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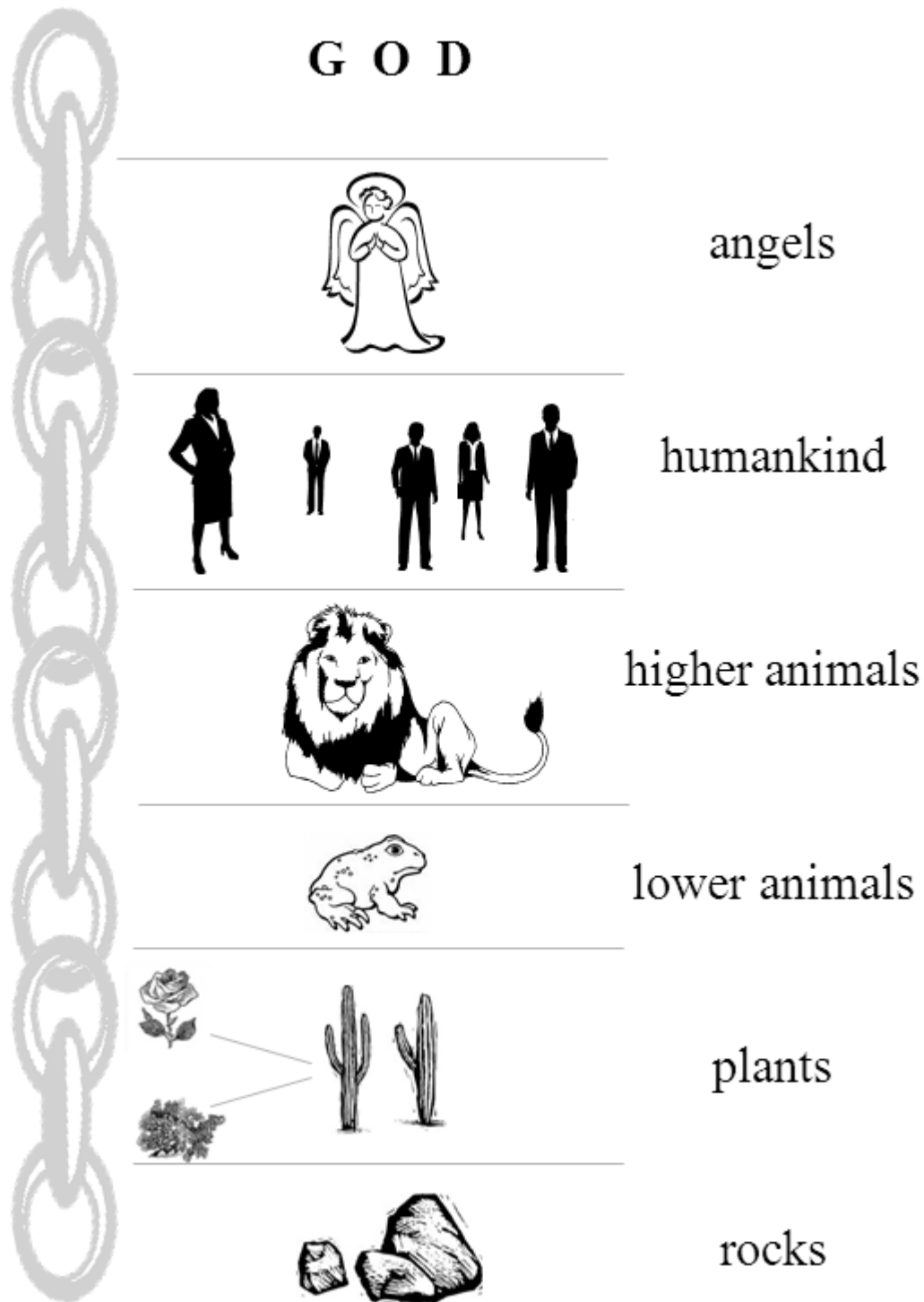
"Gaia and the Great Chain of Being" by Gabriel Egan

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Towards the end of the second World War the literary scholar E. M. W. Tillyard published *The Elizabethan World Picture* as an attempt to describe the mindset of the early-modern period, and especially how people thought about the way the universe was constructed and what this meant for the construction of human society and experiences. According to Tillyard, this mindset was predicated on stability: people had a complex but fixed model of the universe and their precise, God-given, place in it, rather than a sense that human affairs are ultimately a matter for humans to decide. The structure of the universe could be conceived in a number of ways: "a chain, a series of corresponding planes, and a dance" (Tillyard 1943, 23). This essay will focus on the first two of those, and consider some of the ways in which these seemingly archaic concepts about the universe might be useful to us again in the light of the latest ecological thinking.

