Darwinian Theory Reinterpreted

From Chapter Eight of: Nicholas Maxwell, *Cutting God in Half - And Putting the Pieces Together Again* (Pentire Press, 2010, pp. 264-300): see http://discovery.ucl.ac.uk/105672/ .

We saw in the last chapter that free will is possible but wildly implausible granted physicalism. Whatever else we may be, we are at least a fragment of the physical universe. It is just about possible that this bit of the physical universe in which we have our being – our brains, bodies and environment – is so beautifully and intricately convoluted, structured, organized and designed that physical law, unfolding in its remorseless, unthinking way, just happens to be also us, freely deciding what to do, and then making what we have decided happen. It is just conceivable that we, and the physical universe, have dual control – what we are being doubly comprehensible. We just about could have all the might of the physical universe within us, so utterly devoted to our interests as to empower us to initiate and guide our actions.

But if so, this state of affairs really is wildly, incredibly implausible, little short of the utterly miraculous. Why should the fragment of the utterly impersonal physical universe we inhabit be so intricately and conveniently designed and organized so as to facilitate us being in charge of our thoughts, decisions, and actions (at least some of the time, to some extent)? This seems utterly inexplicable. It cries out for explanation.[1]

This profound problem of explanation and understanding has been solved, in outline at least, by Charles Darwin. The solution is his theory of evolution. The blind, purposeless mechanisms of random inherited variations and natural selection, operating initially on some elementary, initial life form have, during the course of some three and a half billion years, produced the millions of diverse living things that inhabit the earth today, including ourselves, all incredibly well-adapted to their conditions of life,

[1] Incompatibilists may hold their view in part because they see compatibilism as being untenable because, at best, it has this apparently inexplicable, absurd consequence.

and so able to survive and reproduce. The blind mechanisms of evolution design both bodies and brains. As a result of designing brains, these mechanisms of evolution build into brains the capacity successfully to pursue those goals in the given environment that are conducive to survival and reproduction, plus the capacity to learn. The eventual outcome has been us human beings, imbued with the capacity to decide for ourselves (some of the time, to some extent) what we want, what we will do, plus the capacity to do it. The miracle of free will is, in other words, the outcome of Darwinian evolution.

However, if Darwinian evolution is to explain the miracle of the existence of free will in this physicalistic universe, it is essential that we adopt that version of Darwinian theory able to perform this task. In what follows, I shall distinguish eight versions of Darwinian theory. Only the final, eighth version is able to explain free will, as we shall see.

Actually, the task before us is broader than to account for free will in the universe. Our fundamental problem is to understand how all that is of value has emerged within the physical universe. I concentrate on a key component of this problem, namely the evolution of the *capacity* to realize what is of value. This capacity may be called *wisdom*, and wisdom, as we saw in the last chapter includes, but goes beyond, free will. I set out to answer two key questions: (1) What version of Darwinian theory is able to explain the evolution of wisdom? (2) How good, how adequate, is this explanation? What are its limits, its inadequacies? Understanding how wisdom (in the sense indicated) has evolved is crucial to understanding how life of value has evolved within the physical universe.

Nine Versions of Darwinian Theory

The task before us is to specify a version of Darwinian theory which provides the best available explanation for the existence of human beings who are *doubly comprehensible* – comprehensible *physically*, and comprehensible *personalistically*[2] (or empathically, in terms of the person's desires, aims, problems, motives, feelings,

[2] See *Cutting God in Half*, pp. 246-250.

plans). We want to understand how beings have come into existence in the physical universe who are *able freely to realize what is of value in life* (at least some of the time, to some extent).

Formulating the problem in this way, as understanding how beings that are *double comprehensible* have come into existence, makes it clear that the sought for explanation must itself take account of *both* kinds of explanation – physical and personalistic.

Darwinian theory is a very special kind of *historical* theory. All historical explanations – including Darwinian ones – make use of other modes of explanation, such as the three discussed in the previous chapter: physical, purposive,[3] and personalistic. But in the case of Darwinian theory, the appeal to these other modes of explanation arises for a much more basic reason. The theory seeks to understand how and why things exist – living beings – that are amenable to being explained and understood simultaneously in two (or even three) different ways: physically, purposively and, in some cases, personalistically. This can hardly be achieved if these modes of explanation are ignored.

Darwinian theory is thus, on this view, quite different from Newtonian theory say, or most other scientific theories, which seek to predict and explain a range of phenomena, but which do not seek to explain why some things are doubly (or in some cases trebly) comprehensible. Unlike other scientific theories, the problem for Darwinian theory is not the incomprehensibility of a range of phenomena, but rather that some phenomena – having to do with life – are, as it were, *much too comprehensible*, in being *doubly or even trebly comprehensible*. It is the excessive comprehensibility of life that is the problem.

Darwinian theory solves this problem historically, by explaining how and why increasingly diverse and rich double (and eventually treble) comprehensibility has come gradually into existence over billions of years in an initially purposeless, singly comprehensible

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[3] Purposive explanations explain actions by construing them to be seeking to attain a goal in a given environment, and are, like personalistic explanations, compatible with but not reducible to physical explanations. The most elementary purposive entity is the thermostat: see *Cutting God in Half*, pp. 204-207. Personalistic explanations are purposive explanations with the added ingredient of sentience or consciousness.

universe. This problem can only be solved in this way, however, if Darwinian theory observes the following principle:

Principle of Non-Circularity: The theory must not presuppose what it seeks to explain. If, at some stage in evolution, Darwinian theory itself employs purposive explanations, the theory must explain how purposiveness of this type has come into existence at this stage of evolution *without using the very notion of purposiveness that is being explained.* And just the same applies to the personalistic.

This Principle must be observed if Darwinian explanations are to avoid becoming trivially circular – presupposing the very thing to be explained. Darwinian accounts of evolution may employ purposiveness and personalistic explanations, at certain stages of evolution, but if so, Darwinian theory must explain how things that exemplify these notions of the purposive or personalistic have come into existence *in a way which makes no appeal to these explanatory notions whatsoever*. Thus, if an appeal is made to empathy in order to explain some evolutionary development, an explanation for the prior evolution of empathy must be given *which does not itself employ empathy as an explanatory notion.* Or, if parental care is employed to explain some evolutionary development, the existence of parental care must itself be explained without this explanation itself invoking parental care. And likewise for purpose, sentience, consciousness, free will, cooperativeness, and so on.

