maybe doesn't work, so I wanted to, maybe to make a proposition and I think it's not very interesting, but I'll try it. So, I wonder what's the kind of metaphor we can use to get inside the body politic, to ask the question from the inside of the body politic and the question becomes: "What is the flesh of the politic?" The flesh of the politic is the kind, the thing you see from the inside of the body. If there is flesh you can make assumptions that there is somewhere a body but you can't see it, because the limits of the body are far from you and you don't have an access to them. And so for me the question is: what is the flesh of the politic? Maybe what are the kind of interactions, what are the kinds of entanglements, next to next, which produce body-like effects? The point for me, which is really interesting in the metaphor of the body politic, is that there are body-like effects: but how can we imagine that from the inside of the flesh of the politic? How can the interactions produce something like body-like effects?

### *Simon Schaffer*

Let me just remind you what you've just been asked, folks. Body metaphors, it's claimed, were designed and work at the level of states, not so much at the level of the planet. Assemblage might be a better metaphor? There's a scalability question there? Because the temptation is just to scale up and that might be a terrible mistake, I have to say partly for the reasons Kyle's just given. Lynn points our attention,

I think extremely astutely, to the role that the concept, indeed, the presence of environment, the unveiled, plays in these reflections once again, the body seems to be troublesome there, partly because it's absolutely not obvious what the individualization of the environment would be, what would we like to do with that and then what Morizot has just raised, a range of troubles with the body. He makes some important claims, which you may or may not wish to agree with, like only animals have bodies. Trees don't, apparently. And significantly we are inside this body, which concerns us in a fundamental way. And the title of our meeting might actually reinforce a certain notion of playing the God trick then we're all outside, we're capable of proposing everything from world government to increasing or decreasing the weight of demographic pressure; when in fact what's happening is that we find ourselves inside, so maybe flesh or, since this is quite francophone, *le chair* would be the way to go, the chair of the body.

### *Tim Lenton*

Fantastic questions. So, the thing that interested me, in the body politic metaphor, was not really the core of the old fable, it was really when I realized that as a collective phenomenon of humanity we are behaving in a heterotrophic away as I was hopefully articulating previously, that we are a collective metabolism that is undoubtedly consuming a huge amount, a growing amount of resources from its environment and pumping out a whole lot of waste products. So for me it's interesting just firstly that the body of the body politic was heterotrophic and also an animal one. When you talk of bodies you bring with it the concept of the metabolism that is, scientifically, the more faithful aspect of the fable or the metaphor that you can carry over and that really starts to speak to the points that Nicola and Lynn were raising, because if the collective phenomenon gets to the planetary scale, it's encountering a very different situation with very meager material inputs from the inner Earth, so it really can't be related neither to an animal nor to a plant, because plants after all are building the chemical parts of their body from their environment, from carbon dioxide in the air, as well as nutrients from the rocks and water. So, for that reason, I absolutely sympathize with the first two questions. I still think if we talk about the human collective phenomenon as within Gaia, then it is reasonable to explore different metabolic metaphors for how the collective human enterprise interacts with the rest of Gaia, however we think of that, and obviously I was making a case for the fact that it's clear this is a very peculiar collective body and it's not really anything like an animal in the way that's been undergoing extraordinary exponential growth since the great acceleration, its most extreme phase. So to someone who thinks scientifically this collective metabolism is

a very un-animal-like thing, it's a poor metaphor in that sense, but the point there is of course it's taking us to planetary scales of consequence. And then we might choose to persist with the human collective within Gaia separation and even then I argue that the more we are materially closed and the more we're like the totality of Gaia in a human enterprise, the better our chances for the long term. That's partly because we're effectively coming to this scale where, as the question has rightly put it, it's stupid to maintain the distinction between environment and living things, in this case human living things, because you retain the scale of consequence where that separation is deeply problematic and becomes un-meaningful.

### *Bruno Latour*

Well, scale is to me, the central question. I want to underline a very interesting tension here about scale, because Jonah is the most of optimistic of us, is always insisting that scalability is possible, and he's also the one of us who has most experience in dealing with conflicts at all level of scales from Maasai herders to multinational organizations. I hear two different discourses: one is that scalability is precisely the great danger, and I'm thinking of Anna Tsing's work and also what Kyle just mentioned and of course Tim (Mitchell)'s description of capitalism, and the other that scalability is actually something essential to spread the experiments. And of course, for me, the most interesting aspect of Lovelock's theory is that it does not jump to a higher scale to speak of Gaia: Gaia is the extension in space and time of local inventions which have scaled up. So heterogeneity seems to be an important signature of a body politic. And it's true, but it's not clearly implied in the definition of classical metaphors of body. So that should be put into the list of properties that I am trying to compile: heterogeneity at the heart of change of scale, which would be different for trees, microbes and of course for humans.

### *Isabelle Stengers*

I cannot but think again to the concept of a body without organs which Deleuze and Guattari created after Antonin Artaud. What they proposed to do without were not the eyes or the stomach as such, but as defined by the classical figure of the body politics, each presenting itself in terms of their function with regards to the common good of the organism. What they were after was the assignation of a functional role to the organs, what they would be made for. So that the body without organs would indeed be, I would say, a functioning body, an assemblage that may well work together but is not to be understood from the point of view of a unity which all would serve. Didier spoke about consistency, which for Deleuze

is a figure of immanence, with no central place from which you can understand it in terms of a whole. It functions together but obeys to no function, it is rather an ongoing composition holding just as long as it does. Deleuze loved the figure of contract against that of law. A contractual bound links parties as heterogeneous, not parts as subjects to a law that transcends them. So the body does not need to be head-oriented, even if it is easier to describe it like that. What is sure is that if you cut the head, it dies, or rather unravels, along heterogeneous times, becoming a rich for proliferating not contracting parties. The tree may have no body, but it has also to be defended against the image of the functional organism. Body and tree are only images when you work with the many holobiontic assemblages which Scott F. Gilbert is proposing. But they are powerful images. The assemblage we call a forest is less vulnerable to such image, more easy to understand as a composition, a multi-specific composition at many different and entangled scales, a kind of cominging with partners feeling each other, but each in its own way. A French biologist, Pierre Sonigo, who was fighting against functionalist ultra selectivist biology, proposed the motto: "My body is a forest" and it was very effective, funny, to have everything in the forest assigned a role. Now it is also true that foresters speak about a healthy forest or a sick one. It would be interesting to understand what they mean by that, to learn about the way connoisseurs evaluate compositions.

### *Scott F. Gilbert*

What's the body of the body politic, or first, what's the body? And I think that biologists are now in a position like physicists were at the beginning of the last century. Just like light is both a wave and a particle, the body has become both structure and process. And, depending on your question, depending on what instruments you use, one sees and studies the body as either substance or process. We've mostly been talking about the body as relationships between entities, and relating those relationships of the body to those relationships of the body politic. But looking at the body as process, at least three interpenetrating types of processes have to be taken into account. First, metabolism. Metabolism is nothing less than keeping your identity by changing your parts, and that's the only way we keep our identity: constantly changing our parts. And that's on the cellular scale. Second, we have a developmental process going on at the same time, and not only during embryonic development. We keep on regenerating our parts. We lose a gram and a half of skin a day and replace it; we lose blood cells every minute by the millions and we replace them. And third, we have a much longer set of evolutionary processes. We're kind of at the intersection, maybe the concrescence, of these three processes, and so I think that when we talk about life in the body we're talking not only

substance but process. Waddington had that wonderful metaphor of the epigenetic landscape, and often that's seen as balls, entities rolling down hills, entities. But the original landscape was a landscape of a river going down a mountain and, of course, the river makes the channels, as the channels make the river. And so, there's this interaction between the organism and the environment there, and, actually, they both can be considered as parts of a system. So, artists in the audience, here's your challenge: try to represent this. Try to represent what we've been talking about: information, body, process, fragility, consistency, interactiveness. As you said, one of our problems is that we don't have a visualization of the body anymore, and I think that's really an important thing for artists to do.

### *Mike Lynch*

I like the question that invites us to consider what it is to be a body; to be inside (dwelling in) a body. It occurred to me that what I'm finding to be particularly informative from talking to and listening to Jonah and many others such as Tim, is that Gaia—as a theory or, more specifically, our sense of the climate crisis—is enabled by technological extensions that allow us to sense, as we do with our own body from within our body in an environment when we sense the world. You can think of the immense amount of measures, sensory systems, satellites, and so on, that are feeding into collective understanding and misunderstanding of climate crisis, as well as the very idea of Gaia as an integrated skin that includes all sorts of interesting energy transfers. Many of the technologies that are now viewed as part of the problem are also expanding this sense of our awareness in a very tangible way. Scott has mentioned that technologies of visualization provide the means and measure of collectively produced and personally produced innovations; and yet technologies both enable our sense of crisis and our imagination of what we might be able to do about it. So, I think that is something that we should consider. Even the research that Deborah described, in how her studies of the ant colonies relied on the way the ants are marked, counted, and visualized, can give us an awareness of a phenomenon that, otherwise we would not see. You know, we all live with ants, we've seen them thousands of times, but without these very clever and systematic ways of organizing the world we don't see the organized properties that Deborah revealed for us. So in a way the body that gives us Gaia is a very different body than the one that is limited by walls and located in space the way we are here.

### *Didier Debaise*

Yesterday Simon gave us a kind of homework which was to add a signature to

the body politics and I think it's a good transition to the discussion. I wrote on my paper the following: "Never pretend that the way by which you characterize the body would explain the politic of the body." What we have to resist to is the direct transfer between the characterization of the body through the politics concerning the body. But we can enlarge it and don't speak just about the body. I thought about that formula, with the discussion between Tim and Isabelle, the way by which you characterize Gaia doesn't explain the politics of Gaia...

*Isabelle Stengers*

Politics does not follow...

*Timothy Mitchell*

Thanks. Thinking about this question, about the inadequacy of the concept of the body to the scale of the politics that is needed, it's also sort of importance of the problem of scaling up and whether the body is too tied to the idea of the state, of the nation state, particularly. I've been thinking in these discussions about this absolutely radical transformation that took place in the middle decades of the 20<sup>th</sup> century, at the same time as the one I was discussing a couple of days ago around the making of the concept of the economy and not unconnected with it, which is the arrival of the idea that we live in a world of nation states. You know, at the beginning of the 20<sup>th</sup> century the dominant idea was that we lived in a world of empires and that those empires were going to consolidate themselves with the British, the French, there was an American empire of continental scale, a Russian one. Then of course it was all a bit upset when two other powers decided they wanted to join and build empires on the same scale, in the middle of the twentieth century. But that vision of a world of empires, and that construction of a world of empires, collapsed with astonishing rapidity in a generation, right? Between the Second World War and the 1960s, I mean there were struggles that continued after that and continue today, but that reorientation was remarkably fast, and of course was also accompanied by the building of a whole set of institutions of global governance, of international law, limited as they have been by the fact that one or two of those empire still exist, still continue under the guise of a nation state. They now use the sovereignty of the nation-state to limit the ability to build and imagine other kinds of, other scales of political body or political apparatus or whatever's the term. But I think it's helpful to remember those episodes when the political order that seemed set forever did just disappear, because presumably that's something we've got to—that's part of why we want to think about this, going forward: that

this particular system of nation states, and especially a system of only nominally equivalent nation states, in which some do continue to act very much as imperial powers and impose themselves over others. It can be useful, it doesn't immediately provide us with the models we're looking for the conceptualization, but I think it can be a source of help.

*Bruno Latour*

I am not trying to save the theme of the meeting that we imagined with Simon, but from this discussion it seems that no one has a final idea of what a body, anybody consists of. If you take the body as being in an environment, for instance, or a body that makes up its own outside, you get a different result. As Scott showed us well, biology has so much transformed what it means by organism, organs, parts and cells, that don't see how can anyone could come and tell us not to use the theme of the body to describe politics. What I think Tim Lenton is trying to make us think about is that Gaia is not just something big that looks like an organism, but something that does not look like an organism at all and that modifies what the very act of scaling up means. Take for instance the great oxygenation event. In Lenton's book oxygen in the atmosphere is the unwanted result of the action of tiny organisms. We follow local organism able to produce their own environment and then scale up. So here Gaia 1.0 offers a very powerful template to rethink about politics including. So we have to use two dictates, so to speak, the one that Didier mentioned but another one which is that there's lots to learn about the innovation proposed by the Lovelock, Margulis and Lenton on the very notion of what scaling is. This is what we meant when we started to think about the "new" body politic. The idea was not to fit all the scientific and political discoveries into the old models. But to use those discoveries about what it is to be a collective—a baboon troop, an ant colony etc.—to rethink any sort of political assemblages.

Probably it was a mistake to reintroduce the notion of body, we should maybe have jumped to the next generation, but if we had said let's study "Gaia politic," we would have run into an even bigger problem, because people would have immediately jumped to the big scale, to the "planetary dimension." But it's the *scaling of Gaia* which is interesting. Not the final scale, the final size, not the fact that it's planetary, it made the planet full of very long numbers of little circuitries which are precisely the earth system science role to describe. I'm commenting also on Mike last point...

*Deborah M. Gordon*

I'm getting lost because there are two things I don't really understand in this

discussion: one is about politics. Isn't politics about power and control? We began with somebody who said of course ants have politics. I don't understand how ants could have politics, so I think that I don't understand really what's meant here by politics. And the other question is about scale. It seems that something is being invoked about scaling that says 'the body' is a kind of magical process that unites everything, by just zooming out... but scaling is always gradual. For example as you just said about oxygen: it wasn't a magical process that went from no oxygen to a lot of oxygen, there was a gradual transition I think that we're talking about something else here when we're talking about scale as zooming up—I don't really understand what that is either.

*Simon Schaffer*

That's great. You were also asked by Emanuele Coccia whether ants are a body. You have not given your response, yet.

*Deborah M. Gordon*

There are a lot of ants, and they all live in colonies. When you look at them, you don't see a colony, you see some ants doing some things: some ants are doing something and some ants are doing something else—just as when you look at cells in a body or trees in a forest. Ants live together, and there isn't really anything else besides the ants, just as the forest is not anything else besides the trees. There is such a thing as an ant colony, or a healthy forest, or a healthy body, or a growing body, or an embryo that turns into something else, only in the same way that anything is a body. Is that an answer?

*Bruno Latour*

You showed yourself that any time you discuss group selection, superorganism, ants individual agency, and so on, you have to come up against paradigms that have been defining human politics and human sociology. Your own encounter with E.O. Wilson that you told us about in your opening statement is a good proof of that. I am not defining politics which is impossible as Didier explained yesterday, I am pointing at the commerce between domains where whatever the entity considered, cells, ants or baboons, we use the same set of principles for ordering how they fit in. What you showed on colony, the way you invented a way to visualize the colony existence without attributing any break between the individualizing ants and their

provisional superposition or overlap as I said, is this not a proof good enough of the way inventions can be made in the political domain? Is it in the set of patterns, or concepts or templates we have to understand order in collective phenomena? Politics is about the way they are collected. This is why I am not too happy with the definition using power, as if there was some sort of situation, some sort of collective where power would not be exerting its influence and that could be said to be non-political. The strength of studying ants, or baboons, or cells, or ecosystems of Gaia is precisely to help human society to get out of a notion of power in order to understand what politics is about. So it's not that ants have politics, I'm not going to use the template to understand politics straight, but your own work, for me, is a decisive political invention that you have been able to describe, ants colony information without having a colony in top of the ants; and that's also the key invention which I've learnt also from Shirley's baboons, which is so important for defining human politics.

*Shirley Strum*

You still haven't said what politics is.

*Mike Lynch*

I'm not going to answer the question of what is politics, but I was just thinking about the ants question which came up earlier. I want to invert the question and suggest a way to notice what's important to preserve rather than to eliminate. Consider how, I hate to introduce his name again, Trump is making many things disappear: The Environmental Protection Agency, the Paris agreement, Obama's health care plan, and so on. To put an optimistic spin on it, he's really making those very institutions remarkably visible. It may be that they don't just need to be preserved, but that they need to be reinvented or strengthened so that they do what they are designed to do. Perhaps by negatively highlighting them for us, we are given some sense, not of what should disappear, but of what should reappear and be more visible.

*Tim Lenton*

There was a question about what's the flesh of the politic that I was going to take the sub part of that interesting question of what you can see from inside the body and Mike in his earlier remarks began to touch on this, the observation... what

we can see from inside the body is changing and developing all the time with our technology. It's interesting for me to reflect on this famous graphic that's called the Keeling Curve—Charles Keeling's measurement of carbon dioxide in the atmosphere. It goes up but it also oscillates and, in scientific meetings, it will be perfectly normal and unobjectionable for presenters to talk about that as the breathing of the biosphere: It would be unobjectionable, no one would bat an eyelid if the presenter came up with and not only showed there are oscillations but described it as the breathing of the biosphere. They might also share a very nice movie which is a composite of satellite imagery, of the greening of vegetation over the annual cycle fluctuating between the hemispheres because there's more vegetation in the North than the South. That's why we get this annual cycle in carbon dioxide. So that may seem an aside but I wanted to go to the things we can see about the history and not just about cells, but of Gaia, because I noticed Bruno five minutes ago providing a narrative of the great oxidation as an illustration of this important phenomenon of the crossing of scales, but I have to caution that there's a very different working model of how things unfolded then as well, which is that the innovation, the biological innovation of water-splitting photosynthesis comes about and, although spectacularly difficult to evolve, for reasons we won't go into, once it has evolved, my word, there's water everywhere, it's an unlimited electron donor compared to the very sparse substances that were being used before and suddenly it would spread incredibly fast. But we're talking about a dynamical system here with the planet and that does not necessarily create an oxygen-rich world instantaneously, instead, as we understand it, Gaia can have very different configurations of planetary scale with, what I would call, "tipping points" between them; and initially it may be that those first photosynthesizers in several hundred million years have created in fact a much more perversely, this may seem odd to you, chemically a much more reducing atmosphere, because they were burying all the oxygen as great rusted iron deposits at the bottom of the ocean. And only several hundred million years later did the whole system tip in what for us would be absolutely sort of what we would describe it as more than catastrophic fashion, in this event the great oxidation. And the reason why I bore you with the science of that thing, which we can barely see, to be fair, in deep time, is that we begin to see it, just in the last couple of decades with new, not just new technology, but new thinking about what we would call the proxies that can disentangle this. I guess the meta point that arises from it is: never to forget that the system in its brutal (that's perhaps a loaded word) dynamics can sometimes convulse quite radically from one stable attractor to another, and that's why I showed you the ice core record yesterday, to remind us that the system, prior to our activities, is showing some indications that it's in one of these unusual states where it may be vulnerable to convulse. I heard you describing it as a more gradual-

ly filtered progression from the original innovation as a small scale possibly filtered slowly over millions of years with oxygen steadily accumulating in the atmosphere. Maybe I misheard you, because I think we generally share our understanding but the comment got picked up by—maybe it was Deborah—and we were painting a picture of something extraordinary, perhaps the most extraordinary thing that happened in history of Gaia, but we were starting to paint a picture that might not be the right picture, of course we're still contesting the picture, but weirdly the picture might matter for what it tells us about how Gaia behaves, if I'm allowed to use that language, or can behave. That was all.

### *Bruno Latour*

No, this is a misunderstanding is that my point which relate to the question of ants and all of us here, is that scaling is *the consequence of the organisms themselves*, so to speak, so we shouldn't apply an priori scale (small, medium, big) to living organisms. This is a principle of actor-network-theory which is very important to resist the split between levels that render the composition of the body politic impossible. The ability of scaling should be granted to the organisms themselves. That's why I alluded to the oxygenation event. Life forms don't find them situated in any big or small frame, they make the frame.

### *Tim Lenton*

I like that observation. The only thing perhaps worth noting is: depending on the nature of the innovation, given all the types of selection, sometimes things escalates spectacular quickly to a planetary scale and that's exactly the point we're discussing with the neoliberal capitalist World Trade Organization realized anti-Gaia yesterday, just like the oxygenic photosynthesizers.

### *Deborah Gordon*

My point wasn't exactly about whether it was gradual or catastrophic, but only that I hear us slipping into talking about scaling as if there were sort of inevitable principles or laws that the world would follow, and those principles, like the 0.75 law, have the same status as 'the body.' I know that's not what you meant but it's easy to think: "Ok let's, you know, let's make a World Court for anti-Gaia behavior and just legislate everything"—that somehow scaling up to that would be an easy thing that just happens by itself according to some principle. In the particular case

that you're talking about, the oxidation didn't happen according to any principle but instead had some dynamics that led to the tipping point. That is an instance of the kind of objection I was making.