In the Great Chain of Being model described by Tillyard, each kind of object in the universe is allocated a place in a hierarchy, from the lowest kinds of object (rocks and other inanimate matter), through the lower and higher forms of terrestrial life, up to the higher beings and finally to God.



[FIGURE ONE]

Rather than seeing the living and non-living entities of the universe as arranged in strictly divided classes with little in common, the Great Chain model draws on Aristotle's idea that ". . . after lifeless things in the upward scale comes the plant, and of plants one will differ from another as to its amount of apparent vitality . . . there is observed in plants a continuous scale of ascent towards the animal" (Aristotle 1910, 588b). This idea of a continuous scale of differences between entities, as opposed to discrete classes of entities, arises from Plato's account of the creation of the world in

Timeaus (Plato 1883, 313-409). As Tillyard's source Arthur O. Lovejoy pointed out, Plato explained how the objects of the world were created as instances of the perfect types in the realm of Forms, and since there were an infinite number of those Forms the objects of the world (including its creatures) must be infinite in variety (Lovejoy 1936, 46-59). There could be no gaps in nature and hence the continuous chain of infinitesimal differences. This is not to say that there are no classes of objects too, but these classes are essentially arbitrary because the objects within them vary so widely. As Macbeth puts it, "hounds and greyhounds, mongrels, spaniels, curs, | Shoughs, water-rugs, and demi-wolves are clept | All by the name of dogs" (*Macbeth* III, i, 94-6¹).

A core Christian principle seems incompatible with Aristotle and Plato's idea of a superabundant world teeming with minutely variant species arranged in a hierarchy. Humankind is supposed to be the whole point of the universe, not one rung on a ladder of creation. Lovejoy examined how medieval theologians dealt with this (Lovejoy 1936, 67-98), and in Tillyard's view the early-modern reconciliation of Christianity with inherited classical and pagan ideas was something of a fudge. This fudge clear in connection with belief about the influence of the planets on human affairs: "It was one of the Church's main tasks to reduce the licence of the late pagan astrological superstition to her own discipline. There was no question of cutting it out altogether" (Tillyard 1943, 49).

The Chain of Being puts all the objects of the universe into a ranking order, and there is a ranking order within categories too: the animals are divided into higher and lower animals. Within the plant kingdom there are more and less sophisticated plants (in Figure One, the rose and some moss), so the larger order (the macrocosm, or big picture) is repeated in the smaller order (the microcosm). The principle of order, of ranking, was supposed to apply in human societies too: some humans were nearer the top and others nearer the bottom, and this occurred not because of what each had done for herself but rather because God had assigned her place in the hierarchy. For early moderns the most familiar human ranking was by gender (men being the heads of households) and class (the aristocracy being the natural rulers). To want to change one's place would be as absurd as moss wanting to be a rose, or a frog wanting to be a lion. In particular, the monarch was supposed to be God's deputy on earth, the binding link between heavenly and earthly order, and duty to one's monarch was a religious obligation. This idea particularly annoyed Cultural Materialist and New Historicist scholars in the 1980s, and Tillyard became something of a *bête noire* in their writing, on the assumption that he had projected his own love of order and hierarchy onto the early moderns (Drakakis 1985, 14-15; Dollimore & Sinfield 1985, 206-7, 210).

Tillyard had anticipated this objection--made at length by Cultural Materialist studies of Shakespeare's history plays especially--acknowledging that ". . . at first sight that drama is anything but orderly". The reason for this contradiction, he explained, was that ". . . the conception of order is so taken for granted, so much part of the collective mind of the people, that it is hardly mentioned except in explicitly didactic passages" (Tillyard 1943, 7). This highlights one of the recurrent problems when handling historical evidence. Should we take exhortations to think and behave a certain a way as a sign that everyone did think and behave that way, or as a sign that they did not and needed constant cajoling? In the present case the problem is

reversed but the logic is the same: should we take the absence of references to order as a sign that they did or did not assume that it was divinely ordained? We cannot settle such points without further evidence. After all, we would not want future historians to interpret the exhortations of modern Western governments to their citizens that they should eat five pieces of fruit a day as a sign that the citizens are doing so, nor that they are ignoring the advice.