If this Principle is observed, we have a theory which may be able to explain the emergence of the purposive and personalistic in a purposeless universe; if it is violated, the whole programme collapses. Darwinian theory merely presupposes what it sets out to explain.

We shall see that Darwinian theory is at present only partially successful in conforming to this Principle of Non-Circularity. One difficulty arises in connection with the unsolved problem of the origin of life.

I now consider eight versions of Darwinian theory which, progressively, give increasingly important roles to purposive and

personalistic modes of explanation.[4] I begin with an extreme version of the theory that banishes "purpose" from the theory (and from life) altogether. I do this so that we may have before us the full range options, from the extreme mechanistic and purposeless on the one hand, to the fully personalistic on the other. The first, purposeless version might be attributed to Jacques Monot and Richard Dawkins. Let us call it:

Darwin(1) The theory is about the evolution, not primarily of living things, but rather of entities that may be called *replicators*. These are genes, encoded in DNA molecules. Replicators replicate themselves by manipulating the "survival machines", or bodies, they inhabit. Evolution of replicators occurs as a result, in essence, of (1) random inherited variation (mistakes in the process of replication), and (2) the natural selection of those replicators best able to survive and replicate.

Comments. This seems to invoke purpose, in that replicators are described as performing such purposive actions as *replicating* themselves by *manipulating* their survival machines. Upholders of this view would insist, however, that this is just convenient metaphor. All reference to purposive action can be eliminated from the theory.

Does anyone defend Darwin(1)? Dawkins certainly seems to, in his *The Selfish Gene*.[5] At one point he says "[The genes] are the replicators and we are their survival machines" (p. 37), and this theme is spelled out at some length in the book. "… the fundamental unit of selection, and therefore of self-interest, is not the species, nor the group, nor even, strictly, the individual. It is the gene, the unit of heredity" (p. 12). He even says at one point that these replicators "are in you and me; they created us, body and

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[4] The account of Darwinian theory developed here, stressing that the theory needs to be interpreted as explaining double (or treble) comprehensibility, this requiring that the theory itself appeals to purposive and personalistic modes of explanation, the mechanisms of evolution themselves evolving, is based on a much more detailed exposition of all this in N. Maxwell, *The Human World in the Physical Universe* (Rowman and Littlefield, 2001, ch. 7).

[5] Dawkins, *The Selfish Gene* (Paladin, 1978).

mind; and their preservation is the ultimate rationale for our existence" (p. 21). And Dawkins states explicitly that is quite wrong to invoke *purpose*. He says "natural selection favours replicators which are good at building survival machines, genes which are skilled in the art of controlling embryonic development. In this, the replicators are no more conscious or purposeful than they ever were. The same old processes of automatic selection between rival molecules by reason of their longevity, fecundity, and copying-fidelity, still goes on as blindly and inevitably as they did in the far-off days. Genes have no foresight. They do not plan ahead. Genes just *are*, some genes more or so than others, and that is all there is to it" (p. 25).[6]

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[6] The gene-centred view is very clearly expressed and defended by Helena Cronin, *The Ant and the Peacock* (Cambridge University Press, 1991). She writes "Modern Darwinian theory is about genes and their phenotypic effects. Genes do not present themselves naked to the scrutiny of natural selection. They present tails, fur, muscles, shells; they present the ability to run fast, to be well camouflaged, to attract a mate, to build a good nest. Differences in genes give rise to differences in these phenotypic effects. Natural selection acts on the phenotypic differences and thereby on genes. Thus genes come to be represented in successive generations in proportion to the selective value of their phenotypic effects" (p. 60). And she adds "We have travelled far from the organism-centred view of classical Darwinism – from a Darwinism that is about the survival and reproduction of individuals" (p. 64). She goes on to stress the importance of strategic thinking in modern Darwinism, and adds "The development of strategic thinking has involved two major shifts from classical Darwinism: first, a view of adaptations that is more conscious of their costs and less sanguine about their benefits, and, second, a greater emphasis on behaviour, particularly social behaviour. The strategists, of course, are not runners – not even robins or rats: they are genes" (p. 66). At first it almost sounds as if modern Darwinism takes purposiveness very seriously indeed, in emphasizing strategy and behaviour, especially social behaviour. But then all this is removed with the declaration that the strategists are genes! For of course genes can only be said to be selfish, strategists or, more generally, purposive, in a metaphorical, not in a literal sense. Only living things are purposive. In re-interpreting the theory of evolution to be about genes rather than living things, modern Darwinism, almost

It is possible to interpret Darwinian evolution in this way, but it seems bizarre and perverse to do so in the extreme. It is as if what one finds utterly amazing and in need of explanation is not life on earth – plants, fish, birds, mammals, human beings, in all their extraordinary diversity, living their extraordinarily diverse ways of life – but DNA molecules. (I once heard Richard Dawkins begin a lecture at University College London with the words "My vision is a world full of replicators"!)

Why does Dawkins take the unit of selection to be the gene, the replicator, and not the individual living thing – the "survival machine" to use his term? Because genes endure thousands, even millions of years, individual exemplifications of a given gene are precisely replicated, and the gene is invariably selfish. Individuals, by contrast, have a short life; they are all different, do not reproduce precisely, and are not invariably selfish (in that they are sometimes altruistic, as when bees sting animals after honey, and so die to save the hive). But these differences do not seem to me to constitute any argument at all against:

Darwin(2) The theory is about the evolution of individual living things – bacteria, viruses, fish, insects, birds, reptiles, mammals, plants, fungi and the rest. These have evolved, and continue to evolve, as a result, in essence, of the twin mechanisms of random inherited variations and natural selection. Living things appear to pursue goals, but they don't really. What the theory does is to explain away the illusion of purposiveness in nature. Life is just a combination of chance and necessity, devoid of purpose.

Comments. Many biologists do, or have, accepted Darwin(2), although many others reject it. Dawkins' reasons for preferring Darwin(1) to Darwin(2) do not seem to amount to very much. Why should the unit of selection persist for thousands of years? Why should reproduction precisely replicate what is reproduced? Darwinian theory is about reproduction *with variation*. Even the argument that only genes are always selfish does not seem to

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incidentally, perhaps entirely unintentionally, removes purposiveness from the theory altogether – or, at the very least, downplays its role in evolution.

amount to much. Altruistic action undertaken to save close kin may be thought of as engaging in a kind of reproduction. One reproduces, not by having offspring oneself, but by protecting the lives of close relatives likely to have offspring of their own. Thus, all that needs to be done in order to make such altruistic action in no way exceptional, but a standard part of action designed to promote survival and reproductive success, is to broaden the meaning of "reproduction" a bit. This is something one needs to do for other reasons in any case, as we shall see below.[7]

The substantial reasons for preferring Darwin(2) to Darwin(1) only really arise, however, when we come to consider versions of Darwinian theory that attribute genuine *purposes* to living things. Whereas it makes sense to hold that living things pursue goals, it does not make quite so much sense to think of genes, stretches of DNA molecules, as genuinely engaged in purposive activity. It may well be that a part of Dawkins' reason for preferring Darwin(1) to Darwin(2) lies in just this feature of the former view – its clear mechanistic, purposeless character, as his talk of *replicators* and *survival machines* suggests.