*Isabelle Stengers*

Okay. The question has come back to “Then what is politics?” and I would like to come back to that because, indeed, it seems to me that we have to avoid to see politics everywhere, as if there was a politics of ants, a politics of baboons, and all that. Oh sorry?

*Shirley Strum*

Politics of baboons is different than baboon politics, isn't it?

*Isabelle Stengers*

Okay, perfect. What I mean to say is that the very term politics is not human, is Greek. And it is the Greeks who, it seems to me, made the -1 gesture. How can we live together without an emperor, the God, an emperor representing God? How can we by our own means decide together the life of the city? So if we pay attention to this gesture -1, it seems to me that we have to ask who is the “we” who has to live without a God, an emperor, without a great principle, who turns the -1 into a great problem. Because other peoples do not encounter this problem when it comes to the manner of thinking and deciding together. I remember the telling of a first Nation Indian—they produce beautiful telling, which are very impressive for white people, which are crafted to make them feel that they are not alone in the world. He said that when his people had to gather around an issue, they drum, for all important occasions they drum, they drum to call those who must attend the gathering, they drum in order to keep the word going. And so he asked “Why, you white, do you never join us in our drumming?” So if drumming is political, it does not tell about a -1 gesture. What matters is not being among “humans,” alone in the world. Our own definition of politics claims to be scalable, in Anna Tsing sense of the term, that is liable to be extended whatever the scale or the situation, but at the price of a redefinition of the situation. And everywhere indeed the -1 gesture has been extended with dubious results. Bruno's Parliament of things complicates the image, participants come as spokespersons of things, not as naked, opinionated citizens. But the making of such spokespersons is unclear, as well as the way of their

exchanges. So my point is that we should resist the temptation to produce a scalable definition of politics. We do not know what drumming would be, who and what is needed. And it is important to remember that from its Greek starting point it was problematic, a matter of concern and experimentation. The question of scaling up must be utterly divorced from the search for scalable definitions.

### *David Western*

A couple of things: first of all, I've been intrigued by the use of the post-selfish gene, post-Gaia 1, post-neoclassical economics, so why not post-body politic and confront what's different about the world today than the emergence of political centralization. So yes, let us use the example of scalability. In the case of environmental governance, there has been a fundamental change in our views of whether it is possible to manage the commons. Garrett Hardin in 1968 wrote about "The Tragedy of the Commons," saying that we could not manage common property resources without privatization or a Leviathan government. Elinor Ostrom showed otherwise in her classic, *Managing the Global Commons*. Societies around the world have sustained common pool fisheries, pastures, forests and water sources through rules of governance that produce win-win outcomes, monitor use, enforce agreed practices and so on. The same applies to public parking lots, highways, airways and airwaves. Collective distributed governance of resources is possible, given a basic set of rules governing access and use. The rules apply to the local commons, like pasture, and the global commons, like combating the ozone hole under the Montreal Agreement, and greenhouse emissions under the Paris Accord. The rules are scale neutral, in other words, if the terms are agreed, invoked, action is monitored and the conditions enforced. So I think the idea of scalability is an interesting one, but for very different reasons in humans than other species. Other species face density-dependent effects—higher mortality due to crowding, food limitations and disease—with increasing densities. Humans don't necessarily. In the case of cities, we have solved the density-dependent effects of crowding and cities are now super-linear growth centers. We are unique in transcending our biological limitations with extra-somatic props, in breaking our evolutionary straightjacket without much change in our physical or cognitive makeup. So my question is this: are the pre-literate, pre-body politic governance systems among say, the Maasai, being re-enacted on the global stage as we become intimately and individually networked? I think there is much to think about in the way small scale societies work as we scale up to a global society just as intimately connected. The lesson from Elinor Ostrom's work is that there are common principles by which we work collectively and effectively together at all scales. To go back to Deborah's point. It would be

erroneous to say that every single thing scales up linearly to the global level, and that's not what I'm implying, I'm saying that there are some things that are super-linear, like city amenities, others that are sublinear, like network efficiency. And to get back to Tim's point: there is other thing that are non-linear, like thresholds in the capacity of forests and oceans to absorb our carbon emissions, and yet others that have breakpoints, like coral bleaching with warming oceans. So we need to be conscious of constraints and limits which are non-linear and can cause rapid and perhaps irreparable changes—a 4° C change in global temperatures, perhaps. I do want to make the point that what is unique about us is, first that we are the only species radically changing every facet of our planet, second that we are the only species that can do anything about it. Imagine if elephants become the super dominant that we are ecologically. Would they care a fig about other species, or be able to anticipate the consequences of their impact, cut back their reproduction and begin clearing up the environmental mess they've made? Perhaps it's lucky that we became the super-dominant species. Finally, to address Kyle's point. You say the monopoly on democracy by the superpowers in global organizations like the United Nations, CITES and so on is reason for concern. True. But for people like myself who represent a third-world country, they also offers a chance to be heard and have an influence internationally. Why is the United Nation Environmental Program in Nairobi and not New York? Because Kenya was a very strong voice in the Stockholm Conference in the 1970s and today plays a role in articulating the views of the growing power of the developing nations in addressing global environmental threats caused by the more powerful nations. Vanuatu, small as it is, had a big voice at the Paris meetings on climate change--because it stood to be the first nation to suffer sea level rise. So I think global bodies cut both ways and take us back to the central issue of how to reconcile political differences. How do we make sure that the governance, not politics, comes to the fore in the global arena?

*Bruno Latour*

We proposed body, then politic and now you propose post body politic, is that right?! Wonderful.

*Simon Schaffer*

Okay, tempted to remind everyone that, especially in this room, the founder of political theory, in this sculpture, Aristotle defines politics as the way in which ants and bees behave. And it's not really until the 17<sup>th</sup> century in Europe, long before then much earlier, sorry, long before then in other cultures, but in Europe it's only

in the 1600s that anybody insists that ants and bees are not political. So the way in which the debate is developed is fascinating, I mean, obviously I'm thinking of Hobbes that it is true that certain living creatures as bees and ants live sociably one with another, which are therefore by Aristotle numbered among political creatures and yet have no other direction than their particular judgements and appetite, nor speech, whereby one of them can signify to another what they think expedient for the common benefit. So not to be judged political. The implication of Hobbes's argument is that signifying to one another what you judge convenient for the body politic is what makes you political, and I hope you agree with me that we've just had 98 minutes of really serious politics.

## Lessons for the Anthropocene from the Socio-Ecological Worlds of Baboons

*Shirley Strum*

When I think about the weighty and abstract issues raised by my colleagues here, I'm at a loss for words. Instead, I approach these issues from the world of baboons who have no speech and no philosophy. Yet Darwin said in *Notebook M*: "Origin of man now proved—Metaphysic must flourish—He who understands baboon would do more towards metaphysics than Locke." Let's see if that is correct.

I showed 5 video clips because baboons and their society are so foreign to us, so different from humans. I didn't narrate because I wanted the audience to make sense of what they saw without my interpretation. The first clip is from a sleeping site early in the morning. Baboons are resting, grooming, and socializing. This is a snapshot of a snapshot. Multiply it by 124 animals (with their simultaneous relationships, goals and desires) and you can imagine the difficulties of mobilizing the troop, for example, to start the day's foraging. What direction should we go? Where is the best food? Where are the dangers? Who should we follow?

The second clip is of a male and his friendship subgroup. These females and youngsters are socially but not biologically related. The group exists through a great deal of social work since their ties to each other come through their bonds to the male.

The next clip shows two infants near their two mothers who are grooming nearby. One infant is a real cultural dope; he has no sense of the risk that his approach towards a group of males (who had just killed a young gazelle) might create. The mother does, however, so she retrieves him. Baboons have to learn to read social signals and socioecological complexity.

The next clip shows adult female, Deborah, doing "social work." Although she

is in the middle of the group, the dense vegetation makes it difficult to see others. That is why she is constantly monitoring around her. She notices a male at a distance, and gives a “come hither” signal requesting him to approach. Unfortunately, he comes with a female who is higher ranking and so displaces Deborah. Keeping the group together is a constant task.

The final clip has an adult male at the top of a tree. He lost the group so climbed the tree to get a better view. You can see how uneasy he is not knowing where the rest are. His “lost” call, a wahoo, doesn’t get a response so he continues to monitor. Even big males need the group.

I’ve redone the rest of my presentation 5 times in response to what I learned from Tim, Isabel, Deborah and Jonah’s material. Still, moving from baboons to humans presents several obstacles. The first is language. Humans don’t have to define “politics.” Maybe we should but it didn’t seem to prevent our discussions. When I say that baboons have “politics,” the term carries a huge amount of historical and cultural baggage and I must specify exactly what I mean by baboon “politics,” I need data to support my assertion, and I should be able to make better predictions about baboon behavior using that term. That is true of any human term I use for baboons. It took me years to accept that baboons really did have “friendships.” I’m grateful to Isabelle for offering a better word, “partnership”—better because it carries less baggage. The next stumbling block in making baboons relevant to humans is how to think about their relationships. Of course, baboons aren’t little humans but is there a continuity or a discontinuity between them and us? And if there is a continuity, what makes the difference. Conversely if there’s a discontinuity, where did those human behaviors come from? This riddle is part of any attempt to use baboons as an explanatory principle. Bruno and I took one approach when we worked together on the “meanings of social.” Our argument was that society has to be negotiated and that baboons and humans use the same processes to construct society. The difference comes because of the resources they have at their disposal. This is the difference that makes the difference. But it also creates a dilemma in considering the Anthropocene challenge to Gaia because the Anthropocene comes from humans applying special resources (that baboons don’t have) to the problem of building society. Can baboons provide lessons for humans in the Anthropocene? I make some tentative suggestions at the end of this presentation.

Part I: Baboon Principles. After so many years watching baboons, I realize that only humans (including scientists) can separate the social from the ecological. Deborah has made this point as well. Here is a baboon example of how the two are intertwined. In the 1970s, the land where the baboon ranged was sold for agriculture. Crops appeared. The baboons (my “language” of motivation may be problematic to ethologists) treated the crops as they would any new resource. They did not

segregate their responses in terms of natural or human induced changes. However, not all the baboons wanted to eat human food or go to crop areas. The group split: one part became raiders while the others remained non-raiders. Initially, the raiders were adolescent and young adult males who, as I saw it, would benefit most from faster growth, and heavier weight that eating crops provided (I don't think they realize this—it is my evolutionary interpretation). By contrast, the females who joined the raiders based their choice less on diet and more on social relationships, maintaining “partnerships” with raider males. But raider females got other benefits. Most were the eldest sisters in their family which meant they were the lowest ranking in the family hierarchy. By leaving their family to join the raider group, they gained dominance status. There was also one old female who joined the raider group. She didn't conform to the female pattern since she was a matriarch and wasn't bonded to any raider male. It took several months of going back and forth for her to decide to stay with the raiders. Although she had an infant with her, he left to be with his older brothers in the troop that didn't raid. What did she gain by joining the raiders—better reproduction and dominance. Eating human food improved her condition and jump started her faster reproduction plus she had fewer females above her in the hierarchy. These are just a few examples of how baboons don't and can't separate the social and the ecological realms.

#### BABOON PRINCIPLE 1: THE SOCIAL AND THE ECOLOGICAL CANNOT BE SEPARATED.

Next, I want to highlight the crucial importance of the “social” (emotions and bonds). I had to translocate three troops to resolve conflict over crops. The only place I could find was much more arid with frequent droughts and generally less food. Fortunately, the baboons survived. But what I witnessed contradicted evolutionary predictions. I thought I would see a “struggle for survival” or a war of “all against all” fought over limited food. However, competition didn't increase. Instead, the baboons depended on the group and each other even more. They learned from indigenous groups (what food to eat, where to find it) and learned how to find water (including eating a new succulent plant) from recently transferred local males. The most convincing example of the importance of the social was during the release of one of the three translocated troops, which were released at different times. During one release two subgroups went in different directions. When they found each other it was a reunion ritual unlike any I've seen before or after. Normally, when individuals or small subgroups who are separated from the main group rejoin the main group, they embrace, make friendly noises and groom their family or friends. This translocation reunion was different in intensity and extensiveness because everyone embraced and reassured everyone else. I had the impression that

they were very relieved to reunite. These reactions helped me realize that the group is a resource when facing an uncertain future in a new land which is not so obvious day to day.

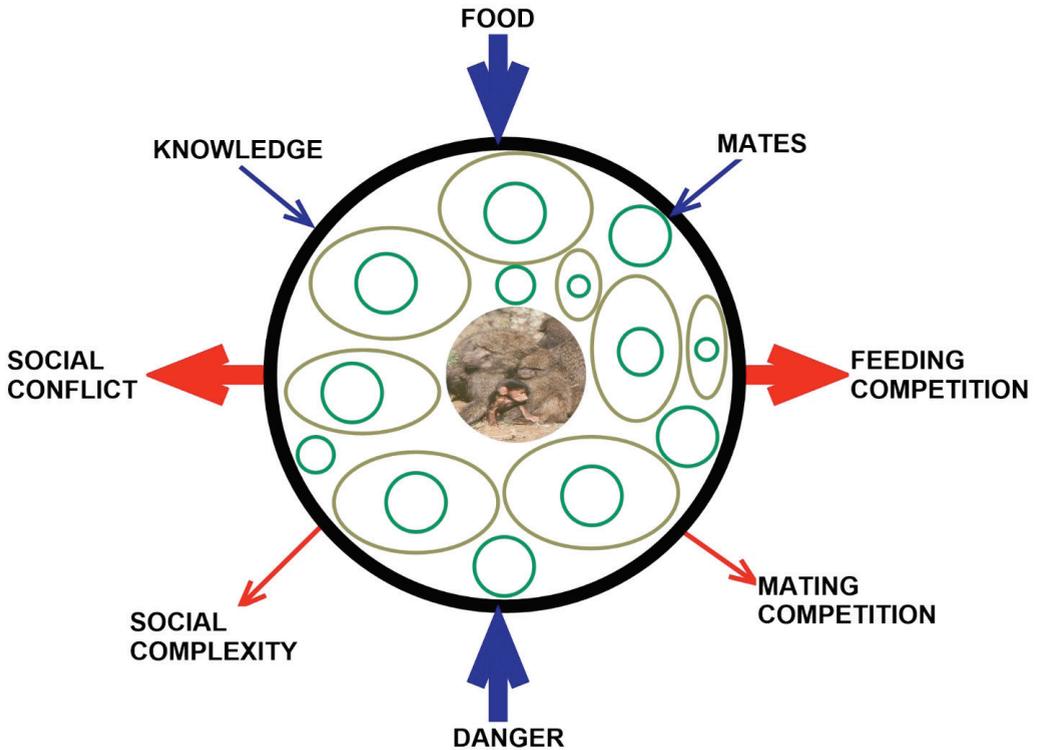
#### BABOON PRINCIPLE 2: THE SOCIAL AS A RESOURCE.

The third baboon principle is about “constraints.” There are constraints which influence individual action. For example, although Deborah says that an ant can’t “be” by itself, baboons really don’t want to be by themselves. Even a male baboon, who transfers between groups during his lifetime, doesn’t want to be alone. The male in the last video clip was upset until he found the others. For baboons, living in a “group” always constrains individual decisions. History is also a constraint on the future. Let me give you one baboon example. Two groups were translocated separately and released near each other. One night a herd of elephants came below the sleeping rocks of one troop. Frightened, that troop moved 3km in the middle of the night. Baboons don’t travel in the dark and they sleep in trees or on rocks for safety. The unpredicted elephant incident initiated a series of home range shifts. Eventually that troop lived more than 20 km from where they were released. By contrast, the troop that didn’t have an elephant encounter, stayed near the area where they were released.

#### BABOON PRINCIPLE 3: THE GROUP AND HISTORY BOTH FACILITATE AND CONSTRAIN FUTURE INDIVIDUAL ACTION.

The next baboon principle relies on illustrating how the Anthropocene unravels past connections using what I’m now calling my “Baboon Gaia” graphic. This is a schematic of the factors that keep a baboon group together or cause individuals to pull away. Normally, we see a dynamic balance between attraction and dispersion of individuals. The little circles and ovals represent subgroups, family groups, and a variety of partnerships. I’ve only included the most important. For example, being in a group has advantages in competition with other groups for food and for defense against dangers.

## Dynamic Model of Baboon Group

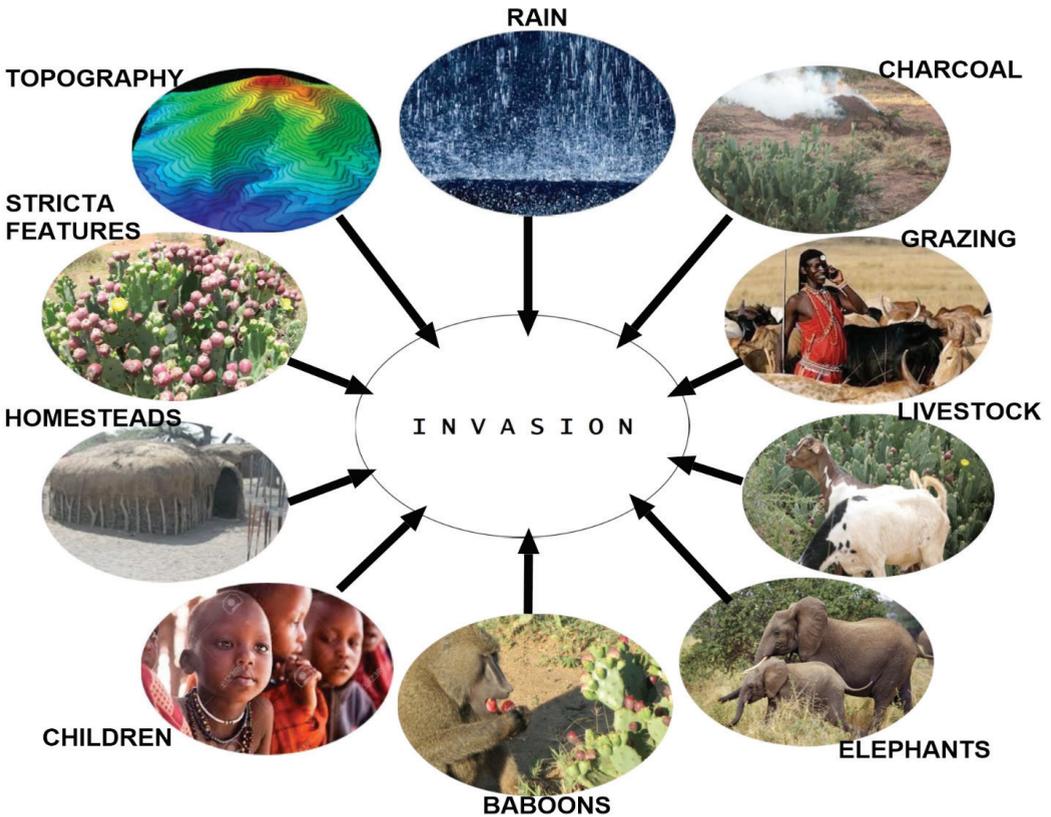


There are other benefits of living with others such as accessing traditional knowledge and mates. But living in a group also has costs such as intra-group competition for food and mates, and a variety of social conflicts. I also see cognitive costs of living in a socially complex group without symbols, language, and material culture.

Now let's consider the impact of the Anthropocene on baboons. Their environment is rapidly being humanized. Most notably, changes in livestock grazing practices facilitated the invasion of an exotic cactus plant which then became a rich and abundant source of food for the baboons. But this abundance disrupted the dynamic balance that kept the "larger" group together. Competition between groups over food declined and changed the balance because being in a smaller group would reduce both social conflict and social complexity. Unpredictably, the group splintered several times. However, there was still the problem of defense against dangers. Smart baboons found a solution by sleeping close to other baboons groups, mobilizing additional eyes and ears when they were most needed. However, in the morning, smaller units left and could travel shorter distances with potentially fewer social conflicts and reduced costs of social complexity.

**BABOON PRINCIPLE 4: CONDITIONS OF THE ANTHROPOCENE DISRUPT DYNAMIC BALANCES THAT EXISTED BEFORE.**

Examining the cactus invasion more closely is also useful. Intact grasslands resisted cactus invasion for 50 years. But human degradation of the rangeland could not account for the invasion by itself. Below is my schematic of many of the influences.