The metaphor of a chain used to represent ranking order is especially appropriate because it implies tension in the model. Each element of the universe is linked to the one above and below by this chain, and within each category there is thus a pull in two directions. The link to a higher group exerts an upward pull on an entity and the link to a lower group exerts a downward pull. Take the lion. The very best part of such a high animal is almost as good as the worst aspect of humanity, while the worst part of it is like a lower animal. This allows for a metaphor of primacy: as the lion is the 'king' of beasts, noble in being so much better than them, so a king who excels amongst kings may be called lion-hearted, like Richard 1 (1157-1199), known as Coeur-de-lion. A lesser monarch, like the Duke of Austria, may enter "wearing a lion's hide" (*King John* II, i, 0) to give himself something of that quality, only to be mocked by another, Constance: "Doff it, for shame, | And hang a calf's-skin on those recreant limbs" (*King John* III, i, 55). In this case, the bastard son of Richard the Lionheart picks up the mocking cry and makes it a refrain (III, i, 57, 59, 125), indicating that if Austria is like any animal it is the ignoble sheep, not the lion. This kind of implicit metaphorization is easily missed if one is not sensitized to it by Tillyard's account of the Great Chain of Being. In an early work of what would now be called eco-criticism, Jeanne Addison-Roberts argued that Shakespeare's plays first dealt with this animal-human metaphorization in a comic mode (employing the "secure hierarchy of the Great Chain of Being") but he began to see the connection as more literal than metaphoric. By the end of his career, Shakespeare was making genuinely hybrid characters such as the part-fish-part-man-puppy-headed monster Caliban, in a recognition that ". . . the chain may be horizontal rather than vertical . . . narrowing [the] gap between man and animal" (Roberts 1980, 82).

The precise ordering of the various ranks of animals might vary from one account of the Great Chain of Being to another (Tillyard 1943, 26-27). In Henry Eden's translation of Giovanni Battista Gelli's version of the myth of Circe's transformation of men into beasts, Ulysses works his way up the scale of creatures until his final dialogue with the greatest of them all, an elephant (Gelli [1558-9], Q6v-T4r), while Henry Peacham's *The Compleat Gentleman* is typical in giving the lion primacy among the beasts (Peacham 1622, B3r). More important than the particular animal chosen is the principle of declension across categories: whichever is the noblest of beasts, the worst part of a lower animal is little better than plant life, and the worst part of plant life (say, moss growing on a rock) is almost as bad as an inanimate object (the rock upon which it grows). Because of this tension, we human beings are torn between our worse halves, which are beastly, and our higher halves, which are almost angelic. At his gloomiest Hamlet sees humankind stuck in the middle, "crawling between heaven and earth?" (*Hamlet* III, i, 130-1), but at other times he stresses the upward pull of the Chain:

[HAMLET] What a piece of work is a man! How noble in reason, how infinite in faculty, in form how like an angel, in apprehension how like a god--the beauty of the world, the paragon of animals! (*Hamlet* II, ii, 305-9)

As well as locating humankind's place, the Chain represents how God has ordered the world as part of his divine plan for the universe. Everything makes sense to God, even though with our limited human minds we cannot see it. In particular, suffering has a place in the big plan, and it simply has to be endured. This is something early-modern Christians could also find in classical texts, in the writings of the Greek and Roman Stoics. In *Titus Andronicus*, Marcus kills a fly crawling across his dish, and his brother Titus calls him a murderer:

MARCUS

Alas, my lord, I have but killed a fly.

TITUS

'But'? How if that fly had a father, brother?

How would he hang his slender gilded wings

And buzz lamenting dirges in the air!

Poor harmless fly,

That with his pretty buzzing melody

Came here to make us merry--and thou hast killed him!

(*Titus Andronicus* III, ii, 59-65)

A fly has family connections and its own concerns just as we have: it is part of the Chain of Being. This moment might well be comic, but it has a serious implication. To us a fly may seem unimportant, but to another fly it might be a family member, a loved one, and indeed these other flies may grieve. Ordinarily, we do not notice their family relations because we do not live among the flies. This example illustrates Tillyard's key idea that there are correspondences between the relations within each plane of existence (the insects, the human) such that certain principles (such as there being a 'best' in that level, a 'primate') are repeated at each level. We now know that Titus is mistaken--flies do not live in families--but the first audiences did not know this and the challenge to our assumptions of alienity stands: how do we know they are not like us?

In the Great Chain of Being we are so far above the insects that we treat them with contempt, but what if (to switch to a polytheistic mode for a moment) the gods feel like that about us? Suppose that rather than having a plan for us all, and thinking us important, we are just trivial to the gods and that is why we suffer. In *King Lear* the same horrible thought occurs to Gloucester, who says "As flies to wanton boys are we to th'gods; | They kill us for their sport" (IV, i, 38). Titus's fear, and that of Gloucester, is all about perspective: how do we seem from God's (or the gods') perspective from on high? In painting, the early-modern period saw the first widespread use of perspective representation such that objects further away from the viewer's vantage point were drawn smaller than things nearby. Titus and Gloucester think that God is so far away that perhaps we are small and insignificant to him. In perspective representation what matters is where you set up your vantage point. From God's perspective at the top of the Chain of Being we are small but in Christian theology (indeed in virtually all religions) humankind is nonetheless the whole point of the universe.