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[7] The worker bee or ant, sacrificing itself in order to save the hive or its close kin, is an extreme case of something less extreme and much more widespread, namely parental care. This involves some self-sacrifice in order to promote the survival of one's offspring, even if not the supreme self-sacrifice of one's own death – although parental care may go to that extreme, when predators are fought or distracted to preserve the lives of offspring, for example. Parental care involves acting so as to promote the survival of one's own offspring, whereas the sacrifice of worker bees or ants promotes the survival of offspring of near relatives: somewhat different, but not fundamentally different. In this context, one should perhaps remember that there are many others cases of living things participating in reproduction even though their own genes are not reproduced. One might think, for example, of bees fertilizing flowers and blossom by distributing pollen, or birds and mammals eating fruit and thus distributing seeds. In these cases, of course, the bees, birds and mammals are after food; they are induced by the reward to serve, unknowingly, the reproductive needs of another species. Nevertheless, it is worth keeping in mind the wonderful variety of activities associated with reproduction.

But does Dawkins' really deny that purpose has anything to do with evolution? It is an awkward denial, for two reasons. First, it creates a wholly artificial division between humanity, authentically purposive in character, and the rest of the living world, devoid of purposiveness according to Darwin(1) and Darwin(2). This problem – this gulf between humanity and the rest of the living world – so much against the whole spirit of Darwinianism, which is all about gradual evolution – is merely an artefact of the above two versions of Darwinian theory, perversely denying purposiveness to non-human living things. Second, Dawkins, like other biologists, is prepared to talk of *design*. But the notion of design presupposes the notion of purpose. Whether something is well or ill designed may well depend crucially on what purpose it is being considered for. A chair that is well-designed as an object to be sat in is appallingly designed if considered to have the purpose of a teaspoon – to scoop up jam or stir sugar into one's tea.

But Dawkins' denial of purpose is perhaps a somewhat trivial semantic matter, rather than a matter of substance. In *The Selfish Gene*, Dawkins makes clear that he takes purposiveness to mean "conscious purposiveness", and he goes on to say that machines, such as guided missiles and computers playing chess, can be made to act *as if* pursuing goals by means of feedback mechanisms and computer programmes (p. 53-6).. If one restricts oneself to a narrow notion of purposiveness – one that requires all purposes to be conscious, or one that insists the actions of the thing in question cannot even in principle be explained physically – then one will be forced to deny purpose (in these narrow senses) to living things. Broaden the meaning of "purpose" so that it becomes free of these restrictions, and becomes such that it includes the compatibilist notion explicated in the last chapter, and it becomes utterly absurd to deny purposiveness to living things. Dawkins himself, indeed, would agree (although, perversely, purposes are attributed by him in the first instance to genes, to sections of DNA molecules, rather than to living things themselves). This brings us to:

Darwin(3). Living things are inherently purposive beings. Their fundamental goal in life is survival and reproductive success, and

all their other goals contribute, in one way or another, more or less successfully, to this fixed, fundamental goal. The *mechanisms* of evolution are, however, blind and purposeless.

Comments. On this view, Darwinian theory does not explain purpose away. On the contrary, it explains how purposiveness has gradually crept into Nature.[8]

It is probable that most biologists uphold Darwin(3). Those who reject the idea that living things are purposive probably do so for reasons similar to Dawkins'; they interpret "purpose" much too narrowly, to mean either "conscious purpose", or "purposiveness that is incompatible with physics".

Darwin(3) is however untenable because, once it is admitted that animals pursue goals, it becomes impossible to keep the mechanisms of evolution free of all elements of purposiveness, as we shall now see.

Darwin(4). Not only are living things purposive. The mechanisms of evolution, inherited variation and natural selection, themselves evolve, incorporating, as they do so, elements of purposiveness – so that these mechanisms can no longer be described as purpose-free. Animals in effect *breed* other species, or even their own species, by their purposive actions, even though they are not aware, of course, of what they are doing. To say this does not mean, however, that evolution itself has a purpose.

Comments. There are at least four ways in which purposiveness insinuates itself into the mechanisms of evolution.

(a) What has survival value may depend on how the animal is living. A change in the way of life may be due to a change of habitat, or a change in the climate. Animals may even create their habitat, as beavers do when they build dams and create lakes. In order to explain subsequent evolutionary developments it will be

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[8] See N. Maxwell, *From Knowledge to Wisdom* (Blackwell, 1984), pp. 174-181 and 269-275; 2nd ed., Pentire Press, 2007, pp. 197-205 and 290-296). This "purposive" version of Darwinian theory is further elaborated in N. Maxwell, *The Human World in the Physical Universe* (2001, ch. 7). See also Maxwell, 'Methological Problems of Neuroscience', in D. Rose and V. Dobson, eds., *Models of the Visual Cortex* (Wiley,1985, pp. 11-21).

necessary to refer to prior purposive action, and prior changes in purposive action, among other factors. Whether a mutation has survival value or not will depend on how the animal is living. For a dog-like creature running about on land, a mutation which turns legs into flippers would be a disaster. But if the creature is already swimming in rivers, catching fish, this mutation would have immense survival value.

(b) Sexual selection. One sex – typically females – may prefer to mate with those who possess certain characteristic features, and as a result, those features will tend to become more prevalent and exaggerated in the population. Thus, peahens, choosing to mate with those peacocks with the most splendid tails, inadvertently partly cause peacocks to have absurdly splendid tails. In order to explain the peacock tails, it is necessary to refer to the purposive actions of peahens, amongst other factors.

(c) Offspring selection. Parents, in choosing preferentially to feed offspring with certain characteristics – allowing offspring who do not have these characteristics to die – may thereby be a part of the cause of these characteristics to become more prevalent in the population. Likewise, some offspring may be better at manipulating parents to feed them than others, thus increasing the likelihood of their survival, and the spread, through the population, of these genetically determined manipulative techniques.