*Opuntia stricta*, a prickly pear cactus, was brought by the English colonial government to the baboon area in 1950's for living fences around compounds. Nothing changed until the heavy rains of an El Niño event in 1998. Previously, people from the Maasai tribe and their livestock moved seasonally to follow good pasture. This El Niño year, they could stay in place. I think of it as a "perfect storm" of interactions. El Niño coincided with a shift in cultural values; Maasai women now wanted to be close to schools and medical care. Permanent homesteads increased and with them heavy grazing in a small area. Soil temperature rose because of bare ground. *Opuntia stricta's* own reproductive strategy kicked in. The plant

relies heavily on seed dispersal from the abundant fruits and not only vegetative growth. Rainfall was an important factor as well since the plant was adapted to a single rainfall regime and now, in Kenya, experienced two rainy seasons. Fruit production took off which was good for the many potential consumers of cactus fruit: baboons, people, livestock, elephants, and later tortoises, hyrax and birds. Charcoal making, new to the area, played its part in the dispersal since cactus pads replaced grass as the top-most layer of traditional kilns creating hotspots for new patches of the cactus.

**BABOON PRINCIPLE 5: ALTHOUGH HUMANS WERE INVOLVED, EVEN A SIMPLE PLANT INVASION DOESN'T HAVE A ONE FACTOR EXPLANATION, PARTICULARLY IN THE ANTHROPOCENE.**

Comparing Baboon Gaia to Human Gaia (and I like Tim's Gaia 2.0), highlights overlooked aspects of Gaia.

1. The social and the ecological cannot be separated.
2. The social is a resource particularly important when facing the "unknown."
3. The existence of a group and a particular history constrain individual options so that not every action is possible.
4. New conditions in the Anthropocene disrupt previous dynamic balances.
5. Single factor explanations are inadequate, particularly given the global reach of the Anthropocene.

These suggest that while, historically, humans have managed to divorce the ecological from the social, they need to be reconnected in human perception and action in the Anthropocene. Since the Age of Humans has no precedent, humans might consider mobilizing the "social" in the face of such unknowns. Policies and interventions should realize that real people in real time have constraints on what they can do. Not everything is possible and few things are reversible. It makes sense to understand how the Anthropocene has disrupted basic social, cultural, and psychological dimensions of human life as well as climate. Finally, single factor explanations, like only blaming humans, are seldom appropriate, less so in the global reach of the Anthropocene.

Today, in the Age of Humans, you can't get away from people. This Dialogue aimed at reconfiguring how we think about the "Body Politic." Why? So that we might find a new way to conceive and act on behalf of the future of our planet. Jonah has the best and broadest perspective for this. My own small piece of the Anthropocene story has shown me that information is important—using it to educate and raise awareness of people. But success depends on appropriate cultural translations. The Maasai I work with would not understand our Dialogue because they do not divide the world into nature and culture. Awareness and understanding are

not enough. People seldom change their behavior without options or alternatives.

I'm unsure of how our discussions around this table might create a new intervention but I have presented my best guess for how to bring baboons to our table.

## From Nature to Precarious Lives

*Didier Debaise*

My starting assumption is the following: The moderns have invented a concept of nature in order to inhabit the earth, thus identifying two things that should without a doubt have been strictly separated. It seems to me that this hypothesis can serve as a guide which allows accentuating an ensemble of transformations which have been developing over the past decades, starting with operations of reciprocal capture between anthropology and metaphysics concerning the subject of the various ways of inhabiting the earth. It has today become paramount to question the particularly modern invention of nature not only because it defines the status and the function of the main categories at the basis of modern thought and its contemporary heritage—even where they are not explicitly concerned with nature—, but also because it constitutes a necessary condition for reflecting upon the consequences linked to the “new climatic regime.” I will proceed in two steps: first of all, I will establish a genealogy of the constitution of nature and its effects; secondly, I will proceed to setting up another manner for the articulation of beings that takes as its starting point the concepts *narrations* and *precarity*.

### WHAT IS NATURE?

The nature of the moderns is essentially a question of *gestures* and *operations*. It was a real mistake to believe that we can found its mains characteristics, its foundation, in the representation of nature. What are exactly these gestures that are on

the root of the invention of nature? I described them during the first day of our meeting but I would like now to enlarge this description. The first gesture is the gesture of the bifurcation of nature. I take this notion from A. N. Whitehead and more particularly, from its book *The Concept of Nature*. In the very first pages of *The Concept of Nature*, Whitehead provides a definition, in the form of a protest: “What I am essentially protesting against is the bifurcation of nature into two systems of reality, which, in so far as they are real, are real in different senses. One reality would be the entities such as electrons which are the study of speculative physics. This would be the reality which is there for knowledge; although on this theory it is never known. For what is known is the other sort of reality, which is the byplay of the mind” (6).

This is the heart of the operation of bifurcation. It is here that the moment of bifurcation is located. Starting with immediate experience, bifurcation operates by splitting such experience into two regimes of existence. In doing so, it takes that which constitutes the primary experience of nature and places it in into a derivate, phenomenal realm. Once this bifurcation is established, once the two regimes are stabilized and subjective experience is rendered as epiphenomenal, it is possible to state that even if a fundamental knowledge of primary qualities is permanently postponed *in fact*, such knowledge would, *by right*, allow for knowledge of secondary qualities, by derivation, even if secondary qualities are the only things that we know, practically speaking. As a result, there is no need for an exploration of bodily perceptions, as such. On this basis, it is possible to define the process of knowledge which is at the root of all epistemologies that are derived from the operation of bifurcation as an operation of correlation between secondary qualities, simple appearances, and primary qualities, which are purely conjectural. As Whitehead summarize it: “Another way of phrasing this theory which I am arguing against is to bifurcate nature into two divisions, namely into the nature apprehended in awareness and the nature which is the cause of awareness. The nature which is the fact apprehended in awareness holds within it the greenness of the trees, the song of the birds, the warmth of the sun, the hardness of the chairs, and the feel of the velvet. The nature which is the cause of awareness is the conjectured system of molecules and electrons which so affects the mind as to produce the awareness of apparent nature. The meeting point of these two natures is the mind, the causal nature being influent and the apparent nature being effluent” (6).

The conclusion to be drawn is that the modern invention of nature did not originate in an ontological position, either dualist or monist, but in *local operations* of the qualification of bodies. The ontology of the moderns comprises the manner in which they have attempted to express the permanently repeated gesture of dividing bodies and their qualities while continually masking this very operation. In short,

this ontology presupposes the gestures, techniques, and operations of division.

Bifurcation leaves a murky zone in its wake, one produced by its own operations. Since all modern experience of nature inhabits this bifurcation and points towards the primary qualities of bodies, which are both constitutive of experience and yet inaccessible to it, a more detailed investigation into these natural bodies in themselves is necessary. The question of quite what these primary qualities are in themselves is put center-stage, dramatized, intensified to the maximum, by this murky zone. But bifurcation leaves open the question of knowing how to characterize bodies when they are extricated from their phenomenal dimension. But this separation continually leads back to a series of questions which receive no adequate response: what *is* a body when it is separated from its secondary qualities? How can we make sense of such a body, since we only have access to secondary qualities? What kind of knowledge would allow us to penetrate into the interior of these non-observable qualities? According to the interpretation provided above, the inability to provide a characterization of primary qualities is not a weakness of the modern conception of nature; it is where it draws its strength. It is the dramatization of this difficulty which constitutes this modern conception. It was necessary to push this point to the extreme, in order to give due weight to the second operation that is constitutive of modern cosmology. Whitehead gives it a new name: “the simple location of matter.” It is this which will provide the abstractions that are required to deal with natural bodies. I will cite the long passage in which Whitehead describes this: “To say that a bit of matter has simple location means that, in expressing its spatio-temporal relations, it is adequate to state that it is where it is, in a definite finite region of space, and throughout a definite finite duration of time, apart from any essential reference of the relations of that bit of matter to other regions of space and to—other durations of time. Again, this concept of simple location is independent of the controversy between the absolutist, and the relativist views of space or of time. So long as any theory of space, or of time, can give a meaning, either absolute or relative, to the idea of a definite region of space, and of a definite duration of time, the idea of simple location has a perfectly definite meaning” (8).

With regard to the question—“what is matter in modern experience?” I would offer the response: a *localizable* point. It is a minimal definition, but it has a radical effect. But if you think about that it’s a very strange definition of the matter, of the reality, because it means that you need to have a geometrical formalism to say what is there. That was a very strange invention of nature, because it’s a complete abstract, complete phantasmagoric definition of nature. And it allows the modern to articulate every being by subtraction. Not reduction, I think it’s not the same and I think we miss something when we focus too much on the re-

duction, because you can reduce and keep the qualities, or at least you can reduce and explain the emergence of a certain amount of qualities, but this operation of articulation of all the beings were possible by the operation of subtraction.

### NEW STORIES

So, the question of the meeting, if I may rephrase it, is how to articulate all the beings without subtraction? I think we had directly, already from the second day, a set of elements to do it. Indeed, during her talk, Deborah showed us, through a video, the steps of an experimentation on ants. The complete experimentation is inseparable from the sequence by which we follow the movement of the ants through different paths. Deborah described it as an “example.” I’m not sure that the term “example” is the most appropriate. Instead, I would propose the notion of *story*. Maybe a new way to articulate the beings after the bifurcation and localization of nature would be to improve, to reconsider the function of *stories*. I had a discussion during the break with Bruno and he told me how ironic it would be to introduce the notion of story now in science studies. At the beginning of the ANT, among a lot of other critics there was the feeling that ANT might be just a kind of “storytelling” and now we would claim that indeed we need to focus on stories because it is a main aspect of sciences... This would be my proposition: to reintroduce stories as an important tool, a real method inside scientific practices.

What is a story? The historian of environment, William Cronon made a useful distinction for our discussion: “a chronology is a simple listing of events in their order of occurrence. In contrast, a story, or narrative, weaves those events together in a way that generates context and meanings. Connection and relationship are central to narrative. Story is about the weaving of those connections, either in the recounting of events (story-telling) or simply in one’s own ‘storied experience’ of the world” (5). It is an art of composition, a way to articulate, to connect, a series of events through different logic (not only chronological). To which purpose? How can we produce these new articulations? To answer to these questions and, by this way, to clarify the status of stories, I would like to use an idea from Anna Tsing. In her last book, *The Mushroom at the End of the World*, she writes: “To listen to and tell a rush of stories is a method. And why not make the strong claim and call it a science, and addition to knowledge” (4).

The important claim is that we would need a new method. I would like to propose now different principles of this method.

*The first one is that we must “exclude nothing.”* Stories as a scientific practice would

begin to take everything that is important in a specific situation. This principle is the exact opposite of the “bifurcation of nature” which implied the subtraction, the exclusions of some elements of our experience, the reduction to only one kind of reality (the matter). Making stories requires an art of composition. Whitehead expressed it in a form which, at first glance, might appear cryptic: “Philosophy cannot neglect the multifariousness of the world—the fairies dance, and Christ is nailed to the cross” (7).

*The second principle is that every knowledge has to be linked to the process by which it was produced.* In *The Meaning of Truth*, William James introduces a differentiation between two kinds of knowledge that can be very useful concerning our discussion: “The most general way of contrasting my view of knowledge with the popular view (which is also the view of most epistemologists) is to call my view ambulatory, and the other view saltatory; and the most general way of characterizing the two views is by saying that my view describes knowing as it exists concretely, while the other view only describes its results abstractly taken” (3). In this quotation, William James characterizes the usual knowledge (popular view) as saltatory and proposes for a more concrete view of knowledge the term ambulatory. To express it in our terms: making stories is a practice of ambulatory knowledge. We can start by an example: “a geologist living in 1928 tells us about events that happened not only before he was born but millions of years before any human being came into existence on this earth” (1). A saltatory vision of knowledge would link the proposition of the geologist to some events that happened millions of years before him, as if he jumped from his present situation to another situation. But “the geologist did not leap from the thing he can see and touch to some event in by-gone ages; he collated this observed thing with many others, of different kinds, found all over the globe; the results of his comparisons he then compared with data of other experiences, say, the astronomer’s.” He translated, that is, observed coexistences into non-observed, inferred sequences” (1). The ambulatory knowledge implies a series of intermediaries which connect the proposition to the event to which it is related. Of course as soon as the link, between a proposition, a theory, an idea, and the events to which there referred, is established, we can make abstraction of all the intermediaries, but this is an effect of the process of knowledge and not the cause.

*The third principle is that all stories begin by a situation of precarity.* As Tsing formulates it: “Most of the time, we imagine such precarity to be an exception to how the world works. It’s what ‘drops out’ of the system. What if, as I’m suggesting, precarity is the condition of our time—or to put it differently, what if our time is ripe for sensing precarity?” (4). The sense of precarity is a sense of the fragility of the existence. It is particularly pregnant in the new climatic regime where we are facing dramatically the fact that things can disappear, that they are in the edge of

the disappearance. If we need other stories, instead of the “bifurcation of nature,” it is because we cannot anymore reduce the precarity of each existence to the general stability of nature.

*The forth principle is that each existence requires a lot of others to persevere in its own existence.* Stories, as a method, should not begin by a specific domain of reality (bacteria, plants, animals, humans, etc.) but by the entanglement of forms of life: “Bacteria made our oxygen atmosphere, and plants help maintain it. Plants live on land because fungi made soil by digesting rocks. As these examples suggest, world-making projects can overlap, allowing room for more than one species. Humans too have always been involved in multispecies world-making” (4). Telling stories is a way to establish the network of dependences of each being. It is not just a question of knowledge; it is in the same time a political question: “In taking seriously the entanglements of ways of life across evolutionary, ecological, affective, and multiple other domains, we are inevitably drawn into a set of complex *responsibilities* for what has come to pass and what may yet still be possible (5).

To conclude, I would come back to my fist assertion: the moderns have invented a concept of nature in order to inhabit the earth. By a set of transformations, and of generalizations, this experimental invention, always linked to local gestures (bifurcation and location) became a real war-machine against all the other manners to inhabit the earth. The “discovery” of this nature became the only legitimate story. Our present situation, the situation in the new climatic regime, requires to give space to other stories, other ways to inhabit the earth. As D. Haraway summarizes it in *Staying with the Trouble*: “We relate, know, think, world, and tell stories through and with other stories, worlds, knowledges, thinkings, yearnings. So do all the other critters of Terra, in all our bumptious diversity and category-breaking speciations and knottings” (2).

## DEBATE

*Mike Lynch*

Okay. This is a question more than a comment. I’m just trying to work out how primary and secondary qualities are being developed. My understanding of it comes from Edmund Husserl (9) writing about Galileo and, as I understand it, the primary qualities would be the mathematical matrix and the invisible entities that, say, in a theory of optics would refer to either particles or rays, geometric lines to depict a lens and visualization, with virtual images and real images, that kind of

matrix. And then the secondary qualities would be the sensory experience of color, of shape, and of distance. I guess the issue that I'm puzzled about is that we've heard quite a few very interesting and convincing stories, I think that the videos that Shirley showed us do show, in some broad sense, things about the baboons, although her instructions on how to see them are essential to any kind of understanding. But we've also heard quite a lot about measurement, mathematics, graphics, and they are part of the story too, so is what you are saying that if we want to frame this with stories, the convincing proofs provided by these mathematical demonstrations would also be framed as part of a story, and would not be dismissed as mere anecdotes, as the bifurcation would dismiss them.

### *Bruno Latour*

As usual I am trying to relate the two very different talks and one of the way is to relate it with the notion of story-telling which might be a shocking way to characterize Shirley's work since it relies on 42 years of field work and data collection. Is there a nuance between telling stories and story-telling? The first is somewhat derogatory "just story," the second is a way to access, summarize and compose data? It is clear from Shirley's own work that she had to fight against a set of anecdotes about baboons in order to offer her own narrative of what all those data meant. Is there a sense in which we could say that stories, narratives, are a scientific way of capturing the reality of how life forms act? There has been a divide in early modern history between scientific and literary story-telling, but are we not at the end of what Didier calls bifurcation? Would that be acceptable to Shirley?

### *Didier Debaise*

As soon as the bifurcation of nature was generalized to all aspects of the modern experience, there was of course a reaction, a way to resist to the dualization that it produced. The main reaction was the romantic one. It admitted the constitution of the two realms produced by the bifurcation but it rejected the predominance of the primary qualities (sciences). It celebrates the secondary qualities (through arts) as a main expression of nature. I think that the relation between art and sciences as we inherit it today has to take into consideration the constitution of the modern nature, which means the bifurcation of nature, and the different ways to try to resist to it.

### *Shirley Strum*

Unfortunately "stories" were used to debunk science during the science wars

which means that in science, “story” has many negative connotations. On the other hand, I think that the science of animal behavior needs stories to capture and convey the complexity of the real world, in my case the complexity of baboons. Currently there are no methods to portray complexity. This is why I think those studying animals and ecology need to revive natural history, Darwin’s kind of natural history which includes comparisons, experiments and even quantitative data into the package. That means telling “stories.” To do this, scientists need to think outside the current paradigm. But I have too often heard the phrase, “the plural of anecdote is not data.” Previously, I agreed—I was trained to agree—but now I resist: the plural of anecdote, (well-situated, supported by other types of data, providing the ability to make predictions about what animals will do), is data and more! The trajectory of my career has been what Didier describes: to put things in relationship to each other and to include more and more context. It is a self-fulfilling prophesy because as you include more context, the only way it makes sense of it all is to tell it as a story. You can’t talk just about data, “this was this and that was that” because how the facts to relate to each other is always as a story. Currently most scientists disagree.

*Deborah M. Gordon*

It’s just to say the same thing in another way. To get from stories to a method, you need a way of putting the stories together, because you could be wrong. We tell stories but we also want to generalize about the stories. When Shirley shows us a clip of baboons doing something, she knows what they’re doing because of other times she’s seen something like that. Her report on what the baboons are doing is not just a story, it is the outcome of a process that brings together many stories. And so whether you call them stories or not, I think persuading people that the story is true, rests on some process of putting stories together. You talk about contingency or the situation, but in order to know that this is a story about the situation, you need to have seen other situations and link these together. What I am saying is that while I like the way that you’ve outlined what a story is, there is another part of the process that you haven’t told us about, which is how you put the stories together. How you know they’re true.

*David Western*

I’ve been extraordinary privileged in my life, growing up amongst pre-literate people, like the Hadza, for who stories are learning vehicles and knowledge generators. When you tell a story in a pre-literate society, you are acting out, performing

and miming and not just talking words. These adjuncts are powerful information transmitters as well as mnemonics. There are typically two types of stories in African societies, those about being a good responsible person in society—a moral upright custodian of the tribe, and those about how to succeed and avoid hazards in life. Who constructs the stories is also relevant. Is the story based on first-hand observation and experience, or handed on from someone else? A bad unreliable story-teller needs to be weeded out from the reliable ones. I think story-telling changes greatly with written language because it can be transmitted without mutation down the ages as in the case of Shakespeare's plays. We have lost so much of the art of storytelling around the campfire of an evening when we can curl up with a book and read alone.

### *Isabelle Stengers*

I would like to come back to Bruno's objection or remark about the difference between telling story and storytelling, which to me is important but should not be an objection. When Anna Tsing tells a story, you know that she is proposing a way of doing science. How could it be a new way since all scientists are telling stories, whether they wish it or not. I would make the hypothesis that she and other people working for instance in environmental humanities, like Thom Van Dooren, like Deborah Rose, really try to do something very risky and without warrant but which is to be appreciated as part of today's situation. They try to tell stories which conform to what is known, but whose first impact is not telling the truth as opposed to falsity, error and all that, but to reactivate our sensitivity. For Van Dooren it's quite obvious. His *Flight Ways* is about bird species at the edge of extinction but extinction is not about the declining number of specimens. Someway he makes us feel what is destroyed, the kind of continuity, of active ongoing laborious obstinate continuity of birds which succeeded reproducing themselves along the ages, and are now confronted with the unravelling of their worlds. I would say that such stories try without warrant to bridge what was opposed as art and science. The facts must be exact, but the point is not the conquest of knowledge, the contrast "we did not know, now we know." The point is to unfold facts, to "irrigate" them, so that we feel the worlds they communicate with. Also, reading Tsing's mushroom stories, one is not captivated by a great story. The intense poetic efficacy of the text is obtained by sober means, weaving thick situations, positively undermining any opposition, between facts and values, *or* nature and culture. Finally I would recall that when Donna Haraway plays proposes a SF mode of thinking, she is not only telling about speculative feminism or scientific fabulations, or science fiction, but also scientific facts.