Humankind was also, until this period, located at the physical centre of things. In Shakespeare's time there was good reason to question whether this was literally accurate. Since ancient times it had been believed, in the West at least, that the Earth was at the central point of a physical universe comprised of heavenly bodies that revolved around it. Astronomers Nicolaus Copernicus (1473-1543) and Galileo Galilei (1564-1642) challenged the prevailing view and argued that the Sun is at the centre and the Earth orbits it. (We now know that this too is wrong: the Sun is an insignificant star among billions of stars.) For all of Shakespeare's career, Copernicus's view was known, but it was not widely accepted until Galileo in 1610 proved (by showing its moon-like phases) that Venus orbits the sun. According to Tillyard, "the ordinary educated Elizabethan" was aware of Copernicus's ideas but rejected them (Tillyard 1943, 34). The standard history-of-ideas interpretation of the seventeenth and eighteenth-century Age of Enlightenment is that all the early-modern commonplace ideas described by Tillyard went the way of the geocentric model. Using rational and empirical investigation, the physical and zoological theories of Aristotle, Plato, and Pliny were replaced by newer and more accurate ideas.

A typical example is Aristotle's belief that inanimate matter could turn into living creatures that "grow spontaneously and not from kindred stock; and of these instances of spontaneous generation some come from putrefying earth of vegetable matter" (Aristotle 1910, 539a). Ovid wrote of the same phenomenon, observing that when the Nile was flooded "and the fresh slime has been heated by the sun's rays, farmers as they turn over the lumps of earth find many animate things; and among these some, but now begun, are upon the very verge of life, some are unfinished and lacking in their proper parts" (Ovid 1916, Book 1 lines 422-29). There is ample evidence that Elizabethans believed in spontaneous generation, which is unsurprising as it follows directly from the idea that only minute differences separate all the entities in the universe, from rocks up through plants and animals. In the drama, Lepidus expresses what no-one in Shakespeare's time had reason to doubt, howsoever peculiar it might seem to us: "Your serpent of Egypt is bred now of your mud by the operation of your sun; so is your crocodile" (*Antony and Cleopatra* II, vii, 26-27).

Taken literally, Tillyard's version of an alleged Picture seems to us so absurd that, as far as I can tell, no critic has bothered to refute it. The focus of the attack on Tillyard has been that early moderns did not actually believe the Picture he outlined, rather than that the Picture itself is wrong. The period's poetry, prose, and dramatic literature is ample evidence that whether or not they believed it exactly, the Picture was in the realm of the believable and had some explanatory force. But recently science has given us reason to ponder whether there are aspects of the Picture that are useful for conceptualizing the complexity of life on Earth, especially the preponderance of macrocosm/microcosm correspondences and the arbitrary distinctions we make between living and non-living matter. There are newly discovered macrocosmic/microcosmic correspondences that puzzle the mind. A glass-plate three-dimensional picture called a hologram will, when smashed, produce a collection of shards, each of which contains not a part of the original picture but a smaller version of the whole. A similar property of repetitions down through the scales of size applies to a set of objects, fractals, defined by precise mathematical formulae. Fractal objects occur in non-organic and organic nature,

such as the snowflake and the fern leaf, and their defining property is self-similarity: the whole is made up of smaller units each of which has some of the properties of the whole (Egan 2006, 26-27, 73, 100, 177) Self-similarity is what the Tillyardian Picture exhibits, and if early moderns believed in it then they were on to something. The most important self-similar system of all (so far as we currently know) is the Earth itself, if, as a number of scientists are beginning to believe, the Gaia hypothesis of James Lovelock is correct.

In the 1960s, the American space agency NASA was planning unmanned voyages to other planets and consulting chemists on the tests a landing craft might perform to look for life (Lovelock 1979, 1-7). A specialist on atmospheric gases, Lovelock proposed that the simplest test is disequilibrium in a planet's atmosphere, meaning the abundant presence of chemicals that ordinarily would react with one another and turn into something else. In the Earth's present atmosphere, the abundant methane and oxygen ought long ago to have reacted in sunlight (producing carbon dioxide and water) and they only persist because the lifeforms of the Earth are pumping out millions of tons of each every year. Lovelock's crucial insight was that the present atmospheric composition did not come about by geological processes preceding life, but it is itself a consequence of life on Earth. This insight suggested a simple test for life on other planets. If their atmospheres contain gases that ought to have reacted themselves away long ago, there must be something keeping up a dynamic equilibrium, and that something probably is (by analogy with how this happens on Earth) life itself. Such a test could be conducted from Earth using spectroscopic analysis of the light from a planet, which conclusion NASA, seeking to justify voyaging to the planets, was disappointed to hear.

Once convinced that our present atmosphere was a product of life, Lovelock addressed the problem that when life on Earth began, about 3.6 billion years ago, the Sun was significantly cooler than it is now, and yet the temperature on Earth must have remained within fairly tight limits for the chemistry of life to continue. The startling conclusion Lovelock drew was that the constituent parts of the atmosphere were continuously adjusted by lifeforms on Earth--altering the balance of gases that retain the Earth's heat and those that let it pass out into space--in order to keep the climate comfortable for life. This seemed to require that the lifeforms collaborated in adjusting their outputs, which idea appeared so far fetched that early research papers by Lovelock were routinely rejected by academic journals. Lovelock continued working on his hypothesis, and introduced into it the further complexity of the chemical reactions between the atmosphere and rock surfaces as they weathered (a process that bacteria can accelerate) and also the oceans full of algae. The result was a chemical model of a complex interconnected chain of reactions whose ultimate effect was to regulate the conditions on Earth for the benefit of its lifeforms. This model he called Gaia.

With the entire Earth unified in this way, it seems artificial to distinguish between the parts that are obviously alive (the biota) and the inanimate oceans, rocks, and clouds. These inanimate parts are tightly coupled in chemical processes with the biota. By analogy, although most of the mass of a tree is dead matter inside its trunk (only the outer layer of cells just below the bark is technically alive) we nonetheless rightly see the whole tree as an organism, for the interior supports the tree as it grows. Why not treat the biologically essential but inanimate parts of the Earth the

same way? Indeed why not treat the entire Earth as a super-organism composed of many kinds of subsidiary organisms, just as a human body contains many other organisms (such as the numerous bacteria living in its guts that have their own DNA and lifecycles) but is nonetheless treated as a singularity? This idea Lovelock first presented in a sequence of papers (the most significant being Lovelock 1972; Lovelock & Margulis 1974a; Lovelock & Margulis 1974b) and then as a series of books (including Lovelock 1979; Lovelock 1988). Neo-Darwinists were vociferous early opponents of Lovelock's hypothesis, objecting that such an Earth simply could not come about by natural selection.

In his most original contribution to his field, Richard Dawkins argued that the effects of genes can be expressed far outside the body of the organism containing the genes--beavers' dams and spiders' webs are expressions of the genes they inherit--and yet he stood firm against such 'action at a distance' on the planetary scale (Dawkins 1982, 234-37). That is, he could see no way that the microscopic bacteria breaking rocks into soil, or the sea algae dragging surface carbon to the sea-bed, could form homeostatic (self-regulatory) systems that affect the whole Earth. A turning point that made scientists take Gaia seriously was Lovelock's publication of a rigorous mathematical model of a simple planet's eco-system in which natural selection amongst plants regulates the planet's temperature to defend against the variations in sunlight (Lovelock 1983). Even more significantly, the Neo-Darwinist William Hamilton and Earth Systems scientist Tim Lenton produced a paper showing how algae might produce dimethyl sulfide clouds (an essential part of the Gaia hypothesis) as an evolutionarily-refined means of spreading their spores more efficiently (Hamilton & Lenton 1998). After a couple of decades of disbelief, the Gaia hypothesis is now frequently invoked in mainstream scientific works about life on Earth.

In one way it is surprising that Neo-Darwinists were resistant to Lovelock's idea that inanimate parts of the Earth could be said to be living as elements within a larger worldwide system, since a central objection to Darwin's original idea had been its seeming to transpose all life onto one gentle gradient leading (over time) from the simplest creatures to the most complex. To some it still seems that certain objects, like the human eye, exhibit 'irreducible complexity', meaning that the various component parts (lens, iris, retina, optical nerve) all work in consort and that not until all are assembled could there be a functioning eye. In this view, there is no such thing as half an eye: either all the parts are present or the collection does not work. An examination of the various eyes around the world easily dispels this nonsense, as there are plenty of creatures with eyes less or more complex than our own. One can easily imagine the earliest eye being a small mutation that gave an early creature a faintly light-sensitive patch of cells that conferred upon it a small but significant survival advantage in being able to detect when it was hidden from predators in a dark place. Over millennia, such an eye would be refined by natural selection, rising in complexity by tiny steps of improvement.

Transposed into the chronological axis, a Great Chain of Being in which creatures vary one from another by tiny differences is precisely what evolution forces us to accept. Indeed, Darwinism itself raises what is called the 'species problem' that is apparent in the Great Chain of Being: how can we say that the giraffes belong in one category distinct from its neighbours if all that separates creatures are slight

individual variations? Darwin failed to explain why evolution has produced creatures that seem to fall into discrete, non-overlapping categories, and in the light of his ideas it might be argued that species are only a product of our minds' habits of categorization (Shaw 1969). The current consensus is that this is mistaken and that the term species is a real taxonomical distinction, and yet the problem of how evolution produces clear gaps between species, rather than hybrids combining two closely-related species, is not yet solved (Coyne 1994). Explanations based on the way that geographical isolation of populations leads, over time, to distinct groups that cannot interbreed--which seems a useful way of thinking about what characterizes distinct species--raise their own additional problems when natural populations decline and the majority of the individuals concerned live in zoos (Hey et al. 2003).

At the roots of the word 'species' are the acts of beholding and the presentation of an appearance (OED species *n.*). Despite the philosophical complexities associated with taxonomy, we are all good at distinguishing other human beings (with whom we might mate) from animals, and at distinguishing from among the animals those that threaten us and those that are safe to eat. As Erica Fudge showed, the borderline case of apes generated considerable tension in early-modern London culture, especially when human-looking individuals were tortured in animal shows (Fudge 2000, 11-13). In Shakespeare's time the privileging of humankind as *sui generis* had not fully taken hold and it was possible to think that a person might in some sense descend to the level of a dog by his behaviour (Fudge 2003). Darwin's great contribution was to overturn the Enlightenment's false distinction of humanity from the other animals and to restore this link in the Chain.

And yet there remains one oft-cited gulf between humans and animals that we should not ignore. Marx put it in Platonist terms:

A spider conducts operations that resemble those of a weaver, and a bee puts to shame many an architect in the construction of her cells. But what distinguishes the worst architect from the best of bees is this, that the architect raises his structure in imagination before he erects it in reality. (Marx 1954, 174)

This invokes yet another, older sense of 'species' meaning idea (OED species *n.* 5c, 6), and one of the things that a person can have an idea about (and that we have long assumed that an animal cannot) is itself. The Great Chain of Being is a representation of humankind to itself, and we ought to be careful not to give ourselves a privileged place simply for being able to think like this. As Frans de Waal, Daniel Dennett, and Richard Joyce amongst others have shown (Flack & De Waal 2000; Dennett 2003; De Waal 2004; Joyce 2006), certain animals, especially the ones higher up the Great Chain of Being, are capable of self-reflection because they have a 'theory of mind' (Premack & Woodruff 1978), which not all humans possess (Baron-Cohen, Leslie & Frith 1985). Cultural phenomena that we pompously take sole credit for, such as morality and politics, can evolve in animal societies. In this regard it is delightful to reflect that Shakespeare named only one of his contemporaries in his plays, and it was not a person but the bear Sackerson, whom Slender implausibly claims to have mastered (*The Merry Wives of Windsor* I, i, 274-6).

Although it illustrates that not all the advances of the eighteenth-century Enlightenment were as rational and empirically justified as they once seemed, the Great Chain of Being remains unfashionable because it is alleged to promote conservative thinking. This is most apparent in respect of the supposed correspondences between the various planes of existence, the so-called macrocosmic/microcosmic analogies. For example, to say that the relationship of a male head of a family to his wife and children is somewhat like the relationship of a king to his people can easily seem to buttress patriarchy with monarchy in order to validate both. But we should note that the analogy also imposes a limit upon power, for it implies that kings are no more entitled to kill their subjects than fathers are their children. We could go further and say that the analogy exposes the ideological work by which one form of power is buttressed with another, because neither is sufficiently strong on its own terms. To assert that kings need to treat their people as though they were children, and yet to acknowledge that the people are not children, is to be well on the way to a critique of the institution of monarchy as a form of infantilization.

In the plays of Shakespeare there are many examples of macrocosmic/microcosmic correspondence that ought to shock modern sensibilities. When Martius receives the news that "the Volsces are in arms" with a casual "Then we shall ha' means to vent | Our musty superfluity" (*Coriolanus* I, i, 224-6) he is likening the collective body of the Roman people to the body of a sick individual needing the purging or letting of an over-abundant humour. Like a body, the city (he suggests) may be cured by having its blood let. Geoffrey Bullough found the inspiration for this line in the source text, Thomas North's translation of Plutarch's *Lives of the Noble Grecians and Romans*, where the wise men of Rome see in war the opportunity to rid the city of "mutinous and seditious persones, being the superfluous ill humours" that make the civil body unwell (Bullough 1964, 516). Using the same analogy, Richard 2's vain attempt to pacify Mowbray and Bolingbroke with "Our doctors say this is no time to bleed" (*Richard 2* I, i, 157) refers both to their particular persons and to the general bloodletting of the body politic that will ensue if their factions cannot be reconciled. The succeeding history plays repeatedly image the ensuing civil wars in physiological terms.

These are indeed grim images, but they are not the only way the macrocosmic/microcosmic analogy may be wielded. In Falstaff's conception, the little kingdom of the body may be roused and unified by the operation of the right kind of alcohol:

. . . it illuminateth the face, which, as a beacon,
gives warning to all the rest of this little kingdom, man,
to arm; and then the vital commoners and inland petty
spirits muster me all to their captain, the heart; who,
great and puffed up with his retinue, doth any deed of
courage. And this valour comes of sherry. So that skill
. . . is nothing without sack, for that sets it
a-work; and learning a mere hoard of gold kept by a
devil, till sack commences it and sets it in act and use.
(2 *Henry 4* IV, ii, 104-12)

Falstaff is talking of a body exercising military valour, but the tone is comic and his interpretation of what we would recognize as the physiological effects of alcohol (dilation of blood vessels, lowering of inhibitions) is brilliantly inventive and explicatory. We now know that the body is indeed a corporation of semi-autonomous systems maintaining equilibrium by complementary, collaborative actions. The mind too, for long imagined as a unitary spirit quite distinct from (but inhabiting) the body, is now understood to be a collection of semi-autonomous modules working in consort and--perhaps only quite recently in evolutionary terms--generating the illusion we call consciousness. (For an argument about how this ought to affect Shakespeare studies, see Egan 2011.)

Scientists routinely metaphorize and anthropomorphize biological actions. Genes are not literally 'selfish' but natural selection picks amongst them (or rather their phenotypic effects) in a way that is most easily apprehended by a kind of short-hand that treats their behaviour as if they were. We can say that selfishness is an emergent phenomena of the way genes interact, so long as we accept that at higher levels (such as within kin groups) the same interactions generate emergent altruism too. The Earth is not literally alive in the Gaia hypothesis, at least not in the way a single cell is undeniably respiring, excreting, and reproducing. But Earth is a system and ". . . self-regulation is an emergent property of that system" (Lovelock 2004, 2), emerging from the way that the biota, the seas, the rocks, and the atmosphere interact. Early-modern habits of mind, especially as evidenced in such models as the Great Chain of Being, are much better tuned to this kind of systems thinking than minds limited by the reductionism of the high Enlightenment, which no longer looks like good science or philosophy.

¹All quotations of Shakespeare are from Shakespeare 1989.

Works Cited

Aristotle. 1910. *The Works*. Ed. David Ross. Vol. 4: HISTORY OF ANIMALS: *Historia Animalium*. 12 vols. London. Oxford University Press.

Baron-Cohen, Simon, Alan M. Leslie and Uta Frith. 1985. "Does the Autistic Child Have a 'Theory of Mind'?" *Cognition* 21. 37-46.

Bullough, Geoffrey. 1964. *Narrative and Dramatic Sources of Shakespeare*. Vol. 5: The Roman Plays: *Julius Caesar, Antony and Cleopatra; Coriolanus*. 8 vols. London. Routledge and Kegan Paul.

Coyne, Jerry. 1994. "Ernst Mayr and the Origin of Species." *Evolution* 48. 19-30.

Dawkins, Richard. 1982. *The Extended Phenotype: The Gene as the Unit of Selection*. Oxford. Oxford University Press.

De Waal, Frans B. M. 2004. "Evolutionary Ethics, Aggression, and Violence: Lessons from Primate Research." *Journal of Law, Medicine and Ethics* 32. 18-23.

Dennett, Daniel C. 2003. *Freedom Evolves*. London. Penguin.

Dollimore, Jonathan and Alan Sinfield. 1985. "History and Ideology: The Instance of *Henry V*." *Alternative Shakespeares*. Edited by John Drakakis. New Accents. London. Methuen. 206-27.

Drakakis, John. 1985. "Introduction." *Alternative Shakespeares*. Edited by John Drakakis. New Accents. London. Methuen. 1-25.

Egan, Gabriel. 2006. *Green Shakespeare: From Ecopolitics to Ecocriticism*. Accents on Shakespeare. London. Routledge.

Egan, Gabriel. 2011. "Shakespeare, Idealism, and Universals: The Significance of Recent Work on the Mind." *The Return of Theory in Early Modern English Studies: Tarrying with the Subjunctive*. Edited by Paul Cefalu and Bryan Reynolds. Basingstoke. Palgrave Macmillan. 278-95.

Flack, Jessica C. and Frans B. M. De Waal. 2000. "'Any Animal Whatever': Darwinian Building Blocks of Morality in Monkeys and Apes." *Journal of Consciousness Studies* 7. 1-29.

Fudge, Erica. 2000. *Perceiving Animals: Humans and Beasts in Early Modern English Culture*. Basingstoke. Macmillan.

Fudge, Erica. 2003. "How a Man Differs from a Dog." *History Today* 53.6. 38-44.

Gelli, Giovanni Battista. [1558-9]. *Circes . . . Translated Out of Italion Into Englishe By Henry Iden*. STC 11709. London. John Cawood.

Hamilton, W. D. and T. M. Lenton. 1998. "Spora and Gaia: How Microbes Fly with Their Clouds." *Ethology Ecology and Evolution* 10. 1-16.

Hey, Jody, Robin S. Waples, Michael L. Arnold, Roger K. Butlin and Richard G. Harrison. 2003. "Understanding and Confronting Species Uncertainty in Biology and Conservation." *Trends in Ecology and Evolution* 18. 597-603.

Joyce, Richard. 2006. *The Evolution of Morality*. Life and Mind: Philosophical Issues in Biology and Psychology. Cambridge MA. Massachusetts Institute of Technology Press.

Lovejoy, Arthur O. 1936. *The Great Chain of Being: A Study of the History of an Idea*. Cambridge MA. Harvard University Press.

Lovelock, James E. 1972. "Gaia as Seen Through the Atmosphere." *Atmospheric Environment* 6. 579-80.

Lovelock, James E. 1979. *Gaia: A New Look at Life on Earth*. Oxford. Oxford University Press.

Lovelock, James E. 1983. "Daisy World: A Cybernetic Proof of the Gaia Hypothesis." *Coevolution Quarterly* 38. 66-72.

- Lovelock, James E. and Lynn Margulis. 1974a. "Atmospheric Homeostasis By and for the Biosphere: The Gaia Hypothesis." *Tellus* 26. 2-10.
- Lovelock, James E. and Lynn Margulis. 1974b. "Biological Modulation of the Earth's Atmosphere." *Icarus* 21. 471-89.
- Lovelock, James. 1988. *The Ages of Gaia*. The Commonwealth Fund Book Program. Oxford. Oxford University Press.
- Lovelock, James. 2004. "Reflections on Gaia." *Scientists Debate Gaia: The Next Century*. Edited by Stephen H. Schneider, James R. Miller, Eileen Crist and Penelope J. Boston. Cambridge MA. Massachusetts Institute of Technology Press. 1-5.
- Marx, Karl. 1954. *Capital: A Critical Analysis of Capitalist Production*. Ed. Frederick Engels. Vol. 1. 3 vols. London. Lawrence and Wishart.
- Ovid. 1916. *Metamorphoses*. Trans. Frank Justus Miller. Vol. 1: Books 1-8. 2 vols. The Loeb Classical Library. London. Heinemann.
- Peacham, Henry. 1622. *The Compleat Gentleman*. STC 19502. London. John Legat for Francis Constable.
- Plato. 1883. *The Works: A New and Literal Version, Chiefly from the Text of Stallbaum*. Ed. Henry Davis. Vol. 2: *The Republic; Timaeus; Critias*. 6 vols. Bohn's Classical Library. London. George Bell and Sons.
- Premack, David and Guy Woodruff. 1978. "Does the Chimpanzee Have a 'Theory of Mind'?" *Behavioral and Brain Sciences* 4. 515-26.
- Roberts, Jeanne Addison. 1980. "Animals as Agents of Revelation: The Horizontalizing of the Chain of Being in Shakespeare's Comedies." *New York Literary Forum* 5-6. 79-96.
- Shakespeare, William. 1989. *The Complete Works*. Ed. Stanley Wells, Gary Taylor, John Jowett, and William Montgomery. Electronic edition prepared by William Montgomery and Lou Burnard. Oxford. Oxford University Press.
- Shaw, Alan B. 1969. "Adam and Eve, Paleontology, and the Non-objective Arts." *Journal of Paleontology* 43. 1085-98.
- Tillyard, E. M. W. 1943. *The Elizabethan World Picture*. London. Chatto and Windus.