(d) Predator-prey selection. The fox, in hunting rabbits, kills those rabbits not so good at evading capture and death. In this way the fox helps breed rabbits better and better at evading foxes. And likewise, rabbits, in escaping from those foxes not so good at hunting, help breed foxes better and better at hunting (since foxes not so good at hunting tend not to survive and reproduce). Similarly, birds breed caterpillars and butterflies good at camouflage, and the latter, in getting better and better at camouflage, may help breed more perceptive birds able to see through it. Yet again, plant eating animals may help breed plants better able to resist the destructive attention of the animal in question. And the plant may help breed animals better able to eat the plant.

If we grant that plants engage in purposive action in the main by means of *growth*, then we may extend the idea that purposive

action influences evolution from animals to plants. Plant growth creates soil, and creates shade, both of which have had consequences for subsequent evolution. Shade in tropical rain forests creates selective pressures for young plants, in a clearing where there is sunlight, to grow quickly so as not to fall into the shade of more quickly growing plants. It also creates selective pressures for plants that can do photosynthesis in shady conditions. Genes that generate these traits will be selected for. And of course those cells, early on in evolution which, as a result of growth and photosynthesis, generated oxygen in the atmosphere made possible all of animal life.

In the above four kinds of cases, actions of animals (or growth of plants, in itself a kind of purposive action), has an impact, along with other factors such as mutations, on subsequent evolution. In all four cases, what is involved may be called *breeding*, analogous to what pigeon fanciers and dog owners do when they breed new varieties of pigeon or dog, with the crucial difference that the animals, or plants, have no idea whatsoever of what they are doing. Their purposive actions have the effects of breeding without there being anything like the conscious purpose of breeding. But then human beings may engage in breeding without being aware of what they are doing. In the case of (a) and (c), the animal unconsciously self-breeds; that is, it breeds its own offspring, its own species.

In *The Human World in the Physical Universe* I suggested another slogan for evolution, to take into account these phenomena: *life breeds itself into existence!*[9]

All this, it should be noted, is wholly orthodox Darwinian theory. Selection still acts on individuals. It is just that how it acts depends to some extent on how the animal acts, what kind of goals it pursues; and the environment in which an animal lives consists in part of other living things whose actions impact on the given animal. Selection is not entirely blind; there is a purposive element, even if no foreseeing of what the outcome will be.

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[9] See Maxwell, *The Human World in the Physical Universe* (2001, p. 174).

Nevertheless, the transition from Darwin(3) to Darwin(4) makes a profound difference, in my opinion, to the way one should view evolution. For the latter version of the theory, unlike the former, makes the actions of animals, our ancestors, a vital part of the explanation of our existence. Evolution is not just blind chance and necessity. Our animal ancestors, striving to live, to eat, to avoid being eaten, to mate, to rear young, are a vital part of the reason for our existence. They did not, of course, intend us to exist. Nevertheless, without their striving, we would not be here. We owe them a debt of gratitude.

Darwin(5). Once individual learning, and the capacity to imitate, have come into existence, evolution by cultural means[10] becomes possible – a kind of evolution that mimics Lamarckianism, in that acquired characteristics are (culturally) inherited. An individual learns to do something new, others imitate the action, and it becomes a persistent activity of the group, even though no genetic changes have taken place. Purposiveness has become a part of the mechanisms of evolution in a much more radical way. These mechanisms have themselves evolved in a much more substantial fashion.

Comments. As an example of evolution by cultural means, one might take the very well-known case of chimpanzees eating termites. An individual chimpanzee discovered that, by pushing a stick into a termite nest, leaving it there for a bit and then withdrawing it, termites, clinging to the stick, can be eaten off it. (Chimpanzees may have started by sticking fingers into termite nests, and then learnt that sticks serve better.) Other chimpanzees, imitating what this one chimpanzee does, learn to do likewise. The trick is then passed on, via imitation, to offspring (and others).

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[10] I employ the somewhat clumsy phrase "evolution by cultural means", and not "cultural evolution", because of the ambiguity of the latter. "Cultural evolution" might mean "evolution by cultural means", but in the relevant literature is generally taken to mean "the evolution of culture". Whereas "the evolution of culture" is about the evolution of a specific kind of thing – culture – "evolution by cultural means" refers to a specific manner in which evolution can proceed – by means of individual learning and imitation (or learning from others).

This is known to have emerged as a result of evolution by cultural means, and not as a result of some genetic change.

Evolution by cultural means is best understood as the development of a new method of reproduction. The characteristic way of life is reproduced, in part by the standard genetic means of sex, embryological development, birth and growth, but also, in part, by means of imitation. Reproduction by imitation makes possible quasi-Lamarckian evolution. An acquired characteristic – a new kind of action conducive to survival, learnt by an individual – can be passed on, by imitative reproduction, to offspring (and of course to others and their offspring).

In order to construe evolution by cultural means as involving a new, or additional, method of reproduction, it is essential to interpret the theory of evolution as being about *life*, ways of living, and not as being just about bodies – let alone genes or DNA molecules. But this is, I maintain, the proper way to construe the theory in any case. Certainly if the concern is to understand how human life has come to exist, this is the proper way to interpret the theory. Once Darwinian theory is interpreted as being about evolving *characteristic ways of life* (including bodies and genes as an integral part of a way of life), it becomes inevitable that evolution by cultural means is to be construed as the development of an additional *method of reproduction* (superimposed upon genetic reproduction). For it is just that: a new way in which a bit of a characteristic way of life (eating termites off a stick) can be passed onto offspring and others.

Evolution by cultural means requires that individual learning, and the instinct to imitate, already exist. If the Principle of Non-Circularity is to be observed, an evolutionary account of the development of these capacities must be forthcoming which does not presuppose these capacities, let alone evolution by cultural means itself. Why, then, should the capacity to learn, and to imitate, have survival value (and therefore be selected when appropriate mutations arise)? The capacity to learn quite clearly has survival value. Even a primitive organism such as a sea anemone, with only a simple neuronal net for a brain, can learn. But what of the instinct to imitate? I suggest this has survival value, and is likely to have evolved, when there is parental care.

Parents, just because they are parents, are likely to be good at survival and reproduction. Therefore, what they do is likely to have survival value. Hence, offspring imitating what they do is likely to have survival value. Thus, whenever there is parental care, and successful parents are around to be imitated, the instinct to imitate is likely to have survival value, as far as offspring are concerned.