*Scott F. Gilbert*

Yeah. I think we are a story-telling species and that might be one of the few defining characteristics of our species. I think all cultures tell and love good stories. Our scientists certainly are a story-telling tribe. Our stories differ from others in that they must be within the confines of data, and we link data points together to make stories, and those stories become data points themselves. There's this reciprocity between story and our data. Our stories allow other stories to be more efficiently told. Again, going back to Donna Haraway, who says that it matters what story tells other stories, I think this is certainly true in science. We have such wonderful stories, such as the fertilisation narrative and the evolutionary narrative, which are both origin stories, telling where and when we came from, and who we are. The stories though, make constraints on what other stories can be told—the creation story of Christianity is not within the bounds of our data—but it also limits the number of scientific stories. I think that when we talked about fertilisation as a hero myth of the sperm, that precludes other stories from being told. There's now good data for those other stories, and they are coming from the periphery to the center, and bringing new questions with them. So I think changes in data can change stories, but it takes a lot of effort to change the story. The holobiont is one of these new stories. There is resistance to its being told as a major narrative. Mutualistic symbiosis used to be a narrative about exceptions to the rule. Now it is becoming a narrative of the normal. So, science is a storytelling enterprise, and we put our data together to make stories, and our stories become the data itself.

*Bruno Latour*

There are lots of connections between those reflections on stories and what has been discussed over those three days because the whole project of revising or re-visiting the theme of the body politic is finding new ways to do politics—which is necessarily about how we speak and to whom. I am impressed by the argument that we are trying to tell stories about precarity at the time of capitalism. It's clear that before we were talking as if the physical framework on which politics unfolded was not itself playing its part. Politics was about humans on stage. Now the stage is moving as well and that's change the ways any story is being told obviously. To add the Gaia scale, the Gaia anxiety to any definition of politics, that also changes every way we tell stories to one another. This is what Isabelle calls the intrusion of Gaia.

My second point is a technical argument of semiotics which has a direct bearing on the two subjects we have been discussing today and the day before: when you tell a stories all the portions of the narrative overlap so that you remember at the

end very well what has been introduced at the beginning. The different episodes *overlap* just like the entities we have been discussing. To take up Didier's argument: when you tell a narrative there is no way to stick to the simple localization. Any moment in the narrative intersect with the other. Every reader of detective stories know that: a word at chapter one is still acting at chapter 15. This is why I am struck by the connection between Scott's objects of his study and how he talks about it. This might be why today at the time of the Anthropocene, we seem to find in story-telling such a powerful ways of doing science in our different fields. This is just a suggestion.

### *Didier Debaise*

I have the impression that there is a misunderstanding and the notion of "metaphor" is very risky as it can give the impression that telling "stories" is a way to narrate differently what was produced in the context of a scientific experimentation. It is exactly the difference that I reject. To say it in other words, the difference between the facts and the story, the way by which a scientific can say "the facts were produced in a process of experimentation, but it would be important to find a story, a metaphor, a visual way, to explain it to the public, to make it more understandable" is an inheritance from the bifurcation of nature. It is the reason why I think that we cannot talk about stories without mentioning the long invention of nature and of the bifurcation. I don't think that scientists produce the same kind of stories that the philosophers or anthropologists produce, and it would be absolutely necessary to differentiate the regimes of stories but we should stop to use the general opposition between facts and stories, sciences and other practices of narration. I don't think, for example, that philosophy has more affinities to narrations than sciences. Philosophy is an inquiry on 'abstractions' and this inquiry require some other modes of narrations.

### *Timothy Mitchell*

Thank you for those amazing presentations. I'm interested in all our different responses to this question of the story. We've talked about, positively or negatively, about storytelling, but not about where that analysis came from; which is, yes about overcoming the bifurcation of nature, but overcoming it by this understanding of precariousness or precarity. In your account it was understanding the dimensions of precarity out of which the necessity, or the usefulness, of storytelling, as a method, as the scientific method, arose. Connecting those two things, rather than connecting storytelling with the absence of bifurcation, but connecting it with the

centrality of precarity, has dropped out of our discussion a little bit. I wanted to bring it back in. One way to do that, in the issues closer to where I work: we've invoked other writings, for example Naomi Klein's work, which is very much about precarity. But would it be the case that what is producing the precarity, in which we find ourselves today, is precisely something which is rendered as not precarious? And that would be capitalism. The reason for the forms of precarity that people find is because of the apparently non-precarious nature of the forces of capitalism. Those have a strength, they have an ability to reproduce, they have a certainty about them, that seems the very opposite of precarity. And is that because such writings about climate politics are actually returning us to a bifurcated vision? Or is it because precarity is always a matter of different degrees? Some precariousness is much more obvious. Is it a question of making more visible, and vulnerable, the other precariousness—the one we call capitalism? That's the question.

*Tim Lenton*

This is a captivating discussion and I sit here reflecting on the thought that I've often talked to an audience about how we climate scientists are telling stories about the future, because, of course, even in the formal process of what we do, whilst we have these complex computer models and we either describe some of the physical things that come out of them as either predictions, or more accurately projections, we actually acknowledged that nobody can predict what the collective phenomena of humanity is or exactly what we're going to do as we go ahead. So we literally describe a series of different storylines about the collective phenomena, the unfolding of the collective phenomena of the technosphere, anthroposphere and they have many forms. You'll be interested, if you don't know them already, by their diversity, although one could of course critique that too many of them assumed, you know, globalisation would march forward and only a few of them are called fragmented world, for example. My point is: what is the nature of the stories we're currently choosing to tell about the future? When I look out into culture at large, I see the elements of precarity, this jeopardy element, this element that things might disappear or rather what I would just call crudely "the apocalyptic narrative" is extremely popular, in Hollywood or with Bruno, apparently, maybe I'm unfair. I find that intriguing and also troubling, I'm not saying that we should have a wider, you know, a narrative of possible utopias of the future, but the fact that there that's so marginalized at the moment is interesting, for me, because we don't articulate or tell stories about the future to each other, very much about a future that we would like to inhabit, instead we relish reading about or watching or whatever apocalyptic stories of the future, which, I presume, few of us actually want to inhabit. And so,

coming back to your three elements of precarity, Didier, and I don't see too many narratives, especially ones of the future that are rich in the entanglement between beings, not the kind of ones that are growing out of the admittedly narrow spheres of science that I'm coming from. Nor do they say a great deal of referencing back to the coming into existence, although to credit the broad scientific enterprise, of course, we are starting to see that happen through the Anthropocene narratives. But I would accuse the general kind of business of contemplating in climate change or the new climate regime, which we already characterized kind of narrowly in the discussions yesterday as very guilty of a pretty one-sided view of precarity and not bringing with it these other important qualities. That would be my... just a poor reflection, I guess. The thing I wrestled with is I tried to imagine and tried to think about writing the unapocalyptic, one of many possible unapocalyptic and more interwoven narratives of the future.

### *Simon Schaffer*

Before we finish, because we are more or less around the time thanks to me, I would love it if Shirley would say a little more from this point of view, I mean, from the point of view of the discussion we've just had about the very startling, very striking and actually very moving example with which you closed, which was the moment when you're engaged in a conversation, with, I take it, an indigenous interlocutor, about the causation of the invasion. And that's an extraordinarily dramatic example, I suppose, of the way in which different narratives interact with each other: baboons caused the invasion? No, they did not, here's the right story. What are the sort of reflections that come to mind thinking back then, to the transformation that you evidently achieved, through that particular performance, which was absolutely remarkable?

### *Shirley Strum*

That was my goal at the end. We don't have many opportunities where "evidence" triumphs over "opinion" or even many case studies. The opuntia story has two tensions: one was that (and parallel to Gaia 2.0), there was no pre-existing indigenous knowledge in the community about opuntia or "invasion." That meant there were no tools to interpret it and know what to do. So when opuntia transformed the landscape, people had many guesses and it made sense to make the baboons responsible. Another factor was that I was with the baboons, an authority to complain to. Next based on mistaken opinions and a tendency of human nature, they passed on responsibility to the baboons. Finally, they wanted the Baboon Proj-

ect to take care of the problem, clean up all the opuntia. At that point even I didn't know what was going on. I had to study it for 10 years to find out. What I found was not a simple answer but a complexity of interactions that made the invasion possible. None of the many drivers could alone have caused the invasion. Understanding, real knowledge—evidence not opinion—helped me think of solutions including a more hopeful future scenario. Now when someone starts to tell me the “baboon myth” of opuntia invasion, I have the evidence. I overwhelm them with facts to the point that they just give up on their “opinion.” It convinced me that if you have information and can explain the situation in a way they can understand, it is possible to change minds. But then you have to provide options, alternatives. Awareness is not enough. Solving the opuntia problem is a much more complex version of what I have been doing for years. People in conflict with baboons hate them no matter their skin color. I starting taking “locals” to see the baboons, up close and personal. I shared information about baboon behavior, traditions, and society. This was a transformative act. Initially, I had one rancher say: “Ok, I won't shoot your baboons, but I'll shoot the others” but later visitors said something much more revolutionary: “Oh, I didn't realize how similar they are to humans. I see them differently now. They are like people.” Maybe I have just been lucky.

*Simon Schaffer*

You mean complex in the sense that you taught us about the contrast baboon-human is the contrast complex complication?

*Shirley Strum*

Yes, it is complex (à la Strum and Latour) because at this point, we really don't know how to simplify that interaction.

*Mike Lynch*

Yeah. Just very quickly. I may have misunderstood the story of the invasion and its relation to the baboons. But one point I'd like to raise for further discussion is not about precariousness, but about the way the baboons turned out to be beneficiaries of the invasion. It seems possible that blaming the baboons as a cause of the invasive plant was related to blaming them as beneficiaries of it. But it's a very different story and a complex one, and a very interesting one that this invasive plant turns out contingently to be sustaining baboons after they've been moved to

another environment.

### *Shirley Strum*

Right, except that many of the conversations about baboon-human conflict preceded the impact of opuntia on the baboons. In time, as the baboons ate opuntia fruit they increased their growth rate and their reproduction. But, there may be something to your point. After the invasion, it might be easier to link the consequences of the invasion and blame the baboons, however this hasn't happened. I included information about how the baboons disperse the seed explaining that baboon impact was within 150 meters of their sleeping site, whereas the elephant dispersal was along a larger 20-kilometre corridor while the human impact through children and livestock and lack of toilets was around the settlements. I never spoke about the benefits to baboons. That wasn't a conscious decision. Later it was easier to see cause and effect or to imagine cause and effect between the benefit of opuntia to the baboons. Even now it is still hard to get people to accept that humans started the whole process. Now, almost a decade later, people are beginning to understand the effect livestock grazing has had.

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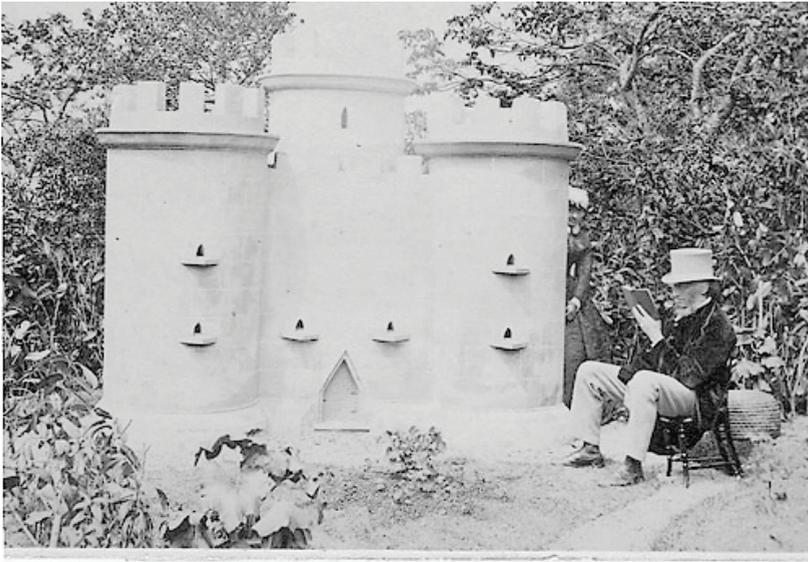
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## Of the Body of Politics and the Body of Nature

*Simon Schaffer*

This is the final substantive session. Bruno's instructions to all of us, I think it's worth reminding ourselves, were that this is not a seminar but a dialogue, and that our task rather was to engage with each other's work, as far as possible. The thought was that some others' interventions should be the topic of what we talk about. That's a custom that's been more observed in the breach during our three days, and I'm going to make a bold fist of trying to do something like that now. I'm extremely conscious of the patience of everyone who's listened for three days, listened to extraordinarily rich and very intense traces of a great deal of work done elsewhere and on other occasions, brought to presence here as a beautiful and reflexive example of the principle of the sociology of association: that in order to define an individual, one must intensely mobilize large-scale networks, as Bruno has put it so well for us. Defining an individual and extending a network are, for him, synonyms. So the relations whole-part, manifold-individual, complex-atom, while sempiternal philosophical questions, are here supposed to be somehow dissolved. Secondly, I'm also painfully aware, especially after this morning's absolutely splendid sessions, that the first half of the title of this dialogue, 'What's the body of the body politic?', should be avoided at all costs. So I'm going to say nothing about bodies and matter and so on: that seems like a minefield from which one should stay away. So I thought, following Didier's trinitarianism, that I talk about the subtitle: identity, sovereignty, ecology. And under those three headings, move relatively quickly through something that seems to me to have emerged from the dialogue and to which I hope we can return in the time that remains to us.

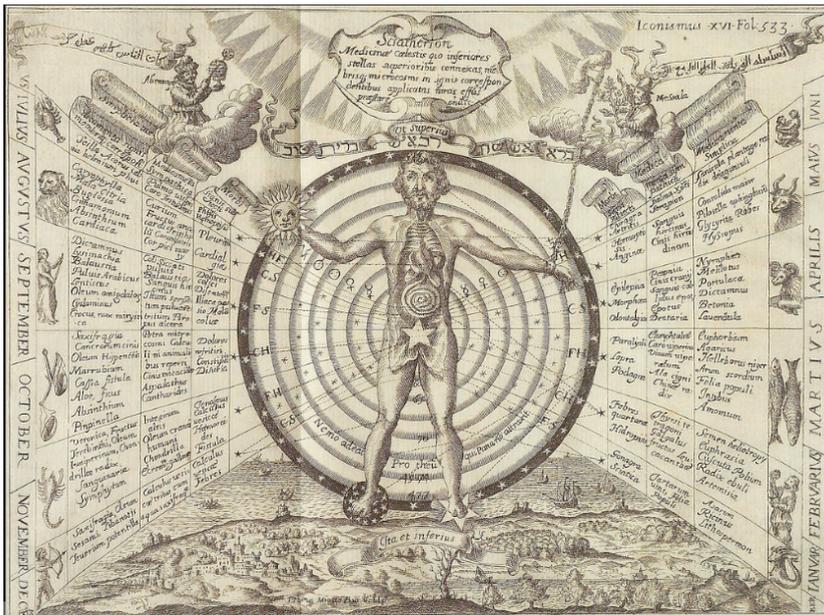


Bee castle (skep), *Broneirion*, *Montgomeryshire (Powys)*,  
made for Colonel Herbert Baskerville, circa 1880

This is the image I'm going to use to symbolise *identity*. It is one of my favourite images from the history of science: it doesn't look like an image from the history of science, but it is. In the late nineteenth century Colonel Herbert Baskerville, no relation, as far as I know, to an owner of any hounds, built a large house in the middle of Wales, in a county then called Montgomeryshire, but now called Powys. His house was *Broneirion* and in the garden he built what's called a bole, an artificial beehive. And he built it in exact imitation of his castle. So this is what *Broneirion* looks like, but at a deeply reduced scale. It's at the honeybee scale, and what Deborah reminded us of, on day one, that honeybees are co-produced with humans, is here magnificently shown. Secondly, he proudly had himself photographed. He defines himself not in front of his own house, but in front of his bee house. You can perhaps make out, behind the bee house (half of his wife, I should say). So I wanted to introduce you to the customs of the British ruling class, first of all, a topic I find endlessly fascinating, but I also wanted to remind us of the importance of co-production in these kinds of affairs. It's absolutely the case that individuation, in the sense of self-definition, in the sense of self-fashioning, involves mobilizing long range and intensely complicated networks, which extend (as an historian I'm bound to remind us of this) not only in space but time. That is to say they are not only synchronic, they are also very importantly diachronic. This takes

me at once to the first lesson that I've learnt in our dialogue from several speakers in several different ways. I'm thinking for example of Tim Mitchell's astonishingly important argument that we are in the future now, that the growth trap defines our predicament because of a present around the period of the later nineteenth century, defined around the period of Baskerville's construction, precisely of this house. His income, let me emphasize, comes from the London to Holyhead railway. He was the principal shareholder of the railway linking London with its most troublesome colony, Ireland. The result of investing in the future value of the London to Holyhead line was to have the castle's honey available at all times of the day and night. So this is about individuation.

The second aspect of individuation, that I've learnt a great deal about in this dialogue, is to begin with Tim Lenton's insistence on the immense importance of what we might call the autotrophism of Gaia. That is to say, to construe it a little more simple-mindedly, it's autarky, the fact that it draws almost nothing, could draw almost nothing, from the spaces adjacent and outwith the zone of Gaia. I want to remind us how astonishing that contrast is with the world as it was understood at the period immediately before the one that I've just described.



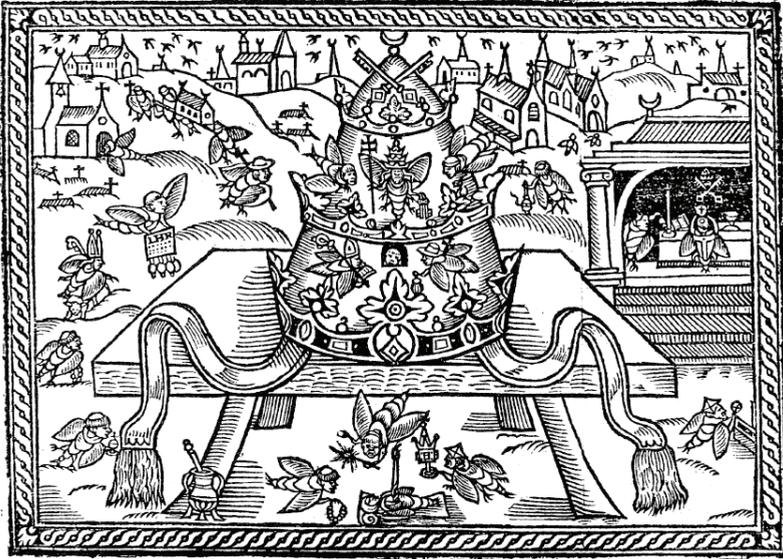
Baroque complication: the relations between the body and the cosmos  
(Athanasius Kircher, *Ars magna lucis et umbræ*, 1646, figure 16)

This is the vision that the baroque Jesuit imagines between the predicament of the individual and the predicament of the cosmos. What I want to remind us of here, as came through in Deborah's work about what happens when you intervene in pathways and how, without reason, as it were, you get adaptive systems eventually emerging, and which comes through in Tim Lenton's insistence on the autotrophism as it were of, at least the autarky, I should say, of Gaia, is that this is about managing trouble. This is what it so often missed in these great cosmograms. This is a cosmogram about trouble. What Kircher is showing here, in the *Great Art of Light and Shadow*, in the 1640s, is not just a superimposition on the cosmos and the influences of the cosmos on that, but the fact this both explains and literally unfolds, but also directs appropriate interventions towards medical management. This is diagnostic diagram. This is a way of dealing with baroque Jesuit immunology. This is about the infections to which the individual is subject and the best strategies for coping with those infections.

What Whitehead calls the *transmission doctrines* of the early moderns here are the same as their theory of infection and immunization, the processes by which one engages with the world, in other words the sensed data that we receive from the world, are the same as, and cannot be disentangled from, the processes by which we are subject to ills and the strategies we should use to defend ourselves against them. So a seventeenth century physician would consult a chart like this, not only to work out what to give the patient, but also when to give it, where to apply it and where to get that *pharmakon*. This is even an advertising sign, because it shows in the far left and far right, lists of the appropriate herbs and drugs for each part of the body, which are keyed to particular planetary positions. It is not just, not even mainly, a cosmogram, but a diagnostic tool that individuates the ills of the person, both by identifying their aetiology, but also by pretending to keep those ills at bay. The floor shown in this image is our world. That's what Bruno calls the *critical zone*. You see that it's the landscape on which we stand and from which many bad things and good things can emerge. There is a landscape cut through to what we would now anachronistically call the geological structure of the world.

There is much more to say about individuation and networking and I hope I've said enough now to motivate a conversation about that and I want to go to sovereignty. Kyle's work is indispensable here: the notion of the person. *Persona* is a mask but (and therefore) a fiction, something which is made and made up, and worn and not in that sense veridical, and yet it is the only veridical agent. In exactly the same period of European history as the one we've just been thinking about with Kircher, one of his enemies, that's to say the enemies of the Church of Rome, like Philips van Marnix, an extremely eminent Netherlandish politician, soldier, artist and litterateur, the author of the Dutch national anthem, made this image. It's called the

“Beehive of the Romish Church” and Marnix describes it as the personification of the Church of Rome.



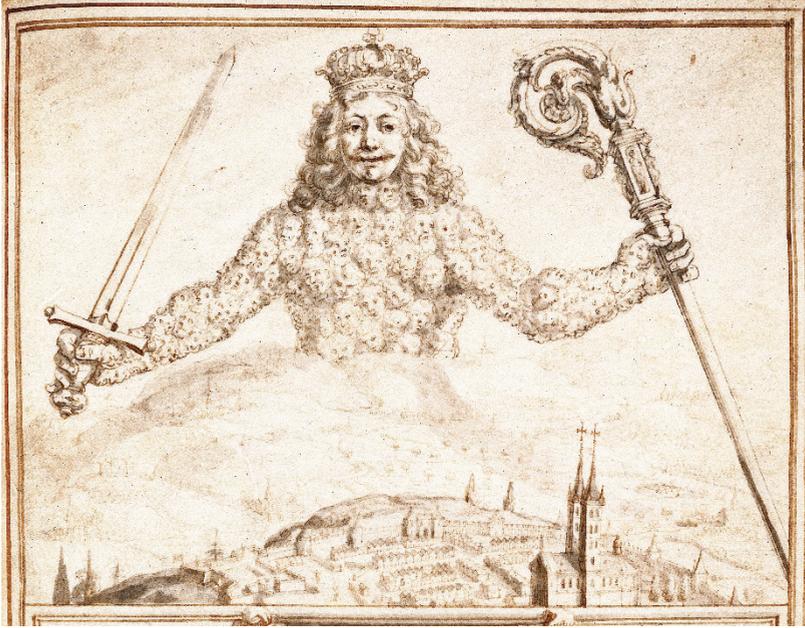
Philips van Marnix, *The Beehive of the Romish Church* (1569/1579)

That’s how the Beehive begins. Now, as you will know extremely well, colleagues, the use of honeybees as the obligatory source of metaphor and reasoning on politics is ubiquitous, especially in the early modern period. This is one of the more magnificent attempts in which each element of the Roman Church is made to correspond to the habit and conduct of bees and vice versa. These bees are persons and these persons are bees. And the structure of Marnix’s text is a legal, a Roman Dutch precisely, legal denunciation of the church because it’s committed a series of crimes just of the sort you’d expect honeybees to commit. For example, he points out the ambiguity, the sex ambiguity of the Pope him/herself. You see that wonderfully in the fractal quality of the central image in which there is a tiara and then in the middle of the tiara is the Pope, who is gendered male but she is surrounded by the apparatus of the papacy and the soldiers (i.e. the priests) to defend her. This is an extraordinary way of showing sovereignty at work, the kind of *mise en abyme*, there’s no other phrase for it, of the resemblance, the metaphorically productive and legally consequential resemblance, between the conduct of insects and the conduct of the enemy, of the papacy.



John Day, *The parliament of bees with their proper characters* (1608/1641)

This text, *The parliament of bees*, was reprinted in London in 1641, when the Civil War in England began: it's about the natural mystical legitimacy of Parliament, rather than the natural, mystical legitimacy of monarchy, and is directed against the monarch. "The Parliament is held, bills and complaints heard and reformed, with several restraints of usurped freedom; instituted law to keep the commonwealth of bees in awe." This is the origin of the Civil War. However, if we're talking about sovereignty, this image shows what we're talking about. This is a drawing almost certainly by Hobbes himself.



Drawing of *Leviathan* title-page (?1651), British Library Egerton MS 1910

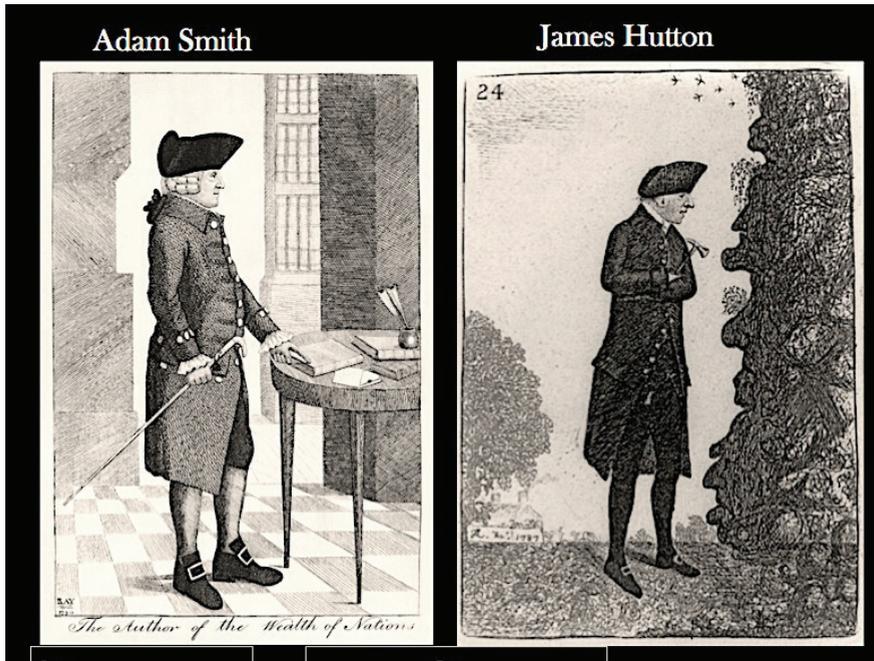
This is an original draft of the *Leviathan* title page in Egerton 1110, given by Hobbes to the artist of the title page. The point to attend to here, the general point on sovereignty that I wish to underline with respect to the relation between parts and wholes in the pre-Gaian moment, is that the faces are looking towards you. In the printed version the components of *Leviathan* look into the face of the monarch, but in Hobbes's original version they're looking at the reader. As Noel Malcolm and others have pointed out to us, this is an important point about the reconceptualization of sovereignty as a collective act at this moment. Because what Hobbes had in view, is that *Leviathan* is composed voluntarily by ordered pairs of conversations between individuals. According to Hobbes, they confer all their power and strength upon one man, or upon one assembly of men, that may reduce all their wills, by plurality of voices, unto one will: which is as much as to say, to appoint one man, or assembly of men, to bear their person; and every one to own and acknowledge himself to be author of whatsoever he that so beareth their person shall act, or cause to be acted, in those things which concern the common peace and safety; and therein to submit their wills, everyone to his will, and their judgements to his judgement. This is more than consent, or concord; it is a real unity of them all in one and the same person, made by covenant of every man with every man, in such manner as if every man should say to every man: I authorise and give up my right

of governing myself to this man, or to this assembly of men, on this condition; that thou give up, thy right to him, and authorise all his actions in like manner (*Leviathan*, chapter 17).

So one gives oneself up. The faces staring at us are ordered pairs who have engaged in this conversation in which they say to each other: “I will give my rights up if you do. And we will both then be subjected by the collective.” The Hobbesian point about sovereignty, a fundamental one, is that it is based on ordered discursive pairs. I thought it would be worth reminding us, in the light of the absolutely remarkable fieldwork on baboons and on ants that we’ve been privileged to hear about, that for Hobbes the role of the social insect is indispensable to this argument. Until that moment, political writers in the European tradition had generally supposed that the model of the *polis* was the social insect, that all politics is to be found in hives and mounds; and what Hobbes says is no politics is to be found there. His reasons are telling for the conversation we’ve just had: one, they do not compete with each other; two, they don’t have reason, so they don’t grumble. Rational people grumble, that’s how you can tell they’re rational. Thirdly, they’re dumb, by which he means they don’t have language, so they cannot use rhetoric. They cannot persuade folk to war; and fourthly, they don’t have any ethics, they only have pain. That means that they only grumble when they’re in pain and if they’re content, well fed precisely, then they’re happy. Hobbes says people only revolt when they’re well fed. Humans only revolt when they have leisure. Revolution is a leisure activity for Hobbes. If you give people free time, they become revolting. So, since the social insects don’t compete, never grumble, can’t use rhetoric and think that being happy is the same as being in an ethically virtuous situation, they’re not political. You would have to have exactly the opposite situation to be a political collective. Now, how does that relate to the direction of the conversations that we’ve had? Quite directly, it seems to me, in the following obvious ways: Jonah reminded us of the immense significance of what is preserved and what is not preserved when one scales up. And what is a stake in most western theories of sovereignty is scale insensitivity, precisely that I can hardly think of a theory of sovereignty in the great tradition, that’s to say the canonical tradition from Aristotle through Fortescue to Hobbes and Mill, that doesn’t precisely claim that you can effortlessly scale from microstructures to macro ones.

They’re the same at all levels. They have a perfect sliding scale. It’s for that reason, let’s just meditate on that, that we are simultaneously seduced and appalled by exercises like the *Powers of Ten* project, because as Bruno has told us it completely leaves out of account all the labor that goes into those shifts in scale from the domestic to the nebula and from the domestic to the electronic, levels that create a vision of smooth scaling, of scaling with no consequences. Scaling insensitivity in effect is

the absolute linchpin, I think, of most political philosophy in the great tradition, though there are some important exceptions. Now this has come up in Jonah's very important intervention around the important notion of the model of the city, and it's come up to in Deborah's work about individuation as the result of interaction rate, and how scaling those interaction rates changes individuation completely.



*Adam Smith* by John Kay, etching, 1790, NPG D16843, © National Portrait Gallery, London

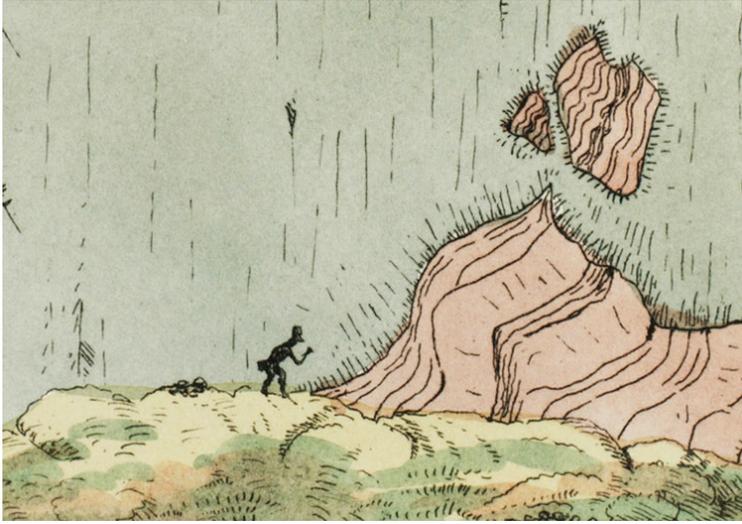
*James Hutton* by John Kay, etching, 1787, NPG D18643, © National Portrait Gallery, London

Now we come to ecology. The man on the right is James Hutton, a Scottish farmer, member of a society for managing the improvement of the Highlands. Improvement is an eighteenth century English word meaning, in effect, complete destruction. For Hutton, “it is by husbandry that the arts of life have been promoted.” He was a literary editor of the man on the left, Adam Smith. Smith's posthumous works were edited by James Hutton. Although I disagree in all sorts of ways with Jim Lovelock's readings of Smith and of Hutton, Lovelock was brilliant enough, as usual, to divine a relation between these two men's projects under the sign of ecology natural and political. Here's Lovelock on Adam Smith's political ecology in a lecture at the Royal Society in 2007, exactly a decade ago.

Our difficulty in understanding the Earth can be compared with that of understanding economics. The eighteenth century economist, Adam Smith, is respected for his intuition of an invisible guiding hand that makes rampant commercial self-interest somehow work for the common good. Two hundred years later we face a similar paradox. We know that the Earth is a benign and comfortable place for life and has been so for most of its history; so how have selfish genes allowed the evolution of an altruistic planet? It is easy now to see how fit organisms are naturally selected but how can the common good for all life also come from natural selection? What we have discovered through Gaia theory is that as the Earth system matures it keeps its climate and its chemistry always fit for life, and the invisible hand that regulates is feedback between its living and non-living parts. But this knowledge has only just entered the domain of science and is not yet conventional wisdom. It took a long time before we recognised that feedback between social and market forces cannot be ignored, so I suspect that we face a similar slow learning process about our relationship with the Earth.

These phrases are extremely telling for us, not just because of the rather obvious manoeuvre of supposing that for Gaia to become common sense would be like the free market version of Smith and economics becoming common sense: the feedback between the market and the social. But it is also claimed here that the learning process would be slow and that what's involved politically is a learning process, which itself as we learnt from Tim Lenton is absolutely of the essence in thinking about the social use of nature in these cases. So here is a wonderful example of what Bruno is teaching us, it seems to me, about the slippery manoeuvrability of metaphor, to be sure.

But much more than metaphorical argument is going on in such cases. How was it then for Hutton? Because, after all, Hutton plays at least as significant a role as does Smith in the ecological formulation of Gaia by Lovelock. He cites Hutton as the inventor of the notion that the Earth is a superorganism and did so influentially that, embarrassingly, the Wikipedia entry for superorganism includes a long discussion of how Hutton invented and was the first person to use that term. Well, the term *superorganism* does not appear until the 1970s. One can go through Hutton's work in vain looking for anything like the notion of superorganism.



*Hutton's section at Salisbury Crags, Edinburgh*  
(from Cunningham, *Geology of the Lothians*, 1838)

This is what Hutton wrote in 1785, and presumably this is what Lovelock found in Hutton:

“Is this world to be considered thus merely as a machine, to last no longer than its parts retain their present position, their proper forms and qualities? Or may it not be also considered as an organized body? Such as has a constitution in which the necessary decay of the machine is naturally repaired, in the exertion of those productive powers by which it had been formed. THIS is the view in which we are now to examine the globe; to see if there be, in the constitution of this world, a reproductive operation, by which a ruined constitution may be again repaired, and a duration or stability thus procured to the machine, considered as a world sustaining plants and animals.”

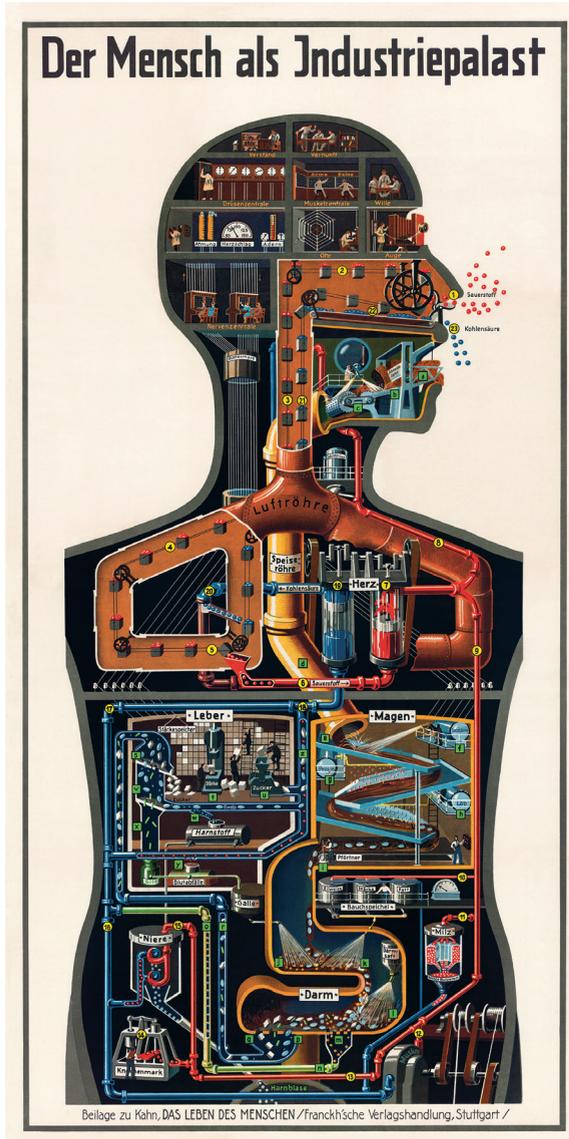
In other words, there is a resource in the Smith-Hutton cosmos for the physiological model that Lovelock used to construct Gaia 1.0. My question to the experts would be, does Gaia 2.0 use resources like that or is there a way to look elsewhere and, if so, where, for these kinds of language forms? Because, precisely, this was a language form born political, developed in conversation with Smith, by Smith's literary executor at the very moment when Smith was working out, after 1776, the consequences of the invisible hand. A metaphorical shift between invisible hand and the physiology of the globe-machine is again much more than a metaphor. There's something else going on politically. The question is that of the mediator between them, as we have discussed a great deal. Kyle raised this point around

the issue of whether natural entities can be persons; it came up in the exchanges between Deborah and Tim Lenton around learning; it was there in Tim Mitchell's arguments about the artificial construction of forms of machinery for bringing the future into the present. These are the resources that in the 1880s would be used in a very powerful way indeed to tax the future and make us bankrupt and under threat.

I wanted finally to remind us why the bad word *body* appeared in the original

quizzical title of this meeting. Shirley Strum put it very well this morning. In the anthropocene you can't get away from people. In other words, the body that is in play here is a version of collective humanity that presses on our experience, our politics and above all the economy in the Mitchelian sense in very evident ways. One of the best examples of this is the version of the collective body at the moment when the Mitchelian system broke down in the Weimar Republic, in Berlin in 1926.

This is designed, effectively, to remind that politics and a certain version of economy were absolutely built into physiological modelling that was neither esoteric nor specialist, but in terms of public education and public debate, in one of the world centres of scientific physiology, economic crisis, political reorganisation and revolutionary struggle. This was the role that the body played. The body is doing a huge amount of work literally but also ideologically. It isn't just, as it were, that the body image's incorporated an



“Der Mensch als Industriepalast”, Fritz Kahn, in: *Das Leben des Menschen*, Franckh-Kosmos 1926

enormous amount of industry and economy, but the reverse is also true. Berliners were being shown here the economic rationality of the factory system by showing them that they were already possessed by and that they possessed the system they were being recruited and mobilized to preserve under conditions of the most extraordinary economic crisis. So, the argument that I wanted to present is that the triad of identity, sovereignty and ecology can, at least from the point of view of rather narrowly construed political and intellectual history, barely be understood without an absolutely indispensable model of individuation through networking; and through the composition of networks and collectives by the multiplication of these gestures of individuation. There is a fundamental relationship that has an immensely interesting and important history in political theology, if nothing else, between the autotrophic and the autarkic qualities of what is now taken to be Gaia. In these kinds of images, the potentially chaotic and ungraspable qualities of the industrial body, the body of the moderns, clearly serves us extraordinarily ill politically and economically, whether we attend notions of the body or not, because it's an obligatory passage point during political, economic and ecological crisis. So, we had better find an alternative, because as Gerard de Vries reminded us of right at the start of the day, we may well be in a position where it's not just a question of institution-building but also decisions about which institutions we should get rid of. That's a very important point with which to close. Thank you very much.

## DEBATE

*Kyle McGee*

Thanks a lot, thank you, Simon. We have just under 40 minutes budgeted for feedback and questions. So render visible your hands. I'll collect a few questions; I think pretty much everything is back on the table at this point: sovereignty, identity and ecology. So, Bruno.

*Bruno Latour*

Well, as usual with Simon we have too many things to get and it takes time to absorb but there's one which is the early image of Kircher on the planetary medicine which is also a term used in one of Lovelock's book, actually the one which was more popular Planetary medicine. So I'm interested in this argument about diagnosis and planetary dimension and I'd like to know more about this expression

because that's linked quite nicely with Kyle argument around what is the word that we could use as a synonym of ligature. It would be nice if you had some word from the 16<sup>th</sup> century to rethink the connections between the different elements of the cosmos and body politic...

### *Simon Schaffer*

What is striking is the early modern conjuncture is that what the Jesuits were doing with those cosmograms was not solely elite knowledge, but it was, we now know, rendering much more widely distributed plebeian models of the comportment of the human body. In almost all literate societies in early modern Europe we have the zodiac man. The idea of the linkage between components of the ailing body and components of the cosmos is clearly very widespread, so what is so interesting is not that we are, as it were, returning to the Baroque, but rather that we are thinking of a way of inverting that relationship and in which it's the cosmos in that restricted sense that now is supposed to be the object of care, of diagnosis and of medical attention. Tim Lenton reminded us that Lovelock proposed to him the idea that he would become a doctor of planetary medicine. What that meant is the precise opposite of what the great European tradition of physic and of medicine has been, which is to mobilize the cosmos in the name of solving small scale individual trouble. The pharmacology of that gesture is not just the solution of the human predicament by mobilizing cosmic forces, it's also solving cosmic problems by mobilizing human forces. This is something that is ruled out by the Jesuit cosmogram. It was common to argue that the sufferings of merely sublunar people were disconnected from the cosmos: "When beggars die there are no comets seen that heavens themselves foretell the death of princes." The Baroque idea is that we cannot cure or even affect what's going on in cosmos, whereas the thought now is we're too late, we are within the anthropocene. So the model of ultimate and indefinite connectivity is there, but the aim has been reconfigured in a very interesting way. Planetary medicine has almost inverted its meaning.

### *Bruno Latour*

So in fact it is all connection...

### *Simon Schaffer*

Several of us have spoken to this issue; Bruno, Mike Lynch and several others using film and other marking techniques have commented on the immense impor-

tance of registration, visualisation to enable a certain kind of diagnosis. I'm using Ian Hacking's arguments in *The Emergence of Probability* that the effective sciences of the early modern conjuncture are the low sciences, the sciences of diagnosis, the sciences that flourish by reading the signs, by following traces, the sciences of abduction not induction, not experiment nor demonstrative reasoning, but an almost unarticulable enterprise of following traces, reading signs and then assigning trouble to its appropriate cause. This is what the Jesuits are supposed to be able to do, what every early modern physician is supposed to be able to do. Those are low sciences, they barely count as science in the early modern period. So rather than looking for resources from the high sciences, what I find interesting about diagnosis is that it's the irruption into medicine of a form of diagnostics, which has not been treated with sufficient respect at all by the great tradition.

*Kyle McGee*

It's a brilliant answer, but I think part of Bruno's question was about the planetary medicine aspect of what it is: not just our knowledge, but what we do, if there are other practices you had in mind beyond the sciences, maybe this will be an opportunity to say something about that...

*Simon Schaffer*

One point that I would want to make, and perhaps hasn't come up quite enough in our meditations and reflections on scale and scaling, is that one interest absolutely at stake in forming this dialogue, is an argument that Bruno and others have been preoccupied by, which is the apparently obvious contrast in scale between what individuals and groups of individuals can do and the size of the crisis of the new climate regime. Summing over very small rather intricate gestures does not look as though it matches the scale of the crisis that is in play in the anthropocene. Yet, precisely what we're learning from the fieldwork in Africa that we've heard about, from political interventions there, from thinking about the carbon economy with Tim Mitchell's work and others, is that it involved intricate and rather small-scale gestures. I note a particular irony, which is that in response to effects that come from rather small-scale interventions we get distressed about the small scale of our responses. That's got to be a mistake, a political error. Such linkages as those embodied in the Jesuit cosmogram might offer a way of rethinking such mistakes.

### *David Western*

I'm always very humbled when I listen to philosophers and I'm thinking of one in particular, Omar Khayam. He said "Myself when young did eagerly seek both doctor and saint, with them the seeds of wisdom did I sew," and skipping a couple of lines, "but ever more came out the same door as in I went." The contemporary economist Ken Arrow put it a more compelling way: "If we don't change the direction in which we're headed, we'll end up in the same place." There is a sense of urgency in the challenges of our global impact we face today and the use of a sensitive Gaia to express it. Simon, you said that the idea of superorganism came into being in the 1970s, but it was preceded in ecology by Clements idea expressed in the early 19<sup>th</sup> century of life as a superorganism early in the 20<sup>th</sup> century. His view was overturned by Tansley, who saw nature as competition of one species with another, a view reflected in Richard Dawkin's selfish gene. That view has changed once again with Holling's concept of complex adaptive systems. Are we going to take another century to change our views of Gaia? I hope not. And I see every reason to move ahead and act to curb our global impact, whether or not we have a good metaphor. We need to change the direction we are headed, regardless. We need to discard certain ideas we had in the past and anticipate a future. We can imagine the future and the consequences of our action without experiencing them directly, for that would be too late to change direction. We need to be in short to be homo prospectus rather than homo sapiens trapped by past experience.

### *Didier Debaise*

I just would like to use this occasion to come back also to the distinction between individuals and collectives. I have the impression that in situations where everything is intertwined, linked together, like in the examples of Scott, this distinction doesn't make any sense. It doesn't make any sense to begin by the distinction between individuals and collectives to see after how they can be linked or what came first and what came after. I don't mean that it has no importance in some situation but I would say that in intertwined situations, there is really no reason to distinguish what is individual and what is collective. Of course, it is always possible to make the distinction for practical reasons, but the mistake would be to believe that as a distinction can be made the reality is either individual or collective. It's a functional difference. If I have to present myself it is required to have a way to individualize myself from all the cells that compose me, but it doesn't mean that there is an individual reality.

*Kyle McGee*

Thank you. We have two fairly different prompts but there may be some relation here and we'll see what Simon can do. Jonah has raised the pressing issue of this paradox of the urgency of the problem and then the slow pace of our conceptualization, certainly in the instance of the superorganism and the concept of Gaia. Jonah asks effectively: do we not need to ask a new question and rethink our human nature along the lines of homo prospectus, forward-looking and projective? Didier has challenged the notion that individuation and collectivization are meaningfully different realities; just because we can draw the distinction doesn't mean that it is something we should do maybe or something that corresponds to reality. I'll leave it there.

*Simon Schaffer*

The rate law is terrible at a conceptual level, and the individual-collective distinction doesn't hold water; we've already thoroughly observed Didier's argument that the body characterization doesn't explain body politics. It's very important to absorb some of the lessons that we're hearing from field work and from ecological projects about recovery systems, about systems that allow all sorts of quite surprising developments at all levels, where a more superficial judgement of what the crisis is would have just been completely pessimistic in these cases. So just exactly what kind of crisis the cactus invasion is and for whom and how that works turns out to be simultaneously more complex in your sense, Shirley, but also more visible in some interesting ways than one might have anticipated. Seizing on that notion of processor offers grounds for optimism, partly because we've learnt so much not just about the immense time dependence of most of the processes but also the way in which they produce these time scales. What counts as temporal development is a result of the processes in which we are apparently intervening whether we know it or not, so what counts as an invasion is both the cause and the result in ways that are obvious. If we don't remember that, we're not taking seriously what Didier's saying, which is not just the fact that there isn't a serious distinction to be made between individuals and collectivity but that it's actually quite damaging.

*Kyle McGee*

Absolutely fundamental point about the production of time scales, but the next question goes to Mike; we also have questions from Bruno and Tim, but we'll start with Mike.

*Mike Lynch*

The juxtaposition that is in Lovelock, and that you vividly portrayed here between Adam Smith and the invisible hand, and then the '80s work on the emergence of Gaia, leads me to wonder about the connection. Obviously, we have been talking about two levels, but with the invisible hand what results on the systemic scale isn't motivated by the actions that compose it. In fact, it's a very benign picture of what happened. And there are other pictures of what happens (or can happen) through the many acts of selfish individuals that would give rise to and sustain capitalism, markets, and so forth, which leads me to worry about this transition we've been talking about between Gaia 1.0 and Gaia 2.0, since the picture with 2.0 would be of a Gaia that in some sense is a collective action, but the ends of the action are designed into the actions rather than introduced as an inadvertent product, as in Smith's mostly benign conception of a market. And I guess that in Lovelock too, Gaia 2.0 would be a benign product of all sorts of actions, but of course with economies you also have the crises that arise and then are subject to various remedies such revolutions, in the extreme case, or more regulatory types of actions in quieter times, and so the question is: What would it mean for the production of Gaia to be something that is a collective-purposive action, as opposed to something that emerges negatively or positively, such as climate change is said to emerge negatively from actions that were not purposefully designed to create atmospheric imbalance? And so, it seems that there is a gap between an economy that struggles, perhaps more explicitly and, in some ways, in a more contained sort of way, and what we would be talking about with Gaia. I just want to raise this question, since we're seeing these vivid parallels between the two. How do we deal with that difference?

*Kyle McGee*

We only have 15 minutes remaining and we have a few questions to handle here, so let me get the questions on the record and then we'll go from there. Bruno I think you're next.

*Bruno Latour*

Well, exactly I follow up on Mike because I'm also interested in two quandary; Jonah's quandary, I would say, which is to ask us to use power of social equal interest of people who are, let's say, traditional, as he said, pre-literate, and to ask us to scale

it up and then we have the Hutton Smith again which is that economy has been describing this meeting simultaneously as a cure and a poison and we never know how to scale it. So what Jonah rightly said several times is that it would be great if we could scale it up unless this process that we called yesterday the common, is precisely unscalable. And then there's Tim Lenton's quandary which is this ironic argument that Lovelock took so much effort to get rid of the teleology in Gaia 1.0 while for Gaia 2.0 we have to reimagine teleology when every aspect of this teleology—general will, world government etc.—, is either impossible or terrifying. So this is not very helpful, I agree, but this is what I'm left with maybe because I'm exhausted, maybe we have actually solved these two points, but I haven't heard the solution so far...

*Kyle McGee*

Neither have I. Tim, you have the next question.

*Tim Lenton*

Yeah, Simon you asked for Gaia 2.0 where do we look for alternative language forms and I'd love to hear probably from you if you think there's a tradition perhaps somewhat hidden around the recognized one that we might be able to draw from there, because I am most fixed by all of the things you beautifully articulated, particularly the incisive Lovelock Smithian fusion view of things it seems to me, as a scientist, my cop-out is to sort of say "Oh the language is just labels" and the interesting thing is that Lovelock himself is using concepts and conceptual apparatus. It is much more recent than those authors and we would all agree, I think, on that, and actually I would say, you know, I hope I presented what I see as very much a work in progress, we have a very imperfect understanding of Gaia 1.0 and we're having an exciting time in science those of us indulging this question, the minority of us indulging it, because new conceptual apparatus is arriving all the time that is helping us get some insight and that's of course the excitement of being a scientist and that's very fresh. I don't know whether that means we should also be working hard on inventing a language for other of the topics we've orbited around.

*Kyle McGee*

Okay, great, there's one question after this and it's going to be the last one.

### *Simon Schaffer*

Mike asked about collective and purposive action and what's at stake in Gaia 2.0. This is also what Tim Lenton's getting at, a strong contrast with any classical Smithian notion of political economy. Lovelock himself says: "Neither Linn Margulis nor I ever proposed that planetary self-regulation was purposeful." So, the issue of purpose is the crux of systems theories and the models, mechanical or not, that are at stake. The puzzle is whether it's possible to have purposes without persons. That's question of this dialogue. If you don't personate, can you be purposive? Can you have purposes? If you don't even have collective persons, can there be purposes? And the answer is clearly yes, there can. The more interesting question is to define those purposes. This goes back to Jonah's point: the purposes have to be characterized. They have to be exquisitely defined in specific actionable terms, urgently. So, the question is not so much about teleology, the question is precisely about persons. It's no coincidence that the Hobbesian transition in the political enterprise wants to expel teleology and insist on the significance of personation in one and the same gesture. Nature is not purposive, it is said. That's the great mistake that had allegedly been made up to 1651, and the solution to the problem of order, which is the solution to the problem of knowledge, is the construction of a proper system of personation, not corporation. This seems really interesting or at least potentially useful. I'm influenced by Tim Mitchell's argument here. Economy is the cure, and economics is the poison. If you go back, as he invites us to do, to all the original semantics of economy, this is a way of answering Tim Lenton's point: are there now lost traditions? There is at least one lost tradition, which is *oeconomy*: Xenophon rather than Plato and Aristotle. This tradition was completely suppressed in just the way that Tim has told us. John Playfair, wrote a book called *Illustrations of the Huttonian Theory of the Earth*, an effort to make Hutton's theory acceptable and comprehensible. The analogy with what's happened to Lovelock is actually quite instructive. Playfair says: "this theory presents us with a system of wise and provident economy" and he means *oeconomy*, not economics. He says it's not purposive, but provident in the sense of a household. This, he claimed, is the world in which we find ourselves and we had better live by the rules of the house. There's clearly a gender politics in play there: *oeconomy* is definitely gendered female.

### *Kyle McGee*

We have time for just one more and that's Isabelle's question.

*Isabelle Stengers*

It's a short one. It is about the question of what is lost when one scales up and I was wondering if Kyle's idea of ligature could not be introduced here, because this, it seems to me, is what is lost when one scales up. So I wonder, what is lost for Hobbes when one scales up?

*Simon Schaffer*

What is lost is interest in Hobbes' sense. What is lost when one scales up is, as Albert Hirschman has argued, passion and interest; because all that folk care about and are invested in, he says, is the most immediate, the most closely bound, the most intimate, the most oeconomic. As one scales up, those little ordered pairs suddenly lose all their power. So, he doesn't theorize war, for example, as the struggle of state against state, or institution against institution, but as the war of all against all. So, everything that matters to individuals, however defined, is at that level. One way of putting it, in more Stengerian and Latourian terms, I guess, is that for Hobbes networks are also frames, that what humans have got going for them is the possibility of framing particular relationships, as well simultaneously extending them, and the notion of *ressort* does both. It is a net, which holds one and keeps away the apparently less important, the apparently redundant, the apparently less mobilizable, and that's what I took Strum and Latour to mean by complication. Hobbes is the theorist of political complication. Hence the antagonism of the Church. Because he was saying all there is in the world is persons, no fairies and spirits, just one-on-one relationships.

*Isabelle Stengers*

When discussing individual and collective this is very efficacious way of resolving the problem, or rather reducing it to its solvable ghost... so maybe that which complicates the problem is precious.

*Simon Schaffer*

Yes. I absolutely agree. You and I have in common an enormous, inexhaustible admiration for complications.



## AFTERWORD

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# Politics - A Glimpse at Bodybuilding

*Bruno Latour*

It was bound to fail! How in our right mind could we have had the idea of convening in one three-day meeting political philosophers with scientists working on ants, baboons, cells, natural parks, together with historians of capitalism and—how totally bizarre!—specialists of the planet taken as a whole, namely Gaia—plus metaphysicians and historians of science thrown in, as well as a bit of legal theory and a lot of social science to stir the pot further? What did we hope to achieve by linking corporate law with embryo development, the management of Amboseli with 19<sup>th</sup> century railway investment, or the competition between baboons and farmers with the philosophy of Whitehead and the autotrophy of the earth system?

And yet the only way to have a chance of renewing the question of the extent, function and future of politics might well be to enter into this strange exercise and, against all odds, to carry it obstinately to the end. Why? Because whatever you expect from the future, you will indeed have to in some way assemble into a joint polity exactly *those various types of beings* that were brought to the table in September 2017. It is true that the term “body politic” has been disputed, but is there a better way to flag the goal of the new geohistorical epoch? No matter how disputed is the geological term of Anthropocene, the September 2017 event is exactly the sort of clarifying process that the term triggers and the sort of occasion it opens for natural and social scientists to be able to collaborate. Indeed, it has provided a new breed of diplomats with the undeserved chance of an improbable encounter, thanks to the generosity of the Cini Foundation, in one of the most beautiful setting there: the *Biblioteca del Longhena* of San Giorgio.

Actually, as Simon Schaffer is never tired of saying, none of the former inhabitants of this abbey designed by Palladio would have been surprised to hear that the nature of politics is to be connected with the order and destiny of bees, ants, cells, entrepreneurs, stars and the variegated climates of the earth. What was obvious in the premodern past is now obvious again today. In effect, what we were convened for was to write down the program of a new fresco of the *Good and Bad Government* before ordering a new Lorenzetti to get to work. And for my ear, Stockhausen's *Tierkreis*—animal circle—beautifully played in the magical auditorium *Lo Squero* the day before our meeting, had the same effect of joining political thought with the vibrations of the cosmos.

Even if it is admitted that a new body politic has to be composed from those bits and pieces—earth, cells, industries, plants, animals, people and sundry—, the key question is to decide what sort of linkages will allow such a composition to proceed, to gain some robustness and to be recognized by its partners as a legitimate form of polity. To use Kyle McGee's term, we had to raise the question of what are the "ligatures" of the new body politic?

I did not have the answer—I still don't—but I sort of knew what connector will *not* work because I have had a long career in tracking down the same failure of composition across several disciplines. Since this quest was the reason that connected the participants assembled in San Giorgio, I feel entitled to revisit the meandering path that ended up composing this particular assemblage of people.

It is in sociology, or more exactly social theory, that I first encountered this strange obsession for composing collective entities as if any inquiry had to start either from individual components or from some contextual framework. I was at the time studying scientists and engineers, and, together with Michel Callon, we were stuck by the sudden variations in the relative size of those innovations: what started in a California garage ended up becoming a gigantic multinational while in a matter of years the whole steel industry of Lorraine had shrunk to a few isolated rusty mills sustained by European funds. Not only was size in constant flux, but every actor was entertaining many alternative definitions of the "whole" inside which he or she was striving. It appeared to us that it was impossible to stabilize either the individual pole or the collective one. Hence, we found it puzzling that the discipline of sociology had to define itself as obviously divided between the "micro" and the "macro" level—or some mix of those two. Obviously, a totally different process was at work that the micro versus macro polarity did not register. There was probably something amiss in the very notion of "level" and that of "individual," as well as that of a "whole" superior to its parts... We became convinced that there was a failure in understanding composition that made it very difficult to register collective phenomena that are never situated above any individual level but that are

comprised of certain ways of being collected and circulated throughout what we called, at the time, networks.

I was still in California when I discovered that a marginal branch of sociology, called ethnomethodology, had actually grasped one of those collecting mechanisms by insisting on there being many contradictory ways in which “wholes” were circulating throughout daily encounters. Harold Garfinkel, Mike Lynch’s mentor, had been an accountant and he had put to good use the powerful ways in which humans constantly “account” for the situations in which they find themselves, to the point where, at each moment of the interactions, there exist simultaneous overlapping interpretations of what all of them are doing. Garfinkel’s insistence of methods and accounts allowed he and his students to bypass entirely the micro-macro conundrum, thereby dissolving the notion of level. “Indexicality” was the word they used to corrode the strange idea that atomic individuals with a well delineated self could then “enter into relations” with others and thereby generate the mysterious entity mainstream sociologists called “society” with its overarching influence over individual actions (1). The whole point of defining with agonizing precision the “ethnomethods” of ordinary practitioners was that it comprised the best way for those sociologists to avoid the cop-out of a social order emerging out of individual interactions. “Emergence” has always been for me an apparently scientific way to say “here a miracle occurs!”

What does this have to do with the question of the body politic, one could ask? Well, it turned out that the discipline of sociology, elaborated in the 19<sup>th</sup> century to absorb the huge transformations brought about by industry and city life, had no time and energy left to escape from the *summa divisio* that had been imposed by liberalism a century earlier in order to invent economic relations. The invention of the market had formatted the figure of the “individual agent” with such force that it was impossible to escape its power except by inventing the counterforce of “society”—hence the endless and obviously sterile debates about the two levels and the thousand ways of overcoming the division. For centuries, as was witnessed by participants of the meeting in the opening ceremony through readings of Aesop and Shakespeare, the best way to ridicule the Fable of the Members and the Stomach was to tell the opposite Fable of the Bees of Mandeville’s fame.

Both myths are so familiar that they have entrenched the choice of composing the body politic in the most trenchant way: either the whole is superior to the parts by design long *before* the parts take conscience of themselves by going on strike—and thus dying—or the whole—that is, the greatest good, namely the market—appears to be bigger and better *after* the individuals (bees or industrialists) have entered into the most selfish competition, and only if they succeed in remaining as selfish as possible all the while. What those two traditional models share is the

certainty that there exists a superior level either before or after the parts play their role, a framework that is able to provide some sort of optimum. No wonder that social theory has had such great difficulty extricating itself from those two fables. And yet those fables have a virtue: they bring bees and body parts into the picture. It seems to me that what might have been worn out metaphors for Shakespeare or Mandeville, could be made *literal* with a bit more attention to how real bees and real cells construct their own collectives.

Observing this construction was just the opportunity I benefited from when I was asked by Shirley Strum to meet her baboons in Kenya. Ethnomethodology had discovered that the utter implausibility of the “individual versus society” explanation was somewhat hidden in human collectives because of the role technology played in providing social ties with a sort of ghostly but long-lasting presence. What of baboons? They have no way of stabilizing their interactions for long. They have to regularly refresh the structure of the troop and each of them has to incarnate the collective in some individualizing ways (2). The act of collecting—as central in primatology as in ethnomethodology but more clearly visible in the former—was done through a whole range of “ethnomethods” that Shirley was able to delineate by her careful accounting, day after day, year after year, for the highly complex process of decisions about ranks, foraging pattern, mating, and grooming—complex but not complicated, as we were quick to explain (3). Because, in lacking speech the baboons had to register their behavior moment by moment, it was clear to me that Shirley’s baboons were offering a powerful alternative to both of the Fables at once. There were neither individual baboons nor an overarching social order but something else, still difficult to name, that was escaping the grasp of the “liberal” versus “organistic” view (4). And this was not a fable but a most exquisite study of a real animal collective of which every single animal had been thoroughly individualized by extending the record of its family and interactive network. At last, in a powerful way, the equivalence between *individualizing* an actor and *extending* its network further through the collective could be made empirically verifiable—and thus demonstrating the complete superposition of those two dimensions. It was thus possible to dispense altogether with the very idea of two levels and to operate what I liked to call a “flattening” of collective assembling.

It is the shock of this discovery that turned my attention back to Hobbes’s Leviathan, so important for our dialog and so well analyzed by Simon Schaffer’s exegesis throughout our meeting. Behind the implausible mechanism of the “social contract,” Hobbes, when inventing his Leviathan, had clearly something else in mind, something that was revealed so strikingly in his most famous frontispiece and which is as far as possible from the two competing Fables that could have been merged in one single story of “the selfish bees and the selfish stomach.” As Simon

had demonstrated, the body politic is not a precursor of “society” as it will be understood in the 19<sup>th</sup> century, but an attempt at superimposing *in the same optical space* and the same conceptual movement, the overlapping partners of the collective which are simultaneously individualized (protected and defined) and extended so as to be the sovereign in some fashion (5). So when in 1981 Callon and I formalized the alternative sociology under the name of actor-network-theory (ANT), it was to Hobbes’ Leviathan that we turned:

“The originality of the problem posed by Hobbes is partly concealed by his solution—the social contract—which history, anthropology and now ethology have proved impossible. The contract, however, is merely a specific instance of a more general phenomenon, that of translation. By translation we understand all the negotiations, intrigues, calculations, acts of persuasion and violence, thanks to which an actor or force takes, or causes to be conferred on itself authority to speak or act on behalf of another actor or force. (...) The social contract displays in legal terms, at society’s very beginnings, in an once-and-for-all, all-or-nothing ceremony, what processes of translation display in an empirical and a reversible way, in multiple, detailed, everyday negotiations. The contract need only be replaced by process of translation and the Leviathan will begin to grow, thus *restoring to Hobbes’ solution its originality*” (6).

Well, as is made clear through our meeting, one can say that the Leviathan has not stopped growing ever since! When, in 1975, I stumbled on E.O. Wilson’s *Sociobiology* in the green alternative bookstore of La Jolla—a book I was impelled to buy at once in spite of its price—I never believed for a minute the author’s artificial extension of economic models to bees, wolves, ants or indeed humans. On the contrary, I was fascinated that exactly the same conundrum held for humans as it did for non—or more than—human collectives. While the purpose of the author was to naturalize or biologize human societies, it was clear, on the contrary, that any theory of associations, no matter what sort of life forms it applies to, suffered from the same difficulty in accounting for the composing of collectives (7). Sociobiology, even at the heyday of its enthusiasm for treating animals and genes as so many Wall Street golden boys or Ayn Rand characters, established a fascinating continuity between different types of beings long before the advent of the Anthropocene forced all of us to consider their linkages again and in a new way. Our meeting, in my mind, was just that: an occasion to rearticulate and reboot some sort of a sociobiology that had been launched so clumsily during a time of extreme deregulation and neoliberalism.

The reason for my resistance to the belief in the extension of neo-Darwinism to animals came in part from Garfinkel’s attention to the process of accounting, but above all from Michel Callon’s powerful application of sociology of science to the

very heart of economics. If the work of Timothy Mitchell is so important for exploring what he calls “the Economy”—a rather recent and by now fully localisable phenomenon (8)—it is because he realized, just like Callon, that no event is calculable in itself without a calculative device of some sort (9). In most human affairs, calculability is the *performative result* of the availability, extension and imposition of formatting rules that render calculations possible. Such an achievement—and it is an immensely costly achievement!—does not mean in any way that the situations are calculable in themselves and for all eternity. It just means that it makes no sense to use calculability as though it were simply present “in principle”: either you have a device and you calculate, or you don’t have a device and states of affair are simply not calculable. Period.

If this essential point of method has been of enormous importance for bringing “the Economy” back to its historical and relatively limited network as we saw during the meeting thanks to Mitchell’s argument on capitalism, it has been, I realized, of even greater importance on the direction taken by sociobiology. The whole neo-Darwinist paradigm, and indeed Darwin’s adaptation principle itself, relies on the hidden possibility that fitness can be calculated, if not by the organism itself, at least by the evolutionary biologists recording their transformations. However, if we follow the performative definition of what is calculable, there is one thing that is surely impossible in the complex interactions of life forms with one another: the ability to calculate which one wins and which one loses. And for a good and magistral reason: to be able to calculate fitness you not only need a device of some sort, but above all you *need a self* with well-defined boundaries to which you can attribute gains and losses! Such a self is exactly what is missing everywhere, except in the most implausible Fable of the Bees & the Stomach. If the selfish bee is a fable it is above all because it imagines that there exists a bounded self. The intricate involvement of overlapping life forms draws a picture infinitely messier than the landscape drawn by the “laws of the jungle” that delighted sociobiologists so much. A jungle where fitness is calculable is called a market—heavy with techniques, accounting, laws and state police—not an ecosystem.

When I had the chance to meet Deborah M. Gordon at Stanford, I realized several things at once: first, that ANT was aptly named after all! Two, that the long kidnapping of ants to play a role in the fight between organicist versus market-based models of society could finally come to an end. And third, that alternative ligatures could be invented empirically for composing the anthill and thereby escape the appeal to any superorganism. Just as Shirley Strum had done, Deborah abandoned the 1, 2, 3 scheme: 1) atomic individuals which then 2) “enter into relations” with others, 3) relations that have the miraculous power of generating emergent properties (10). She was devising for ants what Shirley had done for baboons,

devising a new equivalence between individualizing and extending the network (what I had claimed to be also the definition of the Leviathan). In a long series of equally remarkable studies, she has shown the plasticity of roles ants were having to play—breaking down organicist views of the anthill as a superorganism—but equally the presence of an overlapping entity—the colony—having a quite robust ability to last in time—breaking down just as much the market view of the anthill.

By following each interaction of each ant with the others, the amazing result is that at no point do you need to suppose that there exist atomic individuals entering into relations—the selfish metaphor—nor super-organisms imposing their will over the parts—the “Member and the Stomach” fable. In effect, it is possible to dispense simultaneously with parts and with wholes (11). Wholes—that is the colony—is the fuzzy, uncertain, partially reversible superposition of the multiple activities through which each ant has been able to collect interactions in its own ways (12). In ANT terms, contrary to “Wilsonian” ants, “Gordonian” ants provide the ideal showroom for demonstrating that it is possible to dispense with the two levels that have paralyzed social theory for so long. The ant colonies were entirely “flattened.”

At that point, it became possible, in my view at least, to contemplate an alternative definition of the ligatures of the new body politic by attempting to bring together the different scientists I had become acquainted with.

What had been until then a rather arcane problem of social theory interesting not many people apart from myself, gained a completely different relevance when I began to face an entity that could not possibly be taken as an organism—no matter how inflated you could imagine it to be—and yet that still had to be considered as some sort of completely new form of body politic: namely Gaia. At the scale of the planet, it was clear that all body metaphors were breaking down, not only because, as Tim Lenton showed, Gaia is not heterotrophic (13), but simply because it has literally, as one member of the public mentioned, neither head nor tail. It is not an animal (14). Nor is it some sort of motherly goddess. It is not a superorganism. It is not a whole. And yet it appeals, rather mysteriously at first, to some sort of sovereignty and it bears some family resemblance to the Leviathan. It became clear to me at once that it would be necessary to draw for this new figure a lot of new images in the line with the famous frontispiece of Hobbes’ book, but born out of a totally different pencil.

If I found the task so exciting, it was because the Gaia hypothesis had been devised by two scientists who, by attacking the problem at opposite ends, had again entirely dissolved the two levels models I had been tracking down for years. When James Lovelock wondered where the gas that kept the Earth atmosphere in such a peculiar disequilibrium were coming from, Lynn Margulis was wondering where all the gas she was seeing leaking out of her bacterial mats were going. Gaia, as I began

to reconstruct its original shape, was the aggregated result of the multiple action, over eons of times, of the minuscule beings whose output spread, in a network fashion, *next to next*, creating new conditions for still other critters, without ever jumping to another level. This process could be only be understood if thoroughly “flattened” in some sort of networky way (15). Paradoxically, the “biggest” object of all, much bigger than societies of humans, ants or bees, was also the one that could most clearly *not* be framed by the two Fables of organism or market.

This was made just as clear by taking Lovelock’s side of the problem—there was no governor, nor engineer, nor providence to steer the planet—as by starting from Margulis’s side. Even more interestingly, the small was just as multiple as the big. In a series of stunning discoveries in biology, so elegantly gathered by Scott F. Gilbert’s textbooks (16), it became clear, as he said, that “we have never been individuals” (17). The sheer implausibility of life forms being selfish that I had detected earlier, was now taking on a stunning empirical dimension with the notion of holobionts. Even if the ability of selfish genes to calculate accurately could be granted, the multiplicity of the partners implied in any interaction would play havoc to any balance sheet. What does it mean to calculate the relative fitness of a bull if the fitness of its gut bacteria is not taken into account (18)? What had appeared, in Margulis’s earlier career, as a set of puzzling exceptions—the presence of foreign DNA in cells—turned out to be the rule: endosymbiosis.

What I found so exciting in the “intrusion of Gaia”—as Isabelle Stengers called it (19)—was that just at the time when a complete overhaul of political theory was needed, the “intrusion” offered the best scientific arsenal to reconfigure all at once the tiniest parts as well as the biggest wholes. Paradoxically, Gaia was fragmenting any metaphor of the body at the same time it was also requesting a political alternative to the composition of life forms. This is what Tim Lenton introduced in his enigmatic attempt at comparing Gaia 2.0 with Gaia 1.0 (20). If not parts and wholes then what? The moral and obviously religious project that had always been associated with the two-level stand point and its claim to reach an optimum as dramatized in the joint fables of the “selfish bees and the selfish stomach,” could not possibly work for the greatest power on earth, that of earth itself. Clearly, a fully secular version of social order had to be devised. And this in spite of the daring proposition by Lovelock that Gaia had a goal function, namely that it involuntarily but obstinately ended up being the sturdiest way to improve habitability. With the intrusion of Gaia, things were becoming more interesting but also much more difficult: there was a clear rupture in the long history of imagery of the body politic. Other resources clearly had to be brought in.

Which means we needed philosophers! In the same way as the disputed notion of the Anthropocene was signaling a new geohistorical epoch, it was clear that an

older philosophical period was coming to a close. In spite of its name, the “philosophy of organism” developed by Whitehead was not an extension of any organic metaphor but an end to what he had called “the bifurcation of nature” and, more pointedly, an end to the apparently commonsense idea of “simple localization.” As Didier Debaise pointed out in the meeting, there is nothing simple in simply localizing any entity with the use of coordinates, since such localization implies that a point in space and time can be defined without its predecessors and successors, and without its neighboring events (21). Such a fallacy might be the source of all the difficulties associated with the composition in parts and wholes I had been vainly trying to overcome. Thus, if any meeting was to be assembled to compose the new body politic, Whiteheadian philosophers had to be, if not the arbiters, at least the indispensable go-betweens to navigate the variegated life forms we would have to consider together. We were not expecting from them some sort of conceptual police or some all-terrain philosophy of nature, but an attention to the mistreatment of the conceptual tools inside which empirical results were framed.

Looking back, there was a last missing component Schaffer and I had to consider in proposing our gathering to the Cini Foundation. Just as with the Leviathan, the new body politic, whatever it turns out to be, had to end up establishing a *legitimate* form of polity. Michel Serres had predicted many years ago in his *Natural Contract* that legal and empirical ties had to be merged in some way (22). As Kyle McGee argued throughout the meeting, law has the uncanny ability to build connection *next to next* without ever having to stoop to either essentialism or constructivism (23). Its casuistic way of arguing is indifferent to the two opposed forms of interpretation of its power that play the same role in legal theory as in the two-level standpoint in social theory: it can be described just as well by essentialist as by constructivist tools (24). The formidable capacity of law is to show constantly and literally, case by case, that parts and wholes are simultaneously made. Any practicing lawyer, according to Kyle, knows to produce this miracle of relatively unshakeable wholes out of relatively disjointed parts by reinventing both each time, in each case. (A point that Gabriel Tarde, the putative founder of ANT, had shown long ago because he had been a judge for thirty years before turning sociologist). What struck me in the study of law is that its ligatures look a lot like those that Lovelock and Margulis were devising for Gaia.

With philosophy and law, the ring was closed. Which ring? The one that made sure the problem we had gathered together to tackle would not escape elsewhere. As Schaffer and I had written in convening the dialog: “There has always been a two-way stream of exchanges between biology, law, religion and social theory to the point that it is very difficult when people talk about ecosystems, identity, genetics, organism or globalization to decide if they speak about human or non-human en-

tities. Biologists don't seem to worry that they import social theory to talk about organs and tissues, sociologists don't hesitate to use a legal conception coming from Church history to define the individual, while economists happily mobilize what they take as a "naturalistic" notion of competition to render the optimum calculable, while organization theorists borrow offhandedly the DNA metaphor of cell organization, and so on. Metaphors travel freely, transporting the same unexamined perplexities from field to field. (...) The difficulty is constantly papered over by vague concepts such as organism, emerging properties, systems, totalities." Only if we could assemble enough scholars to close the ring, we could be sure that the problem of composing political collectives would not escape our chase.

After reading the transcript of the discussions of those three days, it is clear that there will be as many interpretations of what has been achieved as there were people around the table and in the audience. But after having retraced the path leading to the speakers arrayed around the table of the *Biblioteca del Longhena*, perhaps I might be permitted to emphasize a few results which might help in starting future meetings about the same topic.

Three principles of composition have shown their fecundity, in my eyes at least. The first is that no matter how empirically different are the collective bodies we considered, it is fully legitimate to compare the few conceptual tools used to make sense of them. The phenomena reviewed in this meeting are indeed thrown in the same vortex that defines politics today. So, even if we had great difficulty in articulating bees, ants, capitalism, conservation, climate, cells, laws and ecosystems with human endeavors, that is not proof of a vain pursuit for some global synthesis, nor of a return to a mythical past, but the practical necessity of today. At the time of the Anthropocene, all the elements that in the past were composing the body politic *metaphorically* are now composing it *literally*. Whether we like it or not, the composition of politics must be extended to all those phenomena in a way that is reminiscent of the premodern past but now in a fully empirical way. When at the concluding talk, Schaffer showed Athanasius Kircher's image of a 16<sup>th</sup> century medical and cosmological chart, I could only think of the parallel with one of Lovelock's books, *Gaia. The Practical Science of Planetary Medicine* (25). The parallel is not one of the same disciplines, it is not the same result, it is not the same style, not the same diseases nor the same cures, but it has the same cosmopolitical goal, except that it has taken on an urgency, a materiality, and a scale that no premodern thinker could anticipate.

The second principle that was fully validated (admittedly my view is biased) is that composition follows the path of "next to next," without jumping to a higher level so as to travel faster and without rolling in some sort of superior global level. It is an old sociology of science result, of course, that a "global view" is never bigger

than the screen of the instruments that scientists are looking at, but here it takes a much more powerful meaning. The adjective “collective” never refers to a change of levels, but to the superposition of collecting endeavors—scientific instruments and accounting devices being the most obvious ones. Although the meeting has not come up with a common definition of terms like “holism,” “emergence,” “wholes,” “parts” and so on, it has clearly traced a path away from the “cop out,” the “miracle” of extracting a society out of individuals. In considering the activity of life forms we have to accept that they overlap with one another in such a way that it is impossible to stress the individuality of one partner without further extending the list of interacting participants. Many of the terms we discussed—“indexicality,” “holobionts,” “commoning” (26), “ligatures,” “autocatalytic networks”—had the same result of complicating the idea that the “whole is superior to the parts” and shifting attention to something more like “wholes are *in continuity with the parts and circulate through them.*” While common sense would require starting any inquiry from a stable definition of the “self” or of the “overall context,” it is clear on the contrary that we should start composing life forms from their overlaps. This is the problem of scale and scaling that David Western mentioned throughout the meeting as simultaneously a source of worries and a possible solution. How can large scale be transformed so as to allow the spread of experiments and traditions which, in his view, are always simultaneously local and translocal? It was reassuring for me to see that the one of us who had the longest experience in managing complex ecosystems was also the one who had the most serene view of the possibility of avoiding the general collapse.

The third principle of composition, and for me the most relevant, is that the intrusion of Gaia weighs on any definition of what politics could mean in the future. On this score, Lenton’s interventions in the meeting have been decisive. And it is worth stressing that if he was the most engaged in the discussion it was, I think, because he represented the least well-defined entity, while the spokespersons of ants, monkeys, cells or ecosystems, or indeed humans, were dealing with collectives that had been delineated and appropriated long ago. Scholars from the past and from the present have a long experience in making up the body politic out of humans or cells, and of comparing societies of wolves, baboons, birds, microbes or plants. They have none in coping with the utter originality of Gaia (27). To the point that, sixty years after the Lovelock and Margulis hypothesis, the exact scientific import of such a discovery is still debated (28). As to the political nature of this emerging form of power and sovereignty, it remains unfortunately a blank page. Other meetings will have to fill it in.

Over the course of three days we covered many more topics, all of which are important for the future task of composing the body politic, but a few moments

struck me as especially important for the future.

One is Didier Debaise's intervention around the notion of simple localization and the discussion about story telling that ensued. Biologists always had the difficulty of having to *reclaim* the very definition of the life forms they study from their preliminary pulverization in a cloud of unconnected data points. In other words, simple localizations that might have some sort of likeness to those used in surveying physical entities (those descending the entropic cascade), are transforming any representation of biological entities (those ascending the entropic cascade) into monstrous artefacts. This breaking down into data points to which relations have to be added from the outside has forced biologists, if they wish to be faithful to the peculiarity of their actors, to invent many reclamation tricks, including the telling of their own stories in order to follow their actors—vitalism, cybernetic feedbacks, autopoiesis, and so on. In that sense, the history of biology is a long attempt to bring together what had been put asunder by simple localization. It is the situation out of which Bergson had tried to extricate philosophy of nature but at the price of a new divide between mechanism and biology. The question is not one of overcoming reductionism or going “beyond” mechanistic metaphors, but of bypassing the preemptory operation of simple localization.

Following Debaise, it would make much more sense, instead of breaking down the connections between overlapping entities and then trying to patch them up by a great deal of story-telling in order to vivify again what has been made dead, to start from the peculiarity of life forms and accept the two principles that make them alive: they *depend* on others within which they are imbricated and this dependence makes them *precarious* (29). These are the two principles that are common to story and to history. Narrativity is not a superficial way to patch up the strict objective description comprised of data points, but the very way in which life forms have to gain their precarious existence through the overlap with others. To tell stories is to be objectively faithful *to their ways* of exploring the world. To be a natural scientist is to start from this precariousness, especially today when Gaia is finally understood as a substitute to nature (30).

Such a decision would lead to the second point that is at the heart of the meeting and on which we spent a lot of time: namely, should we abandon the very metaphor of the body politic? Allegedly, one is no longer allowed to use the term because it is an organicist one that has been rendered obsolete by the artificial building of Hobbes's Leviathan. But as many of us said in the meeting, and Scott F. Gilbert especially well (31), it entirely depends on what is a body. It is clear that John of Salisbury, Christine de Pisan, Saint Paul, Shakespeare—to mention the beautiful texts that were invoked at the beginning—could not envision the sort of body building that Lenton calls Gaia 2.0. And yet we are indeed faced with constructing

a legitimate polity out of totally new components. The point is not to wheel in the overused notion of biopolitics (remarkably absent from our discussions), but to redescribe both biology and politics thanks to the novel views of what life forms are after. So, in the end there is no reason to deprive future discussions from the use of that metaphor of the body, but to recognize that history, a bit like Kantorowicz's insistence on the translation from one King body to the next, entails a similar succession—Gaia being the strangest and newest of all the figures that we have to face.

One of the features of any life form is some sort of consciousness, or goal function, and Lovelock attributed to Gaia the (non-teleological) goal of looking for habitability, which is another way to name precariousness and dependence. In his view, life forms leak out leftovers that make occasions for other life forms to thrive and it then turns out that some of those niches appear to be more robust than others. Habitability will be favored in the end through what Lenton called “sequential selection” (32). This sort of minimalist goal-function, being much less demanding than the natural selection and adaptation requested by Darwin, and devoid of the two-level optimization of Neo-Darwinism, takes on a very different meaning when the Anthropocene is brought in. With this new geohistorical epoch, the notion of goal function of the Earth no longer has a disputed metaphorical dimension; it is supposed to become literal because of the intervention of what *human beings* call having a goal. The increasing weight and visibility of humans is supposed to introduce foresight, planning, learning curves and some of the cognitive abilities they are so proud of.

Unfortunately, this is just at this juncture that Tim Mitchell brought us the third and most disturbing point of this meeting. Contrary to Lenton's hopes for Gaia 2.0, the introduction of human consciousness in planetary politics might be impossible, in Mitchell's view, because capitalism is tailored to render foresight and reactivity impossible. Because of its way of colonizing the future, it is made to blind humans to what is coming. Contrary to the dreams of the geo-engineers, the Anthropocene is not the advent of reflexivity and rationality but the demonstration, on a planetary scale, that some life forms *cannot learn* from their mistakes. The weight of the technosphere, that is, all the decisions to capture savings and transform the future into a debt that has to be repaid through massive investment in hardware, has made it immensely difficult for human societies to adjust to the new situation they themselves created. They have lost their ability to adjust. The expansion of capitalism's blinding of collectives and its breaking of the path of learning takes us back to Milton's version of Aesop “the Fable of the Wen and the Members” where what he said about the Pope would work even better for Mitchell's capitalism: “The head by right takes the first seat, and next to it a huge and *monstrous Wen* little less than the Head itself, growing to it *by a narrower excrescency*.” Our collective ability

to think rationally might have been vastly overstated and the idea of the human race becoming the good steward of planet a sheer impossibility. Lovelock again: “I would sooner expect to see a goat to succeed as a gardener than expect humans to become responsible stewards of the Earth.”

Well, in the end, no matter how neatly we had closed the ring, the problem we had wanted to capture might have escaped us once more. Were we really much further than Tuesday night, when we heard Saint Paul’s beautiful description of the Church?

“For the body is not one member, but many. If the foot says, ‘Because I am not a hand, I am not a part of the body,’ it is not for this reason any the less a part of the body. And if the ear says, ‘Because I am not an eye, I am not a part of the body,’ it is not for this reason any the less a part of the body. If the whole body were an eye, where would the hearing be? If the whole were hearing, where would the sense of smell be?” (1<sup>st</sup> Cor 12)

The problem of composing the body politic rightfully and in time and at the proper scale remains the enigma that is still agitating us all. It is possible that this is not the sort of problem one chases, but a challenge that is slowly approached by retelling with slight modifications all the fables that have been told but in different genres and for different audiences. If this were to be the case, we would then find ourselves much closer to *One Thousand Nights and One* than to *The Leviathan*.

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  12. “Thus there is no such thing as the colony identity, except this aggregate of all of the different, changing, shifting boundaries of the ants.” p. 41.
  13. Lenton: “The planet is an almost perfectly materially closed system at the total scale of Gaia, so it has very little material environment frankly to interact with, just an energetic environment. It has to be an autotrophic and materially cyclic future, technosphere etc. and that is absolutely fundamental.” p. 108.
  14. Baptiste Morizot: “The body begins with the animals and it begins with this kind of beings which have a head. It’s head-oriented. So it’s all over the images of the picture, when you talk about a body, one part of your theoretical unconscious looks for the head. That’s the first thing for me. The other thing is that when you talk about the body you’re outside of it.” p. 224.
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  17. Gilbert, Scott, Jan, Sapp, and Alfred, Tauber. “A Symbiotic View of Life: We Have Never been Individuals.” *The Quarterly Review of Biology* 87.4 (2012): 325-341.
  18. Gilbert: “The term, holobiont appears to be a useful term. It was independently coined at least four times. The current usage of the word was introduced by Lynn Margulis in 1991. It designates the amalgamation of the big organism (the macrobiont, the host) plus its persistent symbionts. The holobiont view claims that the host and the symbionts form the complete organism. For instance, when we think of a cow, we think of this bovine mammal that eats grass. Only, cows cannot digest grass. There’s no gene in the cow’s genome that encodes an enzyme allowing cows to digest cellulose. That’s provided by that rich community of symbionts living in its gut.” pp. 78, 79.
  19. Stengers, Isabelle. *In Catastrophic Times Resisting the Coming Barbarism* (translated by Andrew Goffey). Open Humanities Press, 2015.
  20. Lenton: “I come to the meeting as a child of the Anthropocene, unashamedly thinking about how we could use a little of this scientific understanding to help us construct a

- future world with a sustainable, happy future for humanity within Gaia – and that’s what I’d call Gaia 2.0 – just to recognize that it will include our conscious agency and reflection in some form.” p. 33.
21. Debaise: “The two main operations are the *bifurcation* and the *simple localization*. If we understand well the status of these two operations, the reason why they were so important in the constitution of modern sciences, we will understand to which interests correspond the invention of nature and to what kind of problem the invention was supposed to give an answer. So the general question ‘what is nature?’ can be reformulate: what kind of gestures produced during the 17<sup>th</sup> century what we call ‘nature?’” p. 31.
  22. Serres, Michel. *The Natural Contract* (translated by E. MacArthur and W. Paulson). Ann Arbor: The University of Michigan Press, 1995.
  23. McGee: “What happens when a chain of legal reasons is articulated and a decision is reached. The court has to reach a decision, it’s going to come to a resolution. That outcome is truly an element of the process, not something distinct from it, and it lends itself to being recirculated to become a new value object in subsequent interactions, in subsequent adjudicative processes.” p. 133.
  24. McGee: “My point now is simply that there’s something about the law that seems to *demand* this kind of movement, this kind of vacillation. It’s a requirement or a constraint that is grounded in the bifurcation of person and body. We can see in legal doctrine, and even in contemporary legal practice, a repeated shuttling and shifting back and forth between two registers that are thought to exhaust the real: we would say materiality and discourse today, but we could also say naturalism and constructionism or ontology and epistemology or being and thought.” p. 179.
  25. Lovelock, James. *Gaia. The Practical Science of Planetary Medicine*. No mention of place: Gaia Books Limited, 2000.
  26. Stengers: “Not rules demanding the definition of good and bad, but what Bruno would call the ‘cultivation of ways of overlapping’ and what those concerned claim when they affirm ‘no commons without commoning.’ Commoning is not altruistically forgetting about the ‘interests of the self.’ It is cultivating ways of activating the experience that the selves we are is indeed overlapping with everything which compose the commons.” p. 163.
  27. Except the Maasai who have been David Western’s educators: “Selfish herders are ostracized by their neighbors. A tribe of selfish individuals falls prey to tribal neighbors who manage their grassland better and are more collaborative and cohesive as a society. The social networks, common identity and cohesion is not built around the body politic in the Western philosophical sense, for mobile pastoral societies have no central seat of government or political representatives. Social networks are built instead around the around a body of the cow. The cow is the economic and ecological thread and social epicenter of life that binds and bonds the Maasai to work cooperatively for greater collective gain.” p. 189.
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29. Debaise: "So, the question of the meeting, if I may rephrase it, is how to articulate all the beings without subtraction? (...) This would be my proposition: to reintroduce stories as an important tool, a real method inside scientific practices." p. 250.
30. Debaise: "If we need other stories, instead of the 'bifurcation of nature,' it is because we cannot anymore reduce the precarity of each existence to the general stability of nature." p. 252.
31. Gilbert: "So, what's the body of the body politic? If we wish to talk about the body of the body politic, it would be good to know something about the body. I profess embryology, the science of body construction, a science which is full of metaphors, full of similes, full of analogies and full of images trying to understand how bodies are made." p. 29.
32. Lenton: "Well, just keep that in your mind and let me try to build on that and introduce this idea I'm calling sequential selection. I partly started thinking about because of correspondence I was having with Bill Hamilton in the late 1990s. This is from a letter (...): "I imagine that 'learning' through repetitions over time alone in a sufficiently complex system has to be shown able to replace the currently understood and I'm sure much more powerful 'learning' through repetitions over both time and space that is natural selection as we know it," from Bill Hamilton to Jim Lovelock." p. 146.



## BIOGRAPHIES OF CONTRIBUTORS

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**Tim Lenton** is Director of the Global Systems Institute and Chair in Climate Change and Earth System Science at the University of Exeter. His research focuses on understanding the behaviour of the Earth as a whole system, especially through the development and use of Earth system models. He is particularly interested in how life has reshaped the planet in the past, and what lessons we can draw from this as we proceed to reshape the planet now. Tim's work identifying climate tipping points won the Times Higher Education Award for Research Project of the Year 2008. He has also received a Philip Leverhulme Prize 2004, European Geosciences Union Outstanding Young Scientist Award 2006, Geological Society of London William Smith Fund 2008, and Royal Society Wolfson Research Merit Award 2013. Tim's books include: *Revolutions that made the Earth* (with Andrew Watson, Oxford University Press, 2011) and *Earth System Science: A Very Short Introduction* (Oxford University Press, 2016). Journal articles relevant to the dialogue include: Latour, B. & Lenton, T.M. (2019) 'Extending the Domain of Freedom, or Why Gaia Is So Hard to Understand,' *Critical Inquiry* 45: 659-680. Lenton, T.M. (1998) 'Gaia and natural selection,' *Nature* 394: 439-447. Lenton, T.M. & Latour, B. (2018) 'Gaia 2.0,' *Science* 361: 1066-1068. Lenton, T.M. et al. (2018) 'Selection for Gaia across multiple scales,' *Trends in Ecology and Evolution* 33: 633-645. Nicholson, A.E., Wilkinson, D.M., Williams, H.T.P. & Lenton, T.M. (2018) 'Multiple states of environmental regulation in well-mixed model biospheres,' *Journal of Theoretical Biology* 414: 17-34. Williams, H.T.P. & Lenton, T.M. (2007) 'The Flask model: emergence of nutrient-recycling microbial ecosystems and their disruption by environment-altering 'rebel' organisms,' *Oikos* 116: 1087-1105. Williams, H.T.P. & Lenton, T.M. (2008) 'Environmental regulation in a network of simulated microbial organisms' *PNAS* 105: 10432-10437. Williams, H.T.P. & Lenton, T.M. (2010) 'Evolutionary regime shifts in simulated ecosystems,' *Oikos* 119: 1887-1899.

**Mike Lynch** is Professor Emeritus in the Department of Science & Technology Studies, Cornell University. His research on discursive and material practices in science, law, and everyday life takes an ethnographic and ethnomethodological approach, describing actions as they unfold in time and space from the perspective of the agents involved. He is particularly interested in hybrids and cross-overs among different fields of practice: scientific evidence in legal trials; craft and artistry in the elucidation and presentation of laboratory objects; and the stipu-

lation of distinctions between ‘products of nature’ and ‘compositions of matter’ in patent law. He has authored, co-authored, and edited numerous publications, and continues to conduct research in ethnomethodology and social studies of science. Recent publications include, “STS, symmetry, and post-truth,” *Social Studies of Science* 47(4), 2017: 593-599; “Material play and artistic renderings: The production of essentially useless nanotechnology,” in Philippe Sormani, Guelfo Carbone and Priska Gisler (eds.), *Practicing Art/Science: Experiments in an Emerging Field* (Abington and New York: Routledge, 2019): 81-100; and “Ontography as the study of locally organized ontologies,” *Zeitschrift für Medien- und Kulturforschung (ZMK)* 10(1) (2019): 147-160.

**Kyle McGee** is an attorney and legal theorist. As a practitioner, he represents public entities in environmental protection, consumer protection, and financial fraud matters. His scholarship draws actor-network theory, the philosophy of law, and legal practice into closer relations. His publications include *Heathen Earth: Trumpism and Political Ecology* (punctum 2017), *Latour and the Passage of Law* (Edinburgh 2015), *Bruno Latour: The Normativity of Networks* (Routledge 2014), and *Deleuze and Law* (Edinburgh 2012), as well as a variety of articles and chapters appearing in philosophy, politics, law, and social sciences journals and edited collections. His current research focuses on the theory and practice of water law.

**Timothy Mitchell** writes about colonialism, political economy, the politics of energy, and the making of expert knowledge. Trained in the fields of law, history, and political theory, he works across the disciplinary boundaries of history and the social sciences. Many of his writings explore materials from the history and contemporary politics of Egypt, where he has conducted research over many years. Mitchell is the William B. Ransford Professor of Middle Eastern Studies at Columbia University. His books include *Colonising Egypt* (1991), *Questions of Modernity* (2000), *Rule of Experts* (2002), and *Carbon Democracy* (2012). He is currently working on a study of durability, examining how the more durable apparatuses for capturing wealth characteristic of late nineteenth-century colonialism (railways, canals, apartment buildings, dams) engineered a new method of extracting income from the future—a future we now inhabit precariously today. Like much of his work, this research combines the study of the built world, technical devices, ecological processes, and the history of economic and political concepts.

**Simon Schaffer** is Professor of History of Science at the University of Cambridge. He is the co-author, with Steven Shapin, of *Leviathan and the Air Pump: Hobbes, Boyle and the Experimental Life* (Princeton, 1985, new edition 2011). A

collection of studies in the social history of physical sciences appeared as *La fabrique des sciences modernes* (Seuil, 2014). He has helped edit essay collections for Palgrave Macmillan on *The material cultures of enlightenment arts and sciences* with Adriana Craciun (2016) and on *Aesthetics of universal knowledge* with Pasquale Gagliardi and John Tresch (2017). He was recently awarded the Dan David Prize (2018) and the Royal Society's Wilkins-Bernal-Medawar Medal (2019). From September 2019 he will help lead a new Leverhulme research project, 'Making Climate History,' on the history of climates and of climate sciences.

**Isabelle Stengers** is Professor of the Université Libre de Bruxelles. After graduating in chemistry she has turned to philosophy, and as a doctoral student she has worked in Ilya Prigogine physical chemistry department. Her first work with Prigogine and her dissertation was about the contrast between the conceptual inventiveness of physics and its claim to propose a general world view. This has led her to develop a critique of the model of objectivity that mimics theoretico-experimental sciences and silences the diverging multiplicity of scientific practices. In this perspective she has proposed, as a challenge inseparably political and cultural, the concept of an active ecology of practices, embedded within a democratic, demanding environment. Her work as a philosopher defends the possibility of a speculative, adventurous constructivism, which she relates to the philosophy of Gilles Deleuze, Alfred North Whitehead and William James as well as with the anthropology of Bruno Latour and the SF thinking adventure of Donna Haraway. Among the books, have been published in English translation; *Order out of Chaos* with Ilya Prigogine, *The Invention of Modern Science*, *Capitalist Sorcery: Breaking the Spell* with Philippe Pignarre, *Cosmopolitics I and II*, *Thinking with Whitehead* and *Women Who Make a Fuss* with Vinciane Despret, *In Catastrophic Times. Resisting the Coming Barbarism; Another Science is Possible*.

**Shirley C. Strum** is Professor of Anthropology at the University of California, San Diego, and the Director of the Uaso Ngiri Baboon Project (UNBP) in Kenya. Strum has spent over 47 years studying wild baboons in Kenya. During that time, she has pioneered new ideas about baboons, about animal society, and about evolution. She was the first to suggest that baboon society does not revolve around male aggression and dominance and that both males and females have effective non-aggressive alternatives. These "social strategies of competition and defense" rely on social relationships that create a "social contract" using finesse, intelligence, and collaboration (1972-1979). Tracking the baboons through ecological and social challenges, she uncovered a previously unknown degree of social sophistication and complexity in a nonhuman animal (1972-1979). She documented the evolution of

baboon hunting behavior (1972-1974), the development of crop-raiding behavior (1979-1984), the successful translocation of 3 troops of baboons and their adaptation to new, harsher environment (1984-2004). A series of environmental perturbations demonstrate that baboons can't separate the social from the ecological. The cumulative information on changing environments and their impact on baboon diet, condition, reproduction, and sociality builds a new integrated baboon socio-ecology. Social complexity prevents baboons from making simple evolutionary tradeoffs of costs and benefits. Moreover, chance and history influence a group's future so that adaptation is not the tight evolutionary fit between behavior, society, and ecology as previously believed. Instead, baboons reveal evolutionary processes to have a great deal of tolerance and slippage. Strum implemented one of the earliest community-based conservation programs. Her recent study of the invasion of an alien cactus species (*Opuntia stricta*) provides the first evidence for the process of invasion and illustrates its complexity. She continues to study the humanization of the landscape and its impact on baboons, people, and livelihoods in the Anthropocene (2005-present). A fruitful collaboration that began in the 1980's with Bruno Latour (winner of the Holberg Prize –the Nobel Prize for social sciences) developed the contrast between social complexity in baboons and social complication in humans by focusing on the role of negotiation in creating society. Tracking baboon social complexity over decades shows that baboons can't break their social complexity glass ceiling which severely limits the kind of society they can create. The current baboon research has two tracks. The first set of studies explores how socio-ecological complexity influences individual behaviors and how group level phenomena emerge. The second track focuses on conservation using the best science to understand current problems and to create innovative solutions. As part of the community-based conservation program, UNBP was the first primate project to use research assistants from the local community in 1981. Today, Kenyan field assistants continue to collect information on behavior, ecology, demography, ranging, foraging, and areas of conflict between baboons and the humans living in the same place. One of the troops included in this study, the Pumphouse Gang, has featured in numerous award-winning documentaries including David Attenborough's *Life of Primates* and the Discovery Channel's *Baboon Tales*. Strum is widely published in the scientific literature, and authored a well-regarded popular book *Almost Human: a journey into the world of baboons* (University of Chicago Press, 1987/2001) which was translated into 8 languages. She has also edited books on topics that range from the history of physical anthropology, to community-based conservation to how our ideas about primates have changed.

**David Western** is chairman of the African Conservation Centre, Nairobi. He began research into savannas ecosystems at Amboseli in 1967, looking at the interactions of humans and wildlife. His work has served as a barometer of changes in the savannas and a test of conservation solutions based on the coexistence of people and wildlife. Western directed Wildlife Conservation Society programs internationally, chaired the African Elephant and Rhino Specialist Group, was the founding president of The International Ecotourism Society and a former director of the Kenya Wildlife Service. He also founded the African Conservation Centre in Nairobi, is the patron of the Wildlife Clubs of Kenya, chairman of the advisory board of the Liz Claiborne Art Ortenberg Foundation and was an adjunct professor in Biology at the University of California, San Diego for many years. Western's publications include *Conservation for the Twenty-first Century*, *Natural Connections: Perspectives in Community-based Conservation*, *Kenya's Natural Capital: A Biodiversity Atlas* and, *In the Dust of Kilimanjaro*. His most recent book, *Super-Dominance: an Exploration of Our Past and Future*, is to be published by Yale University Press. He has served on many government task forces redrafting Kenya's wildlife and environmental. His conservation awards include the World Ecology Award for 2010 and the 2012 Life-time Achievement Award for Ecotourism.



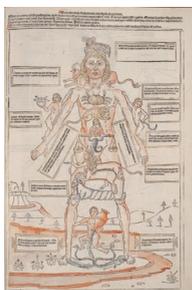


“Do you remember the Aesopian Fable of the Belly and the Members, or the letter of Paul to the Corinthians about the Body and the Church, or *The Fable of the Bees* by Mandeville, or the somewhat dangerous association of pests and foreigners, or the more recent attempts to think of the Earth as a giant organism? None of these stories stops shifting metaphors between one domain—that of the body—and another—that of politics. The result has been the creation of that most important concept of Western philosophy, *corpus politicum*, the Body Politic. One interesting aspect of this most famous topic is that every domain borrows from each other the certainty associated with the other’s authority, so that political science ends up borrowing from biology what biologists borrow from political theory.

This constant commerce of concepts and metaphors, unfortunately, has never guaranteed the quality of what has been ceaselessly transported from one domain to another. The result is that we remain deprived of a coherent definition of collective bodies. Hence the idea of attempting to re-open the question in a Dialogue of San Giorgio by bringing the different domains together and examine what each has really to offer to the others that is genuinely proper to the phenomena it studies.

This book is the outcome of three days of intense confrontation among experts of various disciplines (biology, philosophy, ecology, social theory, anthropology, history of science, political science) aimed at finding a new body’s description for the Body Politic.”

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Zodiac Man. Joannes de Ketham, *Fasciculus medicinae*, Venice: Giovanni e Gregorio de' Gregori, 1491 (Venice, Fondazione Giorgio Cini).