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Gaia

The next big idea

Mary Midgley

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Preface

Every so often, a big idea such as Darwinism or Marxism comes along which does which challenges our basic assumptions about the way the world works. Such ideas do not fit our habitual mental models. They may be philosophical, scientific, economic or religious, but they have real world outcomes which affect our everyday lives. The concept of Gaia (which sees the Earth as a self-organising system maintaining conditions in which life can exist) is such an idea. It challenges us to re-examine the foundations of our relationship with each other and with the planetary system of which we are part. The Gaian idea is very simple, but its implications are profound.

That we need a new mental model for our place in the world is increasingly apparent. The evidence of humankind's abuse of our surroundings mounts daily, yet as the flood waters rise around us, many still deny even the possibility that rainfall and combustion engines may be linked. Gaian thinking can help us to develop a more holistic understanding of ourselves, our organisations, and the needs of our habitat.

The task, however, is very demanding. While we have started to speak of 'holistic government' and 'joined up thinking', we experience intense difficulties in establishing mental connections, dialogues and organisational structures which cross traditional boundaries. We are too used to dividing the world into separate realms of enquiry, failing to grasp the continuum which links such seemingly disparate areas as agriculture, education, advertising and prisons. We are caught up in a way of thinking which separates us from the world, and 'different' parts of the world from each other. This narrowing of our conceptual horizons

affects our ability to make policy, to conceive of solutions, and to implement wide-ranging change.

At the heart of this fragmentation lies the assumption that there is a distinction between ourselves as individual human beings and the world around us. We take this division for granted and conclude that the world is a resource for our use and an arena for experimentation. The essence of scientific empiricism depends upon our ability to conceive of an observer detached from the object of study. An anthropologist visiting contemporary western society would see us as a community trapped within an Enlightenment mind-set, bounded by preconceptions whose limits we cannot perceive.

Mary Midgley's pamphlet probes the deepest foundations of this mindset, and takes forward the task of enriching and supplementing it. She shows that practical questions of policy and individual behaviour are influenced by intellectual history and conceptual structures which we are often not even aware of. In doing so, she is also making an important contribution to an emerging social and political agenda.

Gaia theory takes us beyond the subject/object divide by challenging the conception of ourselves as living on a planet. Instead of 'humans' and 'environment', we and the planet are together. Rather than interacting with our environment, 'we' and 'it' are indivisible. We are a part of, not apart from, the earth. This realisation is not yet widespread, and its implications not yet fully apparent. But in many disciplines, from material culture to medicine, from fiction to jurisprudence, people are searching for forms of expression which can overcome the once obvious divisions and distinctions between categories.

As the traditional borders between subjects break down, the structures and practices of politics will change. If there are no clear dividing lines any more, no strict boundaries, how do we decide where administrative responsibilities lie? For example should a ministry of health deal with the way in which food is grown and distributed? Should it operate sports facilities, and be concerned with the minimum wage? Should a department of education have a say in the housing conditions of children and parents? Indeed the category of 'government' itself is called into question as politics becomes the domain of the group, the individual, and the non-human, as well as that of 'politicians' in the old sense.

The characterisation of the individual also changes. Politicians and journalists like to speak of us as 'motorists' or 'parents' or 'patients' but Gaian thinking recognises that we all inhabit multiple roles which are crucially shaped by our relationships with each other. In addition, it teaches us that no single part of a system is inherently more important than another, with obvious moral implications both for the way humans treat each other and the way they relate to other species.

Gaian thinking can also open up a whole new perspective on the way we think about community. While neo-Darwinism concentrates attention on the individual as a struggling, competitive, 'selfish' unit, Gaia theory provides context, and the insight that co-operation and locus are preconditions of individuality. It can also show how constant adaptation in response to changing conditions is an imperative for organisations, as they struggle to cope with the dynamics and complexities of change.

While this pamphlet does not provide detailed recommendations or prescriptions for policy, it nevertheless provides a strong, practical challenge to our political systems.

Many politicians have said that they will put something – often the environment – 'at the heart of government'. This can only happen when a Gaian view, which sees *nothing* as a ring-fenced 'single issue', takes hold of our imaginations, and we begin to change our lives accordingly.

John Holden

Demos

Summary

The idea of Gaia – of life on earth as a self-sustaining natural system – is a powerful tool that could generate solutions to many of our current problems. It does not just lead to new applications of science and technology. It can also counteract the corrosive forms of social atomism and individualism which infuse much current scientific thought. Its approach, once fully grasped, makes a profound difference, not just to how we see the earth but to how we understand life and ourselves.

Much of the difficulty about grasping the concept of Gaia is not scientific but comes from the fragmented general framework of our thought, which arises from the artificial divisions that flow from Descartes' original fence between mind and body. Our moral, psychological and political ideas have all been armed against holism. They are both too specialised and too atomistic. As many people are pointing out today, that slant is giving us trouble in plenty of other places as well as over Gaia. Yet we find it very hard to change it.

In particular, the question of intrinsic value is increasingly urgent. We must learn how to value various aspects of our environment, how to structure social relationships and institutions so that we value social and spiritual life, as well as the natural world, alongside commercial and economic aspects.

Every thought-system has at its core a guiding myth, an imaginative vision, which expresses its appeal to the deepest needs of our nature. Through most of the twentieth century, many prophets in the West have painted the world in terms of a narrow and romantic individualism, a moral outlook which simply assumes that individual freedom is the only unquestionable value. Indeed, we do not use the notion of

sacredness much today except in a single context, namely, 'the sanctity of human life'. Describing anything else as sacred can cause embarrassment. Yet we are surely beginning to feel how inadequate this attitude is. We are becoming disturbingly aware of larger claims. We urgently need ways to understand them and to act on that awareness. A Gaian perspective can help us here.

This pamphlet sets out the scientific origins and moral implications of the Gaia hypothesis. It then goes on to explore the social and moral bias of other, more dominant forms of scientific thought which have blocked acceptance of it, and to examine the implications of a shift towards a more holistic, Gaia-oriented approach. It concludes with some ideas about the applications in policy and practice of this reorientation in our thinking.

Introduction

Why Gaian thinking is not a luxury

Gaia – the idea of life on earth as a self-sustaining natural system – is a central concept for our age. It can both stimulate practical solutions to environmental problems, and act as a cure for distortions that spoil our current world-view. Current ways of thought tend to trap us in the narrow, atomistic, seventeenth-century image of social life which grounds today's crude and arid individualism. A more realistic view of the earth can give us a more realistic view of ourselves as its inhabitants.

Our ideas about our place in the world pervade all our thought, along with the imagery that expresses them, constantly determining what questions we ask and what answers can seem possible. They enter into all our decision-making. Twists in those imaginative areas account, I believe, for the curious difficulty that we still have in taking the environmental crisis quite seriously – in grasping the place that it ought to have in our scheme of priorities.

Uncovering the appropriate place and role for the idea of Gaia requires us to rethink the special significance which scientific thinking occupies in our everyday lives. Science is not just an inert store of neutral facts. Its facts are always organised according to patterns which are drawn from ordinary thinking in the first place and which often rebound in a changed form to affect it profoundly in their turn. These strong pieces of imaginative equipment need to be understood and criticised. We shouldn't slide into accepting their apparent moral implications merely because they are presented as part of science.

What, then is the theory?

The current Gaian thinking that I believe can help here is a new scientific development of an old concept. The imaginative vision behind it – the idea of our planet as in some sense a single organism – is very old. Plato called the earth ‘a single great living creature’ and this is language that people in many cultures would find natural.¹ Our own culture, however, shut out this notion for a long time from serious thought. Orthodox Christian doctrine damned it as involving pagan nature-worship. And modern scientists, for their part, were for a long time so exclusively devoted to atomistic and reductive explanations that they too rejected this reference to a wider whole. Indeed, during much of the twentieth century the very word ‘holistic’ has served in some scientific circles simply as a term of abuse.

Recently, however, scientists have become somewhat less wedded to this odd one-sided reductive ideology – less sure that nothing is really science except particle physics. The environmental crisis has helped this shift by making clear the indisputable importance of ecology, which always refers outwards from particulars to larger wholes. In that changed context, solid scientific reasons have emerged for thinking that the notion of our biosphere as a self-maintaining system – analogous in some sense to individual organisms – is not just a useful but actually a scientifically necessary one.

Does it seem surprising that an idea should combine scientific and moral importance in this way? That is actually not unusual. The two-way influence of imagery is shown impressively by the powerful Machine Image which was central both to the Newtonian view of the cosmos and to the Enlightenment’s notion of determinism. As Karl Popper put it, ‘Physical determinism ... was a daydream of omniscience which seemed to become more real with every advance of physics until it became an apparently inescapable nightmare.’² During the enlightenment, the machine-imagery had taken charge of the thought. A striking example today is the Neo-Darwinist picture – now extremely influential – of evolution as a simple projection of the money-market. Here the noisy rhetoric of *selfishness, spite, exploitation, manipulation, insurance and war-games* easily persuades people that this new form of Victorian social-atomist ideology must be true because it has the support of science. By using a different imagery and a different basic

pattern, Gaian thinking tends to correct this outdated bias. It does not reject the central scientific message of neo-Darwinism. It simply points out that it is not the whole story.

The scientific origins of Gaia

The idea first arose out of considerations about the difference between the earth and its siblings. James Lovelock was employed by NASA in the early 1960s, designing sensitive instruments that would analyse the surfaces and atmospheres of other planets. But Lovelock was a chemist who had previously worked in biophysics and medicine, and it seemed to him that the experiments proposed for detecting life on other planets were too closely bound to expecting particular features similar to life on earth. A wider strategy occurred to him. Perhaps, he thought,

the most certain way to detect life on planets was to analyse their atmospheres... life on a planet would be obliged to use the atmosphere and oceans as conveyors of raw materials and depositories for the products of its metabolism. This would change the chemical composition of the atmosphere so as to render it recognisably different from the atmosphere of a lifeless planet.³

He therefore compared the atmospheres of Mars and Venus with that of the earth and found indeed a startling difference. By this test Mars and Venus appeared, in a simple sense, static and dead. They

had atmospheres close to equilibrium, like exhaust gases, and both were dominated by the generally unreactive gas carbon dioxide. [By contrast] the earth, the only planet that we know to bear life, is in a deep state of disequilibrium... Earth’s atmosphere is like a dilute form of the energy-rich mixture that enters the intake manifold of a car before combustion; hydrocarbons and oxygen mixed....An awesome thought came to me. The earth’s atmosphere was an extraordinary and unstable mixture of gases, yet I knew that it was constant in composition over long periods of time. *Could it be that life on earth not only made the atmosphere but also regulated keeping it at a constant composition and at a level favourable for organisms?*⁴ (Emphasis mine)

Checking what might follow from this, Lovelock found that there is indeed a whole range of mechanisms by which the presence of life seems, from its first appearance on the earth, to have deeply influenced the atmosphere in a way that made its own continuance possible when it otherwise would not have been.

The scale on which this happens is hard to grasp. I will only mention here only one simple and dramatic element in it – the Carbon Cycle. The carbon which living things use to form their bodies mostly comes, directly or indirectly, from carbon dioxide – the gas which, on the other planets, acts as a full-stop to atmospheric reactions. Life is therefore always withdrawing this gas from the atmosphere. Two statistics may convey something of the scale on which it does it. First, if you stand on the cliffs of Dover, you have beneath you *hundreds of metres of chalk* tiny shells left by the creatures of an ancient ocean. These shells are made of calcium carbonate, using carbon that mostly came from the air via the weathering of rocks – the reaction of carbon dioxide with basaltic rock dissolved by rain.

This process of rock-weathering can itself take place without life. But when life is present – when organisms are working on the rock and the earth that surrounds it – it takes place *1,000 times faster* than it would on sterile rock.⁵ Coal and oil, similarly, are storehouses of carbon withdrawn from the air. All this carbon will go back into circulation one day, but meanwhile it is locked away, leaving the breathable air that we know, air that makes possible the manifold operations of life. Similar life-driven cycles can be traced for other essential elements such as oxygen, nitrogen, sulphur and that more familiar priceless thing, water.

Warmth provides another illustration. In the time that life has existed on earth, the sun has become 25 per cent hotter, yet the mean temperature at the earth's surface has remained always fairly constant. Unlike Venus, which simply went on heating up till it reached temperatures far above what makes life possible, the earth gradually consumed much of the blanket of greenhouse gas – mostly carbon dioxide – which had originally warmed it. Feedback from living organisms seems to have played a crucial part in this steadying process and to have ensured, too, that it did not go too far. In this way the atmosphere remained substantial enough to avoid the fate of Mars, whose water and gases largely

streamed away very early, leaving it unprotected against the deadly cold of space. Here again, conditions on earth stabilised in a most remarkable way within the quite narrow range which made continued life possible.

Lastly, there is the soil. We think of the stuff we walk on as *earth*, the natural material of our planet, and so it is. But it was not there at the start. Mars and Venus and the Moon have nothing like it. On them there is only what is called *regolith* – naked broken stone and dust. By contrast our soil, as Lynn Margulis points out, is a museum of past life;

Soil is not unalive. It is a mixture of broken rock, pollen, fungal filaments, ciliate cysts, bacterial spores, nematodes and other microscopic animals and their parts. 'Nature' Aristotle observed, 'proceeds little by little from things lifeless to animal life in such a way that it is impossible to determine the exact line of demarcation'. *Independence is a political, not a scientific* (Emphasis mine)

In short, if all this is right, living things – including ourselves – and the planet that has produced them form a continuous system and act as such. Life, then, has not been just a casual passenger of the earth's development. It has always been and remains a crucial agent in determining its course.

Putting life together

Orthodox scientists, though they were at first sceptical about it, now accept this general approach as one which can be used and debated within science.⁷ But the importance of the concept is by no means confined to science. It concerns the general framework of our thought. The new scientific arguments bring back into focus the traditional imaginative vision of a living earth – and show how much we need it in our social and personal thinking.

As Lewis Thomas has pointed out, this vision already took on a new meaning for many of us when we first saw the pictures of earth sent back by the astronauts:

Viewed from the distance of the moon, the astonishing thing about the earth, catching the breath, is that it is alive. The

photographs show the dry, pounded surface of the moon in the foreground, dead as an old bone. Aloft, floating free beneath the moist, gleaming membrane of bright blue sky, is the rising earth, the only exuberant thing in this part of the cosmos. If you could look long enough, you would see the swirling of the great drift of white cloud, covering and uncovering the half-hidden masses of land. If you had been looking a very long, geologic time, you could have seen the continents themselves in motion, drifting apart on their crustal plates, held aloft by the fire beneath. It has the organised, self-contained look of a live creature, full of information, marvellously skilled in handling the sun.⁸

No other planet, incidentally, has continental drift and it appears that life may have played a part in making it possible – for instance, by changing the composition of the ocean floor in the way just mentioned.

The prevalence of intellectual apartheid

The scientific details that now articulate this picture of the living earth give it a new kind of standing because of the special importance that scientific thought has for us today. They make us bring our official scientific beliefs together with our imaginative life. Such a union is difficult, because of the separations which our intellectual traditions impose upon us. We are used to hearing of a stark war between the two cultures and of a total separation between facts and values. In our universities, the Arts and Science tend to be well separated.

Much of the difficulty about grasping the concept of Gaia is not scientific but comes from this fragmented general framework of our thought. It arises from these artificial barriers, derived centrally from Descartes' original fence between mind and body. Our moral, psychological and political ideas have all been armed against holism. They are both too specialised and too atomistic. As many people now point out, that slant is giving us trouble in plenty of other places, notably in many areas of medicine, especially mental illness, as well as over Gaia. Yet we find it very hard to change it.

One aquarium, many windows

This difficulty in changing concepts is, of course, a common one. We are always in trouble when we are asked to think about the world in a new way. It is as if we had been looking into a vast, rather ill-lit aquarium through a single window and are suddenly told that things look different from the other side.

We cannot have a single comprehensive view of the whole aquarium – a single, all-purpose, philosophic Theory of Everything. Many prophets, from the seventeenth century to the nineteenth, from Leibniz to Hegel and Marx, have tried to give us such a view. But their efforts have proved misguided. The world is simply too rich for such reductive strait-jacketing. There is not – as Leibniz hoped – a single underlying quasi-mathematical language into which the views from all aspects can be translated.

This does not mean that no understanding is possible. We can relate these various aspects rationally because they all occur within the framework of our lives. We can walk round and look at other windows and can discuss them with each other. But we cannot eliminate any of them. We have to combine a number of different ways of thinking – the views through several windows, historical, biological, mathematical, everyday and the rest – and somehow to fit them together.

When Galileo first expressed his views about the world, not only the Pope but the scientists of his day found them largely incomprehensible. Yet those ideas, when developed by Descartes, Newton, Laplace and the rest shaped the set of windows through which the whole Enlightenment looked into the vast aquarium which is our world. Many in our own age still want to see everything through this set of windows. Others call that set 'modern', contrasting it with various 'post-modern' sets which may be expected to replace it. There is no doubt that the Cartesian approach needs radical revision.

The Age of Alienation: dualism s In trouble

As many people have pointed out,⁹ the central trouble is the dualism of mind and body. The notion of our selves – our minds – as detached observers or colonists, separate from the physical world and therefore from each other, watching and exploiting a lifeless mechanism, has been with us since the dawn of modern science (and of the Industrial

Revolution). Descartes taught us to think of matter essentially as our resource – a jumble of material blindly interacting. Animals and plants were machines and were provided for us to build into more machines.

It is this vision that still makes it so hard for us to take seriously the disasters that now infest our environment. Such a lifeless jumble would be no more capable of being injured than an avalanche would. Indeed, until quite lately our sages have repeatedly urged us to carry on a ‘war against Nature’.¹⁰ We did not expect the earth to be vulnerable, capable of health or sickness, wholeness or injury. But it turns out that we were wrong; the earth is now unmistakably sick. The living processes (or, as we say, ‘mechanisms’) that have so far kept the system working are disturbed, as is shown, for instance, by the surge of extinctions.

Descartes’ world-view did, of course, produce many triumphs. But it produced them largely by dividing things – mind from body, reason from feeling, and the human race from the rest of the physical universe. It produced a huge harvest of local knowledge about many of the provinces. But it has made it very hard for people even to contemplate putting the parts together.

For a long time now our culture has tolerated this deprivation. But it has become a serious nuisance in many areas of knowledge. The problem of free-will is incomprehensible to people who think of mind and body as radically separate. Similarly, it is impossible to understand human motivation if one thinks of feeling as radically separate from thought. The rise of systems theory and complexity theory are thriving attempts to break its restraints. Another such place is the lively debate now going on about problems of Consciousness.¹¹ It is clear that many of us want to see our aquarium – our world, including ourselves – more as a whole, indeed, that we desperately need to do this. To do so, we must attend to aspects of it which Enlightenment dualism cannot reach.

Why ‘Gaia’?

Re-uniting science and spirituality

One of these areas that has been made artificially difficult – the connection between scientific thought and the rest of life – caused serious misunderstanding over the name Gaia itself. Many scientists resisted the theory because they thought this name unscientific. Accordingly, though they eventually accepted much of the detailed science, they avoided acknowledging it and so missed much of the theory’s wider significance.

The name originally arose when Lovelock told his friend, the novelist William Golding, that people found it hard to grasp his idea, and Golding promptly replied ‘Why don’t you call it Gaia?’ which is the name of the Greek earth-goddess, mother of gods and men. When Lovelock used the name, it did indeed rouse interest in the theory. Many people who had not previously understood it now grasped it and thought it useful. Others, however, particularly in the scientific establishment, now rejected it so violently that they refused to attend to the details of it altogether.

Some people today find it surprising that an idea can be large enough to have both a scientific and a religious aspect. This is because, during the last century, our ideas of religion, of science and indeed of life have all been narrowed in a way that easily obscures the connections between them. (Here our windows have become a good deal smaller than they were when Galileo and Newton and Faraday used them. They never doubted that these things belonged together).¹² To get round this difficulty, Lovelock used a different image. He launched the *medical model of Gaia* the idea of the damaged earth as a patient for whom we humans are the only available doctor, even though (as he points out)

we lack the long experience of other sick planets which a doctor attending such a case really ought to have. So he used the name *geophysiology* to cover the skills needed by such a physician.¹³

This medical imagery has made it much easier for scientists to accept the notion of Gaia. When the point is put in medical terms, they begin to find it plausible that the earth does indeed in some way function as an organic whole, that its climate and oceans work together with living things to maintain a normal balance, and that what gravely upsets any part of the system is liable to upset others. They can see that, for such a whole, the notion of *health* is really quite suitable. And of course they find the patient Gaia, lying in bed and politely awaiting their attention, much less threatening than that scandalous pagan goddess.

Gods, goddesses and scientific status

Lovelock, accordingly, came under great pressure to withdraw the goddess and for a while he seriously considered doing so. Eventually, however, he decided that the whole idea had to be kept together because the complexity was real. As Fred Pearce put it in an impressive article in *New Scientist*

Gaia as metaphor; Gaia as a catalyst for scientific enquiry; Gaia as literal truth; Gaia as Earth Goddess. Whoever she is, let's keep her. If science cannot find room for the grand vision, if Gaia dare not speak her name in Nature, then shame on science. To recant now would be a terrible thing, Jim. Don't do it.¹⁴

Lovelock didn't. He does indeed constantly emphasise the scientific status of the concept:

I am not thinking in an animistic way of a planet with sentience...[Gaia] behaves like a living organism to the extent that temperature and chemical composition are actively kept constant in the face of perturbations. I am well aware that the term [life] itself is metaphorical and that the earth is not alive in the same way as you or me or even a bacterium.¹⁵

But he still writes, with equal firmness, 'For me, Gaia is a religious as well as a scientific concept, and in both spheres it is manageable ... God and Gaia, theology and science, even physics and biology are not separate but a single way of thought'.¹⁶

This raises the question; is religious talk actually incompatible with science, as objectors to the name had implied? It is interesting to note that such talk is readily accepted in one area of science – and that an area which is often viewed as the archetype of all science, namely, theoretical physics. As Margaret Wertheim has pointed out, most of the great physicists of the past, from Copernicus to Clerk Maxwell, insisted that their work was primarily and essentially religious. More remarkably, too, their modern successors still make the same claim, comporting themselves as a scientific priesthood. As Einstein put it, '*In this materialistic age of ours the serious scientific workers are the only truly religious people*' (emphasis mine). Einstein himself showed how sincerely he meant this by constantly referring to God in explaining his own reasoning ('God does not play dice', 'The Lord is subtle but not malicious' and so forth). And he explicitly said that this attitude was serious

Science can only be created by those who are thoroughly imbued with the aspiration towards truth and understanding. The source of this feeling, however, springs from the sphere of religion.¹⁸

Later physicists have not dismissed this approach as a mere personal quirk of Einstein's. Instead, they have developed it in many best-selling books with titles such as *God and the New Physics*¹⁹ *The Mind of God* *The God Particle* *The Physics of Immortality: Modern cosmology, God and the resurrection of the dead* and many more.

Is there perhaps some reason why religious talk of this kind is appropriate in physics, but is scandalous when applied to the chemical and biological concerns of Gaian thinking? Or does the scandal lie not so much in the subject-matter as in the sex of the deity? Is the idea of a female power in the cosmos somehow more unscientific than that of a male one? As Wertheim shows, a somewhat fantastic element of misogyny has indeed always been linked to the sense of sacredness that distinguished this study. The physical priesthood was an esoteric male

one guarding a male god. Emphasising this, Henry Oldenburg, the Royal Society's first secretary, declared that its express purpose was 'to raise a Masculine philosophy'.²³ This language closely echoes Francis Bacon's clarion-call for the new science to produce 'a Masculine birth of time', an epoch when men could turn their 'united forces against the nature of things, to storm and occupy her castle and strongholds'.²⁴

There is nothing new, then, in the association of religious language with science. Of course the personifications in this kind of talk should not be taken literally. Einstein made it clear that his God was very far from being a personal one. Yet the reverent, awe-struck attitude that lies behind such talk is surely suited both to science and to our general relation to the cosmos. Einstein was not being silly. Anyone who tries to contemplate these vast questions without any sense of reverence simply shows ignorance of what they entail. And if the system of life itself is taken to have participated in the history of evolution in the sort of way that Gaian thinking suggests, then a substantial part of this reverence is surely due to that system. If it has indeed played a crucial part in stabilising conditions on earth through billions of years, preserving the atmosphere and controlling the temperature in a way that has saved the earth from becoming a dead planet like Mars and Venus and turning it instead into the cherished blue-green sphere whose picture we all welcomed – then our only possible response to that feat is surely wonder, awe and gratitude.

This sense of wonder and gratitude is clearly what the Greeks had in mind when they named the earth Gaia, the divine mother of gods and men. They never developed that naming into a full humanisation. They never brought Gaia into the scandalous human stories that they told about other gods – stories which, in the end, made it impossible to take those gods seriously at all. But the name still expressed their awe and gratitude at being part of that great whole.

Today there is evidently more, not less, reason to feel that awe and gratitude, because we understand more about the scope of the achievement. The sense of life itself as active and effective in this vast development has been made far stronger, not weaker, by our grasp of evolutionary history. This is the sense that Darwin expressed when he wrote, at the end of the *Origin* 'There is grandeur in this view of life'.

Intrinsic value and the social contract

This sense of awe and reverence is not, then, at all alien to science. It is necessary to it, though of course it is central to religion as well. Every belief-system, whether scientific or otherwise, involves some order of values, some pyramid of priorities. And all such pyramids have a terminus. For all of us, there must be some things that matter in themselves, not merely as a means to something else, and these things are the objects of awe.

Secular thought in the West has not dropped this notion of intrinsic value. Instead, during the last century, it has simply ruled that the only thing that has such a value is human individuality. Today we use words such as *sacred* and *sanctity* readily enough to describe human life, but become suspicious if they are used for anything else. We have grown accustomed to think that the non-human world exists only as a means to our ends, so that there could be no inherent reason why the fate of the earth should concern us. Yet, faced by the growing environmental crisis, we become less and less confident about this immunity.²⁵

Our habitual individualism uses a minimalist moral approach which already has difficulty in explaining why each of us should be concerned about any individual other than our own self – why our value-system should ever go beyond simple egoism. It answers this question in terms of the social contract which is supposed to make it worth while for each of us to secure the interests of fellow-citizens. The answer to the question 'Why should I bother about this?' is then always 'Because of the contract which gives you your entrance-ticket to society'.

This contract model works fairly well for political life, for which it was originally invented. But it is notoriously inadequate for the rest of life.

We know that we cannot think of rights and duties as optional contracts set up between essentially separate individuals. Relations between parents and children are not like this – and each of us, after all, started life as a non-contracting baby. Nor indeed are most of our personal relations. But we have not yet grasped how much worse this misfit becomes when we have to deal with the rest of the natural world. Even over animals, the legalistic notion of contractual rights works badly. And when we come to such chronic non-litigants as the rain-forest and the Antarctic it fails us completely. Entities like these are not fellow-citizens. They never signed a contract. They know nothing of us. How, then, if duties are essentially contractual, can we possibly have duties to them? John Rawls raised this question rather suddenly as an afterthought at the very end of his famous book *A Theory of Justice* and could only say that it was one which lay outside his contractual theory.²⁶ He added that it ought to be investigated some day. But, as often in such cases, the real response has to be ‘you shouldn’t have started from here.’ Rawls’s book was the definitive statement of contract ethics and it marked the end of the era when they could pass as adequate.

Granting citizenship to wildernesses

Individualism is bankrupt of suggestions for dealing with these non-human entities. Yet we now have to deal with them, and promptly. They can no longer be ignored. Clearly, too, most of us do now think of the human drama as taking place within this larger theatre, not on a private stage of its own. The Darwinian perspective on evolution places us firmly in a wider kinship than Descartes or Hobbes ever dreamed of. We know that we belong on this earth. We are not machines or alien beings or disembodied spirits but primates – animals as naturally and incurably dependent on the earthly biosphere as each one of us is dependent on human society. We know we are members of it and that our technology already commits us to acting in it. By our pollution and our forest-clearances we are already doing so.

What element, then, does the concept of Gaia add to this dawning awareness? It is something beyond the fact of human sociability, which has already been stated, for instance by communitarians.²⁷ It is not just the mutual dependence of organisms around us, which is already to some extent being brought home to us by ecology. It goes beyond think-

ing of these organisms as originally separate units that have somehow been forced to co-operate – as basically independent entities which drive bargains for social contracts with each other (‘reciprocal altruism’) because they just happen to need each other to survive. The metaphysical idea that only individuals are real entities is still present in this picture and it is misleading. Wholes and parts are equally real..

All this means that, in spite of recent influences, direct concern about destruction of the natural world is still a natural, spontaneous feeling in us and one that we no longer have any good reason to suppress. Most people, hearing about the wanton destruction of forests and oceans find it shocking and – as has become clear in the last few decades – many of them are prepared to take a good deal of trouble to prevent it. This feeling of shock and outrage is the energy-source which makes change possible.

It has not yet been properly tapped. As happened over nuclear power, it takes a disaster to bring such needs home to people. Yet the feeling is already becoming stronger and more vocal. It leads people to subscribe to environmental organisations. Though we have been educated to detach ourselves from the physical matter of our planet as something alien to us, this detachment is still not a natural or necessary attitude to us. Since we now know that we have evolved from a whole continuum of other life-forms and are closely akin to them – a point which nobody ever explained to Descartes – it is not at all clear why we should separate ourselves from them in this way. On this point, of course, the findings of modern science agree much better with the attitude of those supposedly more primitive cultures where people see themselves as part of the whole spectrum of life around them than they do with the exclusive humanism of the Enlightenment. They also agree better with most of our everyday thought. The element in that thought which is now beginning to look arbitrary and unreal is its exclusive humanism.

Indignant concern on behalf of the environment does, then, already exist. Our difficulty is that we cannot see how to fit it into our traditional morality which – both in its Christian and its secular forms – has been carefully tailored to fit only the human scene.

How should we deal with this conceptual emergency? I do not think that it is very helpful to proceed as some moralists have done by promoting various selected outside entities such as ‘wildernesses’ to the

status of honorary members of human society. If we claim (for instance) that a wilderness such as the Antarctic has intrinsic value because it has independent moral status, meaning by this that we have decided to grant it the privilege of treating it like an extra fellow-citizen, we shall sound rather inadequate. These larger wholes are independent of us in a quite different sense from that in which extra humans – or even animals – who were candidates for citizenship might be so. Our relation to them is quite different from the one which links us to our fellow-citizens.

There is, indeed, something unreal about the whole way of thinking which speaks of these places as though they were distinct individual ‘wildernesses’, units which are applying separately for admission to our value-spectrum. Though we divide them for our thought, they function as parts of the whole. At present, indeed, the Arctic and the Antarctic are letting us know this because their ice, melted by global warming, is affecting the entire state of the oceans. That process is already producing widespread floods that threaten the destruction of places such as Bangladesh and Mauritius and widespread damage elsewhere. Nearer home, it also looks liable to upset the Gulf Stream in a way that may drastically chill the climate of Europe. Without that convenient warming system, we in Britain would find ourselves ten degrees colder, sharing the climate of Labrador, which is on much the same latitude. And if that change happens it could apparently happen quite quickly. Globalisation is no longer a distant option. It is here already.

The surprising inefficiency of selfishness

Could straightforward rational self-interest be enough to guide us? Strangely, it seems that it is not. When things go well, we simply don’t believe in disasters. Long-term prudence, reaching beyond the routine precautions of everyday life, is an extraordinarily feeble motive. Human beings drive their cars wildly, climb mountains without proper maps and constantly run out of money. On a grander level, the weakness of human foresight was pleasingly seen in the failure of the electronics industry to provide in advance against the Millennium Bug. For fifty years all these highly-qualified, intelligent and well-funded people apparently assumed that the twentieth century would never come to an end. Although they got away with it on this occasion, this example

is interesting because – as in the case of our own death – it was not doubtful that the emergency would arise. But prudence is supposed to operate on probabilities as well as on certainties. And the increasing probability of environmental disaster has been well-attested for at least the last thirty years.

During all that time, whenever the travellers in steerage reported that the ship was sinking the first-class passengers have continued to reply placidly, ‘Not at our end’. Only very gradually and shakily is this prospect beginning to be admitted as an influence on policy – a topic that should be allowed now and then to compete for the attention of decision-makers, alongside football and teenage sex and the Dow-Jones Index and European Monetary Union. Only gradually is it beginning to be seen that ecology is actually a more important science than economics – that the profitable exchange of goods within the ship is a less urgent matter than how to keep the whole ship above water. When the story of our age comes to be written, this perspective may seem surprising.

Our imaginations, however, are not ruled by our reason. We do not easily expect the unfamiliar, and major disasters are always unfamiliar. When we are trying to be prudent, our thoughts turn to well-known and immediate dangers, nervously avoiding a wider scene. That is why self-interest alone cannot be trusted to answer our question about why the earth should concern us. Of course prudence must come in, but unless other reasons are already recognised prudence usually manages to evade the larger topic. That is why we need to think about those other reasons – about the ways in which the terrestrial whole, of which we are a part, directly concerns us, and would still do so even if we could get away with abusing it. As I am suggesting, we shall never grasp the nature of that kind of concern so long as we try to model it on the civic concern that links fellow-citizens. *Duties to wholes, of which one is a part, naturally differ in form from duties to other individuals.*

Outward and inward looking concerns

For understandable political reasons, ever since the Enlightenment, our culture has made huge efforts to exclude outward-looking duties altogether from Western morality. Pronouncements such as ‘there is no such thing as society’ and ‘the state is only a logical construction out

of its members' are only recent shots in this long individualist campaign. But the natural strength of outward-looking concern can be seen from the way in which many such duties are still accepted. For instance, the idea of *duty to one's country* still persists and it certainly does not just mean duty to obey the government. Again, even in our society, where the idea of *duty to a family, clan, locality or race* has been deliberately played down, those ideas still have great force whenever a particular group feels threatened by outside oppression. The current revival of nationalism among various groups, especially in the United States, and the emphasis laid on *sisterhood* by feminists, all testify to this force. In other cultures, where no attempt has been made to undermine it, its strength is unmistakable.

Another corporate claim which can operate powerfully is the idea of a *duty to posterity*. This is not just the idea of a string of separate duties to particular future individuals. It is rather the sense of being part of a great historical stream of effort within which we live and to which we owe loyalty. That identification with the stream explains the sense in which we can – rather surprisingly – owe duties to the dead and also to a great range of anonymous future people, two things which have baffled individualistic thinkers. Even when there is no conscious talk of duty, people who work in any co-operative enterprise – school, firm, shop, orchestra, theatrical company, teenage gang, political party, football team – find it thoroughly natural to act as if they had a duty to that enclosing whole if it is in some way threatened.

And this, it seems to me, is what is now beginning to happen about the earth itself, as the threat to it begins to be grasped. When an enclosing whole which has been taken for granted is suddenly seen as really endangered, all at once its hidden claims become visible.

However, through most of the twentieth century, many prophets in the West have preached a kind of narrow and romantic individualism, a moral outlook which simply assumes that individual freedom is the only unquestionable value. This is a doctrine held in common by Jean-Paul Sartre and Ayn Rand. Despite the difference of style, the European and the American forms of it share a central message – social atomism. Both conceive the individual's freedom as negative – a matter of avoiding interference. Politically, however, there is rather an impor-

tant difference because the kind of entity that counts as 'an individual' is different in the two versions.

The European version still speaks of individual people and therefore stays close to real anarchism. The American one, however, expands to include commercial freedom. And commercial freedom, in its modern form, is a different thing and a very strange one. The entities which it conceives as free are no longer individuals but corporations, often very big and impersonal ones. The rhetoric of free trade, in fact, does not now refer to individual freedom at all. The old romantic vision of commercial freedom which Herbert Spencer presented in the 1880s – a vision of heroic individual tycoons carving out the course of evolution with their bare hands – does not fit today's conditions at all, whatever may be thought of its exactness in his own day.

There has, in fact, been a remarkable shift here in the central tenet of individualism. The metaphysical belief in human individuals as the true atoms of social life – the only properly real and sacred kind of unit – has given way. At the moment, the focus has shifted to another kind of entity, the big corporation. But since that kind of entity, in its turn, is now beginning to look rather less than ultimate – since the Internet is threatening its supremacy by building a more diffused way of doing business, while individual speculators infest it from within and shake its control – this does not seem likely to be the end of the story. These corporations may prove to be dinosaurs, entities remembered only as we remember mediaeval guilds. What surely emerges is that the whole idea of a single favoured, exclusively real unit was mistaken in the first place. *Life goes on on various scales, each of which is real and has to be thought of in its own terms.*

Sociality survives

This shift of emphasis to a kind of corporate freedom is, however, just one more indication of how individualist propaganda cannot destroy the corporate element in morals. Of course we still value our personal freedom very highly. Psychologically, our emphasis on it may perhaps be largely produced by overcrowding, by the sheer increase in human numbers and in social mobility during the last century. We all see far more people, especially far more strangers, in our daily lives than our ancestors did, which imposes stress and social exhaustion.

Yet humans – even modern, civilised humans – are still social animals to whom, on average, the desolation of loneliness is a much worse threat than the interference of their fellows. On the positive side, too, we have talents and capacities which absolutely require generous, outgoing co-operation for their fulfilment – a point which Hegel got right. Paradoxically, there are many things which a free, solitary individualist is not free to do. He cannot be a parent, a quartet-player, a tragic actor, a teacher, a social reformer or even a revolutionary. Even Nietzsche's Zarathustra noticed this difficulty:

A light hath dawned on me. I need companions.... living companions which follow me because they desire to follow themselves – and to go to that place whither I wish to go²⁸

In fact, apart from certain narrow political contexts, human beings are not in the least like the pure, consistent, prudent egoists that social contract thinking requires. And today people are coming to see this.

Of course it is true that we need to stop the powerful oppressing the weak, so we must have political institutions to prevent the exploitation of these corporate loyalties. That is why we need a free press to answer the propaganda of governments. And since the press itself comes under commercial pressure, that pressure, working through the labour market, through advertisements and through countless other channels, is, on the whole, much more alarming today than the power of religion. But the need to ward off these dangers cannot mean that we can do without corporate loyalties altogether. The outgoing, social side of human life vitally needs them.

Paradoxes of sociobiology

I suggested earlier that one thing which makes our social nature hard to see today is the intensely individualistic ideology which pervades recent sociobiological discussions of evolution – their suggestion that organisms evolve so exclusively by competition that co-operation at any level is not just wrong but impossible, since it is contrary to nature.

This story is officially based on Darwin's work, but is actually much more extreme than anything to be found there. Its real ancestor is Herbert Spencer. The remarkable thing about it is the unbalanced

rhetoric in which it is expressed, the colourful imagery used to inflate an interesting but modest range of facts about natural selection into an all-purpose individualistic melodrama.

This rhetoric is distinct from the official purpose of these discussions and often conflicts with it. Officially, they are an entirely admirable celebration of evolution and of our oneness with the rest of nature. Sociobiological thinking aims to counter the narrow, exclusive humanism of which I have been complaining by making humans appear on their proper scale in the vast evolutionary context. It aims to show the grandeur of that context in a way that removes any sense of degradation from our assimilation to the rest of nature and makes us feel at home in the natural world.

I entirely accept all this, so I shall say no more of it here. But the language used to express it, and the implications that follow that language, have a quite contrary effect. I think the details of this paradox are quite important. But they are somewhat aside from our main business here, so I have relegated them to an appendix.

Rhetoric, myths and religion

The central thing that is worrying about the sociobiologists is the extent to which unexamined moral and political ideas have become grafted into their scientific thinking. Sociobiology, however much it celebrates the unity of life, also tends to generate, through its uncontrolled rhetoric, a mindless social atomism. Gaian thinking, in which the relation between the two aspects is far better understood, can, I believe, do a good deal to correct that bias.

It is interesting, too, that the sociobiological celebration of evolution has, equally with Gaia, a religious angle, though one which the scientists involved appear not to find shocking. Indeed, Wilson for one welcomes this idea. He describes the evolutionary story, and the materialism which he thinks underlies it, as a rival mythology in direct competition with traditional religion, an improved substitute which can be relied on to supersede it:

Religion constitutes the greatest challenge to human sociobiology and its most exciting opportunity to progress as a truly original theoretical discipline. If the mind is to any extent guided by

Kantian imperatives, they are more likely to be found in religious feeling than in rational thought... Make no mistake about the power of scientific materialism. It presents the human mind with an alternative mythology that until now has always, point for point in zones of conflict, defeated traditional religion..... The time has come to ask; Does a way exist to *divert the power of religion* into the great new enterprises that lay bare the source of that power?²⁹ (Emphases mine)

This mythology is, he says,

'guided by the corrective devices of the scientific method, addressed with precise and *deliberately fictive appeal* to the deepest needs of human nature, and kept strong by the *blind hopes that the journey on which we are now embarked will be farther and better than the one just completed* (only emphases).

It is a faith carefully framed to suit the tastes of its potential congregation. This consideration is evidently strong, since it is hard to see what scientific grounds Wilson could possibly offer for expecting the future to be better than the past. That expectation did, of course, figure in Lamarck's and Herbert Spencer's view of evolution. But scientists are supposed now to have abandoned it. Progress of that kind forms no part of Darwin's doctrine and current science says nothing to support it.

Wilson is, of course, recognising the important truth that every thought-system has at its core a guiding myth – not in the sense of a lie but of an imaginative vision. And, unlike some scientists, he sees that this is as true of scientific world-views as it is of any others. True beliefs need their imagery quite as much as false ones do, and a steady stream of imagery has in fact played a crucial part in the rise of modern science. In the early days that imagery centred on comparing the physical world with the clockwork *machines* of the early industrial revolution, an analogy which, after proving immensely useful, is now running into trouble in places such as particle physics. Darwin, for his part, notoriously relied greatly on the metaphor of *selection* another comparison which has been very useful but has proved to have drawbacks.

There is nothing wrong with such images, but, as these examples show, no one of them can ever serve for all purposes. No picture should be allowed to become an imaginative monoculture. They all need to be corrected sometimes by other ways of thinking. The mythology that is offered today as a celebration of evolution by people like Wilson and Dawkins is one-sided because it is profoundly and arbitrarily individualistic. Its imagery of *selfishness, spite, manipulation, invent, leeches, war games* and the rest unmistakably reflects the naive social atomism of the 1970s and 1980s.

No doubt this dramatic language has been useful in bringing out certain aspects of evolution and can still be used to investigate them further. But it really is important that people who use it should grasp its mythical character – should see that it is just one optional vision among others, a slanted, incomplete picture belonging to a particular epoch, a story which always needs others to correct it, not a final universal truth. The mythical quality which is often held to be an objection against the concept of Gaia is certainly no less present in the *Selfish Gene*.

In the real world, as many biologists have pointed out, co-operation and competition go together as two sides of the same coin and, of the two, when things get at all complicated, co-operation must usually come first because it makes other interactions possible. If we consider how much co-operation is needed to organise even a competitive institution such as the stock-exchange – or, indeed, even to organise a single school sports-day – this should surely be obvious. As Brian Goodwin puts it:

There is as much co-operation in biology as there is competition. Mutualism and symbiosis – organisms living together in states of mutual dependency – such as lichens that combine a fungus with an alga in happy harmony, or the bacteria in our guts, from which we benefit as well as they – are an equally universal feature of the biological realm. Why not argue that 'co-operation' is the great source of innovation in evolution, as in the enormous step, aeons ago, of producing a eukaryotic cell, one with a true nucleus, which came about by the co-operation of two or three prokaryotes, cells without nuclei?

He points out that these co-operations are particularly striking at the microbial level, which is why recent increases in understanding of that level have directed people's attention to them. But at every level they are an essential feature of life. Darwinism, he says, describes

the evolutionary process as one driven by competition, survival and selfishness. This makes sense to us in terms of our experience of our own culture and its values.... Darwinian metaphors are grounded in the myth of human sin and redemption....But Darwinism short-changes us as regards our biological natures, We are every bit as co-operative as we are competitive, as altruistic as we are selfish, as creative and playful as we are destructive and repetitive. And we are biologically grounded in relationships which operate at all the different levels of our beings....These are not romantic yearnings and utopian ideals. They arise from a rethinking of our biological natures that is emerging from the sciences of complexity.³¹

Sorting out the levels

When the idea of Gaia was first introduced, one of the things that shocked scientists about it was the way in which it clashed with this individualistic picture, which they were used to regarding as particularly scientific. It seemed to them that they were being asked to accept an idea of organisms working cosily together to improve their environment, an idea which was incompatible with their evolving by cut-throat competition. Over-dramatising both stories, critics asked whether Gaian thinking supposed these rival entities to form committees and plan climate-change together?

This conflict, however, does not really arise because the two processes take place at different levels. At the local level, organisms do indeed compete with one another and with neighbouring species. But one of the ways in which they compete is in finding ways of improving their environment, features which alter it – say, by making it warmer or wetter – in a way that helps them to survive. As Lovelock says;

If, in the real world, the activity of an organism changes its material environment to a more favourable state, and as a consequence it leaves more progeny, then both the species and the change will increase until a new stable state is reached. On a local scale adaptation is a means by which organisms can come to terms with unfavourable environments, but on a planetary scale the coupling between life and its environment is so tight that the tautologous notion of 'adaptation' is squeezed from existence. The evolution of the rocks and the air and the evolution of the biota are not to be separated.³²

Our interpretation of Darwin's great vision is altered.... It is no longer sufficient to say that 'organisms better adapted than others are more likely to leave offspring.' It is necessary to add that the growth of an organism affects its physical and chemical environment; the evolution of the species and the evolution of the rocks, therefore, are tightly coupled as a single, indivisible process.³³

Such improvements can help others as well without damaging those who make them, because they expand the living-opportunities available to all. That is how life was able to spread over the planet in the first place. It makes no difference to this result which of the competing species got ahead of another in a particular development because this is not a zero-sum game. An obvious example is the tropical rain-forest which continually absorbs and recirculates rain. As Tim Lenton says:

A trait that brings the resulting organism closer to the optimum growth conditions will spread. Such a trait is, by definition, 'Gaian'. In contrast, a mutation in an 'anti-Gaian' direction will have its spread restricted by putting the organism responsible at an evolutionary disadvantage.... There are many examples of living plants altering climate to their own benefit. Ecosystem-level environmental feedbacks must be understandable in terms of natural selection.... Ecosystems that have stabilising feedback will tend to persist and spread, whereas ecosystems that develop destabilising feedbacks will tend to collapse and disappear.³⁴

Living?

Another feature which alarmed some scientists was the use of the word 'life'. If we accept this way of thinking, can we really say that the planet itself is in some sense alive?

Obviously this is a verbal question, but it raises very interesting considerations about the way in which this concept works for entities operating on different scales. One objection made to calling the earth alive was that nothing can be alive unless it reproduces, and of course

planets do not go out and mate with other planets. The biosphere has not developed, as a species does, by the mutation and selection of planetary genes.³⁵ But it is not obvious that reproduction of this kind has to be a necessary condition for an entity's being considered alive. Spermatozoa, for instance, are commonly thought of as alive, since they visibly swim around. They are unquestionably part of the process of life. But they do not mate with other spermatozoa to produce young and allow of natural selection between their progeny. Scientists can distinguish between living and dead spermatozoa without having to suppose them capable of reproducing *on their own scale*. Similarly, the distinction between Mars and Venus as dead planets and the earth as a living one can, as we have seen, be made by clear and relevant marks without any reference to planetary reproduction.

Perhaps we should think of life, like 'order', as something that can be present in different ways in units of different sizes. Asking about this, Lewis Thomas comments;

Item. I have been trying to think of the earth as a kind of organism, but it is no go. I cannot think of it in this way. It is too big, too complex, with too many working parts lacking visible connections. The other night, driving through a hilly, wooded part of Southern New England, I wondered about this. If not like an organism, what is it like, what is it *most* like? Then, satisfactorily for that moment, it came to me; it is *most* like a single cell.³⁶

He proceeds to develop this analogy. All this raises the question of what elements the notion of *life* actually involves, something that is really not simple. It is a complex concept which remains in many ways mysterious to us. Lovelock comments -

Take the concept of life. Everyone knows what it is but few if any can define it. It is not even listed in the [standard] Dictionary of Biology. *If my scientific colleagues are unable to agree on a definition of life, their objections to Gaia can hardly be rigorously scientific.*

If we ask a group of scientists 'What is life?' they will answer from the restricted viewpoint of their own scientific disciplines. A physicist will say that life is a peculiar state of matter that

reduces its internal entropy in a flux of free energy, and is characterised by an intricate capacity for self-organisation. ... A neo-Darwinist biologist will define a living organism as one able to reproduce and to correct the errors of reproduction by natural selection among its progeny. To a biochemist, a living organism is one that takes in free energy as sunlight, or chemical potential energy, such as food and oxygen, and uses the energy to grow according to the instructions coded in its genes.

To a geophysicologist, a living organism is a bounded system open to a flux of matter and energy, which is able to keep its internal medium constant in composition and its physical state intact in a changing environment; it is able to keep in homoeostasis....*Gaia would be a living organism under the physicist's or the biochemist's definition* (emphases mine)

The crucial point is that life is not an accident or an alien invader but an aspect of the earth itself. The sharp divisions we make across this continuum reflect academic specialisations rather than unbreakable natural barriers.

There is no clear distinction anywhere on the earth's surface between living and non-living matter. There is merely a hierarchy of intensity going from the 'material' environment of the rocks and the atmosphere to the living cells. But at great depths below the surface, the effects of life's presence fade. It may be that the core of our planet is unchanged by the presence of life, but it would be unwise to assume it.³⁸

He points out that the things which we think of as most clearly alive often have parts which are not alive, just as the earth does. Our own teeth, hair, nails and bones are largely dead, but they are all parts of us, some of them necessary parts. Then there are trees. The bulk of a tree – the heart-wood – is not alive and neither is the outside bark. There is just a thin layer of living tissue under the bark and in the leaves. But these are all parts of the living tree. Again, coral polyps are the only live part of a coral reef, but they have built the reef and they form a whole with it. A termites' nest, similarly, has been formed by its inhabitants

and is constantly being changed by their activity. Polyps and termites cannot possibly be understood in abstraction from their co-evolved homes. Neither can we.

Conclusion

What can we do about it?

Most of this discussion has dealt with the imaginative role of Gaian thinking, not with its implications for policy. But of course those issues are linked. A clearer, more realistic imaginative vision of the world is bound to make for a clearer sense of priorities. The lurid competitive myths which have recently coloured our views both on human social life and on evolution can obscure our real dangers completely. As I began to write this piece, the main item in the news was a typical one; not (of course) how to use less fossil fuel so as to save the rain-forests, but how to force the French to eat British beef which they believe to be tainted with mad cow disease. As I finish it, the World Conference on Climate Change at the Hague is being driven off the front pages by quarrels in Florida about the disputed American presidential election and civil war in Israel. Recent floods, in Britain and elsewhere, have lately begun to make environmental dangers seem more real. But responses to this quickly subside into attempts to find somebody to blame and worries about patching up the immediate damage. The UK government is trumpeting its leadership on the reduction of carbon emissions in the face of other countries' failure, though such reductions are only a modest small step towards the kind of shift which is actually needed.

Of course human beings naturally think like this much of the time. Local squabbles fascinate us. But we don't have to be wholly imprisoned by them. Common dangers can shake us out of this narrowness. About the earth they are, it seems, beginning to do so. And when they do, it is very important that we should have other, non-competitive ideas available to give us a different perspective.

For about a century and a half, competitive ideologies have reigned more or less unopposed in our culture and the notion of the physical world as an infinitely exploitable oyster has been widely accepted. Social atomism and Social Darwinism have been the romantic myths of the early capitalist age, the background assumptions that now need correcting. What Gaian thinking can do is to help us to see what is before our eyes rather than look at these videos. It brings us up with a quite new force against facts that we have been told about already but have never really taken in.

Does it also revise our view of what those facts are? In detail it probably will do this. Scientists are now using Gaian ideas (not always under that name) to investigate how the earth's maintenance systems work, and no doubt they will reveal new factors. But the main picture is before us already. It centres on global warming. The earth is suffering from a dangerous fever while the most powerful people on it keep piling on more and more blankets of greenhouse gas – the very stuff that life has had so much trouble keeping under control for so many centuries – thus making the fever worse. And there are so many of us humans now – so many more than the ailing earth can easily carry – that we can no longer rely on slight palliative measures. It is foolish to keep on 'buying time' and not using it.

What, in this situation, needs to be done first? This is a question about priorities. And the key to it is perhaps clearest in the image that I used earlier of an ocean liner which is beginning to sink – only (as we explain) not at our end.... Of course it is understandable that we do not see the planetary danger. Other, more immediate evils constantly demand our attention. Conditions on the terrestrial ship are bad in a thousand ways and endless things need to be done about them. But if the ship sinks, curing those evils will not be much help. The message is not that we should value the health of the earth above human needs. It is that these are not alternatives. Without a healthy earth, humans cannot survive anyway. As Lovelock puts it;

Our environmental concerns are nearly all human and personal. We worry far more about some remote danger of harm from pesticide or unusual genes in food than we do about the grim inevitability of global warming and all the harm that it will

bring. We drive heedlessly to the supermarket in our polluting cars where we buy organic, pesticide-free food for ourselves and our family. Our priorities are all wrong. Our demons of nuclear radiation and carcinogens from chemical industry are there but tiny and feeble compared with the monsters that endanger the earth and that we made.

We should fear the effects of removing natural habitats with their ability to serve as global and local regulators. We should stop all further habitat replacement by farmland. We might even need to encourage intensive agriculture if doing so saves land that can be set free to return to its natural state.

We should fear the consequences of changing the composition of the atmosphere. We need to replace as soon as possible fossil fuel energy production with solar, nuclear or any other large-scale non-polluting power sources.³⁹

These things come first. After them, he says, comes the need to conserve fresh water and to prevent the excessive accumulation of CFCs and similar substances that deplete stratospheric ozone and add to the thickness of the gaseous greenhouse

All other environmental projects come after these. Of course that does not mean that they do not matter. They do matter, just as it would still matter to look after sick people on a sinking ship. But doing so is no substitute for plugging the leak. Of course Lovelock's relative tolerance of nuclear power does not mean that he ignores its dangers. It simply marks his sense of the far greater dangers – to humans as well as to everything else – that go with gross changes in the earth's climate and the overriding need to meet those dangers right away.

Is it actually possible for us to shift our priorities in this way? Does the new millennium, with its promise of change, perhaps make so drastic an alteration possible? Can it shake our deep and habitual short-termism? These curious lines across the calendar do help our thought, in spite of the nonsense that attends them. They serve to remind us that change can happen, that our recent ways of living are not fixed in stone as eternal verities. Perhaps it is rather surprising that we need this reminder in an age where huge changes are already happening, an age where (to take trivial examples) businessmen in

London now consult a Feng Shui expert about the site of their offices and are afraid to smoke in meetings, two things which they would have found unthinkable twenty years ago. It is not just an unreal piece of moralising to suggest that we should cut down the use of cars. In spite of the car-lobbies, the approaching prospect of gridlock is not actually popular and many European cities, such as Frankfurt, now live happily with streets that have been largely cleared of the nuisance.

Cars are indeed a most interesting and potent symbol of our changing concepts of freedom. In fantasy, cars are seen as a way of liberating their (solitary) driver from all outside interference, as they do in television advertisements where a lone car roams a romantic landscape, achieving a bizarre kind of omnipotence. In the real world, this dream-solipsism is still disappointed. It is unfortunately impossible to eliminate the other drivers. Everybody, therefore, tries to achieve their own private omnipotence, resulting in a lot of stress, smash-ups and road-rage.

Our recent method of handling the planet has been rather similar and it is turning out no more successful. Perhaps it really is time for us to change it.

Appendix

Sociobiology: the politics of fiction

It is because the rhetoric of sociobiology bears on our central topic of individualism I think we need to follow it out further. The spiritual ambitions of sociobiological thinking are high. As Edward O. Wilson puts it:

I consider the scientific ethos superior to religion.... The core of scientific materialism is the evolutionary epic.... the evolutionary epic is probably the best myth we will ever have. It can be adjusted until it is as close to truth as the human mind is constructed to judge the truth. And if that is the case, the mythopoeic requirements of the mind must somehow be met by scientific materialism so as to reinvest our superb energies.... Every epic needs a hero, the mind will do.... Scientific materialism is the only mythology that can manufacture great goals from the sustained pursuit of pure knowledge.⁴⁰

This is a lofty project. Yet somehow most sociobiological accounts of the workings of Nature sound rather like descriptions of a bad day on the New York Stock Exchange. Thus M.T. Ghiselin, echoing Dawkins and Wilson's doctrines in language which is only slightly noisier than theirs, writes as follows

The evolution of society fits the Darwinian paradigm in its most individualistic form. The economy of nature is competitive from beginning to end.... the underlying reasons for social phenomena

are manifest. They are the means by which one organism gains some advantage to the detriment of another.

No hint of genuine charity ameliorates our vision of society, once sentimentalism has been laid aside. What passes for co-operation turns out to be a mixture of opportunism and exploitation. The impulses that lead one animal to sacrifice himself for another turn out to have their ultimate rationale in gaining advantage over a third; and acts 'for the good' of one society turn out to have been performed for the detriment of the rest. Where it is in his own interest, every organism may reasonably be expected to aid his fellows. Where he has no alternative, he submits to the yoke of communal servitude. Yet, given a full chance to act in his own interest, nothing but expediency will restrain him from brutalising, from maiming, from murdering – his brother, his mate, his parent or his child.. Scratch an 'altruist;' and watch a hypocrite bleed.⁴¹

Sociobiologists reach this strange conclusion by three steps. First, they treat the innumerable altruistic and co-operative activities which are well-known to occur among plants and animals as if they were just devious stratagems to produce more descendants. Second, they imply that producing these descendants is itself somehow an advantage to the parent, an advantage described as an increase in its 'inclusive fitness', which simply means 'having more descendants'. Third and strangest of all, they dramatise that ancestor's situation by the use of lurid motive-words such as 'selfishness', 'spite' and 'charity' which give the impression that it is deliberately planning its dynastic future. They then further confuse things by things by sometimes – but not always – attributing these motives to the genes rather than to the organisms themselves. .

These writers do, of course, occasionally explain that their words must not be taken literally. But the disclaimers are brief and are so completely cut off from their surroundings that they do not have much more force than the tiny warnings on cigarette packets. Like those warnings, they are cancelled by their context. As in the Mafia, the sin is confessed but there is no intention of amendment. These writings continue to mix metaphor and literal science so thoroughly that it is

clear the authors themselves do not know how to distinguish them and it is not to be expected that their readers should do so.

Spencerism and Thatcherism

It seems worth while to ask why anybody ever picked so odd a word as *selfish* as a technical term when something like *selectable* would have been so much more appropriate? And why did the public respond so eagerly, making these books instant bestsellers?

It seems clear that the reason for all this had nothing to do with science. It lay in a fresh outcropping of the strong egoistic, individualistic strain in our political and moral thinking which dates from Hobbes. That strain became associated with evolution in Darwin's day through Herbert Spencer and the Social Darwinists in a romantic glorification of capitalist enterprise entirely typical of that time.

Already at that time, the imagery began to give trouble. Theorists, including Darwin, who discussed conflicts of interest in the rest of nature constantly used images drawn from two particular human institutions – war and commerce – and in that non-human context it was not too hard to remember that these were only metaphors. But when the discussion turned back to human affairs, it became much harder to be clear that these were not literal descriptions of human life, new truths about its characteristic motives and intentions, truths which showed that it could all be reduced to these two simple models. The drama shaped by those models was then projected back, in its turn, onto the cosmos, producing a picture of the universe in which commercial rivalry provided the key guiding principle for everything 'from gas to genius'.

Spencer and his followers thus saw competition as the all-explaining pattern both for human life and (somewhat casually, for they were not scientists) for the rest of nature, though Darwin himself, always anxiously aware of the limits of our knowledge, carefully avoided these extensions.⁴² Since that time, the confusions of crude 'Social Darwinism' have, of course, been repeatedly answered and by the mid-twentieth-century it had fallen into disfavour. But, as often happens, the imagery and the temper behind it remained, waiting for another theoretical vehicle. In the United States, in consequence of Spencer's influence and the actual development of capitalism, a kind of faith in Social

Darwinism is still often taken for granted. (Wilson, for one, evidently accepts it as his background). In Britain this is less true, but romantic individualism itself still has a more general fascination which makes it surface from time to time in most of us as a handy simplification. As Michael Frayn says,

In some moods, at any rate, it seems to us that Robinson Crusoe is the human archetype.... We feel that human society, with all its compromises and relativities, is a construction from the series of atomic individuals, each of them sovereign and entire unto himself. We feel that we are Crusoes who have been set down in sight of one another, so that the difficulties of communication and co-operation have been *adde dto* those of our isolation. As if we are what we are and then we enter into relations with the people around us.⁴³

But man is the child of man. He comes from the belly of another human creature, seeded there by a third. He can become conscious of his thoughts and feelings only by articulating them in a language developed by communication with his fellows. Even in his inmost nature he is defined by interaction with other beings around him.

Dawkins's and Wilson's books⁴⁴ both came out in the mid-1970s, a time when, on both sides of the Atlantic, the moral tide was on the turn from the relatively idealistic, co-operative temper generated after the Second World War towards a more relaxed mood of self-expression and self-indulgence. In Britain, the real advantages which the Welfare State had produced were becoming familiar. They were beginning to be taken for granted while the drawbacks which had gone along with them began to be sharply felt. Bureaucratic control and the 'culture of dependence' were seen as grave evils. The immediate remedy prescribed for them was a return to commercial freedom and to extreme individualism generally, which was seen for a time, with a good deal of unrealistic nostalgia, as a social panacea.

Appearing at this point, these two exciting sociobiological bibles were seen as simple celebrations of selfishness and suited that temper

perfectly. Their doctrines have therefore, not unnaturally, been described as biological Thatcherism. It is right to stress that the authors themselves reject this charge. When taxed with moral or political implications they usually recoil in astonishment saying that they are only doing science. And it is quite true that they do not make the kind of specific political recommendations that the Social Darwinists made. But one does not have to give detailed advice to have a moral and political influence. No doubt their vagueness about moral contexts is genuine. But this only shows, I think, how poorly current scientific education prepares scientists to understand the crucial place of science in the rest of life.

This sociobiological story is really significant because it illustrates how the patterns of thought used in science and especially its dominant images – are drawn from everyday life and are often returned to that life in significantly altered forms. And today, when we respect science so deeply, we find it increasingly natural to turn to those thought-patterns for guidance on central matters in our lives. Indeed, Dawkins himself introduces his book by offering just this kind of guidance;

We no longer have to resort to superstition when faced with the deep problems; Is there a meaning to life? What are we for? What is man?...[then, quoting GG Simpson] ‘all attempts to answer that [last] question before 1859 are worthless and... we will be better off if we ignore them completely’.⁴⁵

He clearly recognises here, in fact, that an idea can indeed have both scientific and moral importance, which is what I am saying is true in the case of Gaia. But if this is so, then it seems that scientists are responsible for thinking through the social consequences of what they are suggesting. On these vast subjects, it is not possible only to be doing science. Science done at that level cannot help involving morals and politics as well.

Notes

1. Plato, *Timaeus* section 33.
2. Popper K, 1972, ‘Of Clouds And Clocks’ in *Objective Knowledge: An evolutionary approach*, Oxford University Press, p222
3. Lovelock J, 1988, *The Ages of Gaia* Oxford University Press. p5.
4. Lovelock J, 1991, *Gaia, The Practical Science of Planetary Medicine* Gaia Books Ltd, London, pp21-22.
5. *Ibid*, p111.
6. Margulis L and Sagan D, 1995, *What is Life?* Weidenfeld & Nicolson, London, p26.
7. For a review of recent discussions see Lenton TM, ‘Gaia and Natural Selection’, *Nature*, vol 394, 30 July 1998.
8. Thomas L, 1976, *The Lives of a Cell* Futura, London, p170.
9. See for instance Devlin K, 1997, in *Goodbye Descartes: The end of logic and the search for a new cosmology of the mind* John Wiley & Sons, New York, and the entire works of Richard Rorty.
10. For examples, see Passmore J, 1974, *Man’s Responsibility For Nature* Duckworth, London, ch1.
11. There is now a thriving *Journal Of Consciousness Studies* something that would have been inconceivable twenty years ago.
12. On the radical interdependence between their religious and scientific thinking see Wertheim M, 1997, *Pythagoras’ Users, God, Physics and the Gender War* Fourth Estate, London, chs5 and 6
13. This is the topic of his book *Gaia, The Practical Science of Planetary Medicine*
14. Pearce F, 1994, ‘Gaia, Gaia, don’t go away’, *New Scientist* 28 May.
15. Lovelock, 1991, *op cit*, pp6, 11, 31.
16. Lovelock, 1998, *op cit*, pp206 and 212.
17. Wertheim, 1997, *op cit*, p12.
18. Einstein A, 1940, ‘Science and Religion’, *Nature*, vol 146, no 65, p605.
19. Davies P, 1984, *God and the New Physics* Simon and Schuster, New York.
20. Davies P, 1992, *The Mind of God* Simon and Schuster, New York.
21. Lederman L and Teresi D, *The God Particle*, Houghton Mifflin, Boston.
22. Tipler FJ, *The Physics of Immortality: Modern cosmology, God and the resurrection of the dead* Doubleday, New York.
23. Wertheim, 1997, *op cit*, p100. For more about this amazing but highly influential sexual chauvinism see Easlea B, 1981, *Science and Sexual Oppression* Weidenfeld & Nicolson, London.
24. Farrington, *Philosophy of Francis Bacon* pp62, 92, 93; Spedding, *Works of Francis Bacon* vol 4, pp 42, 373.
25. John Passmore laid out this problem admirably in *Man’s Responsibility for Nature* (London, Duckworth, 1974) and it has continued to occupy environmental philosophers ever since.
26. Rawls J, 1971, *A Theory of Justice* (Harvard University Press, p512, cf p17. I have discussed this remarkable move in *Animals and Why They Matter* (University of Georgia Press, 1984, pp49-50).
27. Etzioni A, 1995, *The Spirit of Community* Fontana Press, London.
28. *Thus Spake Zarathustra* Introductory Discourse section 9.
29. Wilson, EO, 1978, *On Human Nature* Harvard University Press, pp175 and 192-3.

30. Ibid, p209, my emphases.
31. Goodwin B, 1994, *How the Leopard Changed its Spots*, Orion Books, London, pp xii-xiv and 166-168.
32. Lovelock, 1988, op cit, pp33-34.
33. Lovelock, 1988, op cit, p63.
34. Lenton, 1998, op cit, pp444-445.
35. See Dawkins R, 1982, *The Extended Phenotype*, WH Freeman and Co, Oxford and San Francisco, pp234-237.
36. Thomas, 1976, op cit, p4.
37. Lovelock, 1991, op cit, p29.
38. Lovelock, 1988, op cit, p40.
39. Lovelock, personal communication, December 1999.
40. Wilson, 1978, op cit, pp201, 203, 207.
41. Ghiselin MT, 1974, *The Economy of Nature and the Evolution of Sex*, University of California Press, Berkeley, pp155-156.
42. See Hofstadter R, 1959, *Social Darwinism in American Thought*, Braziller, New York, p47.
43. Frayn M, 1964, *Constructions*, Wildwood House London, section 67.
44. Wilson EO, 1975, *Sociobiology: the new synthesis*, Harvard University Press. I have not multiplied quotations from Wilson and Dawkins here because I do not want to waste space on books that are so well known. But I have discussed them fully elsewhere, notably in *Evolution As A Religion* (London, Methuen, 1985, chs 14 and 15) and in *Beast and Man* (London, Routledge, 1995), where the early chapters, especially chapter 4, deal largely (and sympathetically) with Wilson.
45. Dawkins R, 1976, *The Selfish Gene*, Oxford University Press, p1.