Parental care is very ancient. Crocodiles, ancient beasts, engage in a form of parental care. It seems likely that dinosaurs did as well. So it may be that evolution by cultural means has its roots deep into our evolutionary past, well over 65 million years ago, and long before human beings existed.

Evolution by cultural means introduces an even more substantial element of purposiveness into the mechanisms of evolution. These mechanisms consist, in essence, as I have said, of two elements: (i) reproduction, with some inherited variation, and (ii) natural selection. The transition from Darwin(3) to Darwin(4) affects these mechanisms in affecting (ii), natural selection. This acquires some elements of purposiveness, as we have seen, even if it is not itself purposive, in that the outcome is not sought for, planned or intended. Evolution by cultural means introduces a more radical kind of purposiveness into the mechanisms of evolution by affecting (i) reproduction. The way of life is reproduced (with variation) in part by means of individual discovery and imitation. Both discovery, and imitation, are purposive (as understood in this context).

It may even be that the outcome is in part purposively intended. Cats and tigers teach offspring to hunt. Their actions may have the purpose of getting offspring to learn how to hunt skilfully and successfully.[11] Even in the pre-human, animal world, the outcome of elements of cultural reproduction may be purposively intended. If so, purposiveness here becomes an integral part of the mechanisms of evolution in a really substantial way.

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[11] What is at issue, here, is not whether the mother cat consciously knows what she is doing, but whether her actions have as their goal (whether consciously or not) to teach the kittens to hunt well.

Even though evolution by cultural means began long before human beings came into existence, it is above all with human beings that this form of evolution really comes into its own. As a species, we are very similar to others in all sorts of ways. We share 98.4% of our genes with chimpanzees. But in one dramatic way we are utterly unique. We are the product of evolution by cultural means to an extent far, far beyond anything found in any other species. It is this which accounts for the multitude of differences between us and all other species. Above all, of course, language is a product of evolution by cultural means. And language then makes endless other things possible, inaccessible to all other species. Art, science, democracy, justice, elaborate technology, planned social progress, even wisdom: these all become possible once there is language.

It is important to appreciate that evolution by cultural means, even though not itself involving genetic changes, may have an important impact on subsequent genetically determined changes. Consider again the dog-like creature running around, and hunting, on land. Suppose now that one individual, perhaps by accident, discovers that fish can be caught in a river, which are good to eat. Others learn by imitation. Many dogs spend time in the river hunting fish. Now a mutation appears making legs somewhat flipper-like. Given the new way of life, which has evolved culturally, flippers have great survival value, even though they would have been disastrous before the evolution by cultural means took place. The dog-like creature becomes a beaver-like creature, and evolution by cultural means led the way. It is a part of the reason for the evolution, from dog to beaver.

In reality, of course, such an evolutionary change would happen gradually, as a result of a combination of cultural and genetic changes, interacting with one another, over a long period of time. The really important point is that evolution by cultural means can have an impact on, can be an integral part of, genetically based evolution, the one intertwined with the other.

Almost certainly this took place in connection with the evolution of language. It seems reasonable to suppose that an elemental language came into existence first, perhaps by evolution by cultural means. Chimpanzees have three words in their

vocabulary, one for snake, another for tiger. Once a primitive language exists, one can easily imagine that selective pressures exist for being good at speaking and understanding language. Perhaps this is required to mate, and have offspring. Perhaps men have more mates if they are good at speaking. Random genetic changes that produced brains, muscles and larynxes good at speaking would, in these circumstances, be selected for. Our human capacity for language would have evolved by means of an intricate interweaving of cultural and genetic developments, often called gene-culture *coevolution*.

A small but telling example of such coevolution in humans is cited Boyd and Richerson, *Culture and the Evolutionary Process* (University of Chicago Press, 2005, pp. 191-192). Most of the world's adults can't digest milk. Infants can but adults cannot. They lack an enzyme required to digest lactose, the sugar in milk. However, in those regions that have long had a history of keeping cows and dairying – Europe, parts of Africa and Asia – most adults can digest milk. The ability to drink milk is due to a single gene, widespread in those areas that have a history of dairying. As a result of learning to keep cows – an example of cultural evolution – the gene for digesting milk has survival value, and spreads in dairying populations, something it does not do in populations which do not keep cows.

Evolution by cultural means has been construed in a very different way by Richard Dawkins, not as a new *mechanism* of evolution, but as the creation and replication of a new kind of entity – the *meme*. A meme is a scrap of culture – a slogan, a song, an idea. Memes inhabit brains, and replicate themselves by being transmitted from one brain to another, somewhat analogously to the way genes inhabit bodies.

It is not surprising that Dawkins should construe evolution by cultural means in these terms. His gene-centred, purpose-depleted vision of evolution obstructs thinking of evolution by cultural means as the development of a new, quasi-Lamarckian method for the reproduction of purposive ways of life, grafted onto genetic reproduction. Meme replication and evolution seems to mimic gene replication and evolution; it is understandable, therefore, that

Dawkins should want to construe evolution by cultural means in these terms.

How do the two versions of evolution by cultural means compare? Darwin(5) is broader in scope, in that new actions that have evolved by cultural means, such as the chimpanzee trick for getting termites to eat, need not constitute memes. Darwin(5), because of its emphasis on the evolution of *purposive action*, brings to the fore, and renders explicable, the way in which evolution by cultural means can have an impact on subsequent evolution of bodily changes determined genetically, in a way in which Dawkins' meme view cannot. In other words, Darwin(5) brings to the fore the fact that non-genetic evolution of behaviour can help bring about subsequent evolution brought about by genetic changes. Finally, and following on from the last point, Darwin(5) very strikingly reveals how elements of purposiveness can be incorporated into the *mechanisms of evolution* themselves. The view helps us understand how Darwinian evolution of animal life can, seamlessly, become purposive human history. The meme view does not do this.

Do those concerned with evolution – biologists, anthropologists, archaeologists, psychologists and others – appreciate just how fundamentally evolution by cultural means transforms the orthodox conception of Darwinian evolution? I am not at all sure that they do.

For the first six or seven decades of the 20th century, social scientists treated cultural or social evolution of humans as if this were quite distinct from Darwinian evolution.[12] But then, associated with an explosion of interest in Darwinian theory, social scientists began to appreciate that Darwinism has far-reaching implications for the social sciences, and for social or cultural evolution in particular. Around 1980, a number of evolutionary thinkers realized that cultural evolution cannot be dissociated from Darwinian evolution because genetic and cultural evolution

[12] Donald Campbell put the matter like this. Having referred to a body of work by social scientists on social evolution published between 1950 and 1970, he remarks "In all of this, social evolution is seen as a separate process from biological evolution, although made possible by it": Campbell, *American Psychologist* (vol. 30, 1975, p. 1104-1105).

interact with one another. Works began to appear that recognized this interplay of genetic and cultural evolution, or *coevolution*. There is, for example, *Culture and the Evolutionary Process* by Robert Boyd and Peter Richerson (1980), and their subsequent *Not By Genes Alone* (2005); there is *Human Culture: A Moment in Evolution* by Theodosius Dobzhansky[13] and Ernest Boesiger (1983); there is *Coevolution: Genes, Culture, and Human Diversity* by William Durham (1991); and there is *The Evolution of Culture* edited by Robin Dunbar *et al.* (1999). Then there are a number of works that propound some specific theory concerning some aspect of human evolution, but in a way which presupposes gene-culture coevolution, such as *The Scars of Evolution* by Elaine Morgan (1990), *Grooming, Gossip and the Evolution of Language* by Robin Dunbar (1996), and *The Mating Mind* by Geoffrey Miller (2001). Social scientists, as one might expect, tend to concentrate on evolution by cultural means as it affects human evolution. Others have, however, studied evolution by cultural means in animals: see, for example, *The Evolution of Culture in Animals* by John Bonner (1980). A book that covers both is *Social Evolution* by Robert Trivers (1985).

In view of the extensive literature on gene-culture coevolution (of which the above is but a glimpse), what grounds can I possibly have for declaring that evolutionary biologists do not sufficiently emphasize the fundamental role of *purposive action*, of behaviour, learning and culture in evolution? What I find lacking is an awareness of just how widespread and fundamental is the role that goal-pursuing action plays in evolution, and how dramatically the theory needs to be reformulated to take this role fully into account. It means that the theory needs to be reformulated to take into account that *the mechanisms of evolution themselves evolve* as purposive action, learning, imitation, culture and evolution by cultural means come to play increasingly significant roles.

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[13] In this book the interaction of cultural and gene-based evolution is at least acknowledged, although earlier, as we shall see, Dobzhansky dismissed the so-called "Baldwin effect": see Dobzhansky (1970, p. 211).

Darwinians are scornful of the idea that the actions of the giraffe's ancestors, in stretching to eat leaves high up in trees, had any causal role in producing the present-day giraffe's long neck. This, it is claimed, is utterly discredited Lamarckism. Thus do Darwinians reveal their failure to appreciate just how fundamental is the role of purposive action in evolution. For, of course, Lamarck is right – or partly right. *The stretching of the neck of the giraffe's ancestors does play a vital causal role in the subsequent development of the giraffe's long neck*. Stretching does not directly cause offspring to have longer necks. There is here no inheritance of acquired characteristics. But if ancestors had not stretched their necks, the modern giraffe would not possess its long neck. Ancestors stretching their necks to reach leaves good to eat is not *sufficient* for offspring to develop long necks. But it is *necessary*. Only then do mutations that lead to longer necks have survival value, and thus spread through the population. It is reasonable to hold that, throughout the animal kingdom, purposive action leads the way. Beaks, teeth, tusks, camouflage, claws, muscles, horns, hooves, digestive systems, and other bodily characteristics only develop because animals are living in a certain way in a certain environment and, relative to these, the bodily characteristics in question have value from the standpoint of survival and reproductive success. As I have said life unknowingly *breeds itself into existence*.

Thus, how an animal lives crucially affects what has survival value, and this in turn crucially affects the animal's evolution. In particular, changes in the way a kind of animal lives, which may come about because of genetic changes, environmental changes, or evolution by cultural means, can have dramatic consequences for that animal's subsequent evolution. It may well be that changes in ways of life play the leading role in evolution.[14]

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[14] To the demand that evidence is required to substantiate this thesis, my response would be that the thesis is an all-but straightforward implication of Darwinism. Changes in ways of life are bound to change what has value for survival and reproductive success, and this in turn over time is bound to have consequences for gene-based evolution in a majority of cases. Furthermore, changes in ways of life are bound to occur, as a result of environmental changes, changes of habitat, changes in

I remember well the way in which my whole perception of evolution changed dramatically as a result of becoming aware of the all-pervasive influence of purposive action on evolution, some time in the late 1960s. This came about as a result of three events. First, there was a stray remark of J. Z. Young during a lecture at University College London on the brain. He remarked that the way an animal's memory worked would depend on how it lived. With a shock I realized the obvious: evolution designs brains, and therefore minds. And how an animal lives affects how it evolves. The second event was a remark of Karl Popper during a lecture at the London School of Economics. He made the point that fish acquired the capacity to emerge from the sea and live on land only because certain fish took to living in shallow water near beaches, thus becoming stranded in pools every now and again as the tide retreated. Living in this way, developing the capacity to breathe air, and move across land, would have had great survival value, something which would not have been the case for fish living in the deep ocean. How the animal lives, in short, crucially affects its subsequent evolution. Purposive action, and *changes* in purposive action, may well be at the leading edge of animal evolution quite generally. The third event was reading Alister Hardy's *The Living Stream* (1965), of which more in a moment.

The outcome was a profound shift in the whole way in which, it seemed to me – and still seems – evolution needs to be understood. The actions of animals, our ancestors, in the past, for millions of years, have had a vital role to play in bringing about our existence. Evolution is not just blind chance and necessity, to quote the title of a book by Jacque Monod (1974). Our animal ancestors, striving to live, to eat, to avoid being eaten, to mate, to rear young, are a vital part of the reason for our existence. They did not, of course,

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predators, food supply, or competitors, or changes brought about by learning. The boot is on the other foot. What requires establishing is that changes in ways of life only rarely affects subsequent gene-based evolution. In the absence of evidence for this thesis, we should adopt the Darwinian view that changes in purposive action widely, even generally, lead the way in subsequent gene-based evolution.

intend us to exist. Nevertheless, without their striving, we would not be here. We owe them a debt of gratitude.[15]

Major development in Darwinian theory took place around 1930 with the rediscovery of the work of Mendel on genetics, and its incorporation into the theory of evolution, and associated with the work of R. A. Fisher (1930), J. B. S. Haldane (1932) and Julian Huxley (1942).[16] We ought to recognize that a similarly dramatic development in Darwinian theory took place some time in the 1980s with the incorporation of elements of Lamarckism into the theory. Lamarck was wrong to hold that acquired physical characteristics are inherited. He was right, however, in his view that purposive action plays a vital role in subsequent evolution of physical characteristics. And he was right to hold that acquired characteristics are inherited: this occurs in evolution by cultural means, the acquired characteristics being learned purposive actions that are passed on by imitation. Lamarck did not get everything right, but who does? Even Darwin made mistakes.

Why has the vital role that purposive action plays in Darwinian evolution not received the proper emphasis it deserves in modern accounts of the theory? A part of the reason may be that discredited Lamarckism has formed an intellectual barrier in the minds of evolutionists to recognizing the Lamarckian character of Darwinian evolution.[17] Another, possibly related reason, has to do with a failure of evolutionary biologists to get the history of the idea right. The idea that evolution by cultural means can have an

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[15] For my earlier accounts of this purposive version of Darwinism see the references given in note 8.

[16] Fisher, R.A., *The Genetical Theory of Natural Selection* (1930, Clarendon Press); Haldane, J. B. S., *The Causes of Evolution* (1932, Longmans); Huxley, J. S., 1942, *Evolution: The modern synthesis* (1942, George Allen and Unwin).

[17] Orthodox Darwinians do, it is true, acknowledge the Lamarckian, or "quasi-Lamarckian", character of evolution by cultural means: see, for example, Cronin (1991, p. 373). Boyd and Recherson (1985) are prepared to say that cultural evolution creates "a kind of 'Lamarckian' effect" (p. 9). But the Lamarckian character of Darwinian evolution *per se* is not acknowledged. On the contrary, it is fiercely resisted. This further substantiates my point that orthodox Darwinians do not fully recognize and acknowledge the vital and general role that purposive action plays in evolution.

impact on subsequent gene-based evolution is usually attributed to Mark Baldwin, and is usually known as "the Baldwin effect". Baldwin did indeed publish a version of the idea long ago in 1896.[18] G. G. Simpson appears to have introduced the phrase "The Baldwin Effect" (Simpson, 'The Baldwin Effect, *Evolution* 7, 1953, pp. 110-117). It is extensively discussed in Daniel Dennett's *Darwin's Dangerous Idea*.[19] There is even an entire book devoted to the subject, the outcome of a conference, with the title *Evolution and Learning: The Baldwin Effect Reconsidered* (Weber and Depew, 2003). But the idea did not come, originally, from Baldwin. And in so far as Baldwin expresses the idea, he does so badly. Some of the modern accounts of the idea are even worse.[20] As expressed by Simpson, and by many since who have followed him, "the Baldwin effect" amounts to this. A new kind of action in a group of animals that comes about as a result of learning, is eventually determined genetically. But this falls to the obvious objection: if an animal has learnt to act in a certain way, what possible value for survival and reproductive success can there be in having this learnt action become such that it is determined genetically? There would be no selective pressure for this to occur. And "the Baldwin effect" has been dismissed on just these grounds, by Simpson (1952), by Mayr, E. 1963, *Animal Species and Evolution* (1963, Oxford University Press, pp. 610-612), by Dobzhansky (1970, p. 211), and others. Depew, for example, puts the objection like this: "If learned behaviors are so effective in getting a useful trait passed from generation to generation at the cultural level, there will presumably be no selection pressure for the spread of genetic factors favoring that trait" (Weber and Depew, 2003, p. 15).

But all this represents a catalogue of errors. Evolution by cultural means was first put forward independently by Lloyd Morgan, C., (*Science*, 4, 1896, pp. 733-740), and Osborn, H.F.

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[18] See Baldwin (*Science*, N.S. 3, 1896, pp. pp. 438-441 and 558-561; 1896, *The American Naturalist*, 30, pp. 354-451 and 536-553).

[19] Dennett, 1996, *Darwin's Dangerous Idea* (1996, Penguin Books, pp. 77-80, 190, 300, 322-3, 338, 374, 403n, 463).

[20] Dennett's characterization of "the Baldwin effect" is peculiarly opaque for an author usually so lucid: for the reference, see previous note..

(*Science*, 4, 1896, pp. 786-789). Baldwin took the idea from Lloyd Morgan, subsequently took the credit for it, and then failed to do the idea justice.[21] Lloyd Morgan's idea, of course, is not that a new kind of purposive action, passed on by imitation, eventually becomes determined genetically, but rather that new purposive actions generate new selective pressures, and mutations which create traits which *facilitate* the new actions will be selected for. Thus, if a dog-like creature takes to catching fish in rivers, it is not this new action which will become genetically determined: rather, mutations which tend to transform legs into flippers will be selected for, given the new way of life. Evolution by cultural means has not been given the importance it deserves in part because it has so often been understood in a peculiarly bungled form, which renders the idea untenable. Finally, as we have seen, it is reasonable to hold that purposive action plays a vital and widespread role in evolution even when evolution by cultural means is not involved. Cultural evolution may not have been involved in the giraffe acquiring its long neck, but purposive action was involved.[22]

There is one book that does do justice to the idea that purposive action is at the leading edge of Darwinian evolution – and to the history of the idea: Alister Hardy's *The Living Stream* (1965). Hardy sums up the idea as follows:

> If a population of animals should change their habits (no doubt, often on account of changes in their surroundings such as food supply, breeding sites, etc., but also sometimes due to their exploratory curiosity discovering new ways of life, such as new sources of food or new methods of exploitation) then, sooner or later, variations in the gene complex will turn up in the population to produce small alternations in the animals structure which will make them more efficient in relation to their new

[21] See Hardy, A., *The Living Stream* (1965, Collins, pp. 164-169), and Bateson, P. 2004, (*Biology and Philosophy* 19, 2004, pp. 286-289 and 290-291).

[22] Darwin(4) incorporates purposive action into the mechanisms of evolution but does not involve evolution by cultural means.

> behaviour pattern; these more efficient individuals will tend to survive rather than the less efficient, and so the composition of the population will gradually change. This evolutionary change is one caused *initially* by a change in behaviour (Hardy, 1965, p. 170).

Hardy begins with the evolution of camouflage, the effectiveness and cleverness of which is the outcome of perceptive predators seeing through early ineffective efforts – a clear case of unknowing breeding. He then goes on to expound and illustrate the way in which Lamarckian evolution by cultural means has consequences for subsequent gene-based evolution. And he discusses the history of the idea: the contributions of Lloyd Morgan, Osborn and Baldwin, and the subsequent contributions, of one kind or another, by Simpson (1953), Huxley (1942), C. H. Waddington (*The Strategy of the Genes*, 1957, Allen and Unwin) and others. He quotes E. S. Russell (1916)[23] as declaring "We need to look at living things with new eyes and a truer sympathy. We shall then see them as active, living, passionate beings like ourselves, and we shall seek in our morphology[24] to interpret as may be their form in terms of their activity" (Hardy, 1965, p. 181). He quotes E. Schrödinger (1958) as asserting that "Without changing anything in the basic assumptions of Darwinism we can see that the behaviour of the individual , the way it makes use of its innate faculties, plays a relevant part, nay, plays the most relevant part in evolution" (Hardy, 1965, p. 189).[25] Hardy also quotes a passage from James Hutton which beautifully expresses a version of the idea, written "a hundred years before Lloyd Morgan and Baldwin put forward their versions of the theory…eleven years before Charles Darwin was born and twelve years before Lamarck first published his evolutionary views" (Hardy, 1965, p. 179).

Given all this, one might suppose that Alister Hardy is, today, hailed as a major figure in launching the idea that purposive action

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[23] Russell, E. S. *Form and Function: A Contribution to the History of Animal Morphology* (1916, John Murray.

[24] The study of the form of living things.

[25] Unfortunately, as Hardy points out, Schrödinger goes on to retract much of the content of this splendid brief statement of the basic idea.

plays a key role in evolution – the key idea of what I have called Darwin(4) and Darwin(5). Not at all. He is rarely mentioned. Boyd and Richerson (1980) and (2005); Durham (1991); Dunbar (1996) Dunbar *et al* (1999), Miller (2001), Bonner (1980), and Trivers (1985) make no mention of Hardy whatsoever. Dennett (1996) does refer to Hardy, but only as the author of the aquatic ape hypothesis, and in connection with Elaine Morgan's long-standing and brilliant championing and development of the idea. Even Morgan does not refer to Hardy's *The Living Stream*, although much of her work illustrates the key idea of that book.[26] Peter Bowler's *Evolution: the History of an Idea* (2009) does mention Hardy, but only to say "Hardy (1965) openly endorsed the Baldwin effect" (p. 367). Furthermore, this is in the context of discussing Arthur Koestler's anti-Darwinian ideas.[27] Of the 14 contributors to *Evolution and Learning: The Baldwin Effect Reconsidered* (Weber and Depew, 2003), only one mentions Hardy, and only very briefly and obliquely, in connection with a letter of Waddington to Hardy (p. 146). There is, however, a critical essay review of the book by Patrick Bateson (2004) which emphasizes the importance of Hardy's contribution, and refers to the work of others along similar lines as well.

Alister Hardy's own explanation for the neglect of his thesis and book was that, in the penultimate chapter he went on to defend telepathy. This may well have played a role. In any case, the continuing neglect of Hardy's work is symptomatic, I claim, of a continuing failure, on the part of evolutionary biologists and social scientists, to do justice to the profound transformation in Darwinism that is brought about when one acknowledges the vital and general role that purposive action plays in evolution. Only

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[26] The aquatic ape hypothesis holds that pre-human ancestors lived on the shores of rivers, lakes and the sea, and spent time in the water, many of our bodily characteristics stemming from that way of life. This illustrates the general idea that a way of life has consequences for gene-based evolution.

[27] But to be fair to Bowler, he gives a good brief formulation of the misnamed Baldwin effect: "new habits are supposed to determine which genetic variations are most useful" (Bowler, 2009, p. 367). The word "supposed" here does not, however, exactly inspire confidence.

then does one recognize that the mechanisms of evolution themselves evolve, as they assign increasingly important roles to purposive action, and become Lamarckian in character, as we have seen.

So far nothing has been said about sentience or consciousness. I now repair that omission with the next version of Darwinism.

Darwin(6). Sentience. Purposive explanation becomes increasingly important as we move from Darwin(3) to Darwin(5). At a certain time (or perhaps independently at a number of different times) living creatures became *sentient*, and what may be called *sentient* explanation became relevant to evolution, in Darwin(3) to Darwin(5) ways. (Sentient explanations take the inner sensations of the creatures in question into account. All sentient explanations are purposive, but not *vice versa*.)

We saw in chapter 3 that the experiential cannot be derived from science that is reducible (in principle) to physics. We can take this to imply that sentient explanations cannot be derived from purposive ones. This means Darwinian evolution cannot, even in principle, explain how the sentient has emerged or evolved from the non-sentient, purposive, neurological and physical. Necessary and sufficient neurological conditions for sentience do however, presumably, exist, and we can speculate as to what these may be. Elsewhere I have suggested that sentience emerges with the transition from what may be called *sequential* to *motivational* control.[28]

There is a wasp that lays its egg and then flies around, clutching the egg, looking for a suitable hole in the ground in which to bury it. When it finds a candidate, it puts the egg down at a fixed distance from the hole, goes into it to see if it is suitable and, if it is, comes out, fetches the egg and buries it. All this looks as if the wasp knows what it is doing. However, if the egg is moved a bit further away while the wasp is investigating the hole, the wasp will emerge, pick up the egg, place it at the fixed distance from the hole, and then investigate the hole again for suitability. This can

[28] See Maxwell, *The Human World in the Physical Universe* (2001, ch. 7, and especially pp. 180-185).

be repeated many times. Evidently, the wasp is led by its brain to do one specific kind of action (fly around looking for a hole, or put the egg down at a fixed distance from the hole, etc.) until, it is triggered to move onto the next specific action in the sequence of actions. The wasp has no idea of its overall goal (to bury the egg in the ground). It achieves this goal by achieving a sequence of precisely specified intermediate goals, the completion of one triggering pursuit of the next in the sequence. This is what I mean by "sequential control".

It is very different, I surmise, from the way tigers are controlled by their brains to go hunting. The overall goal – eating food – is actively represented in the tiger's brain, and the brain has to work out what actions have to be performed if the goal is to be realized. This means the tiger may, on different occasions, perform different actions in order to attain the final goal of eating. This is what I mean by "motivational control".

I conjecture that it is the transition from sequential to motivational control which leads to the emergence of sentience. The goal of eating, represented in the brain by means of characteristic neurological activity *is*, for the tiger, the *feeling* of hunger, the *desire for food*.

From the standpoint of survival value, motivational control has the great advantage over sequential control that it is flexible. It is open to leading to a variety of different actions in different circumstances, in ways in which the rigid sequence of specific actions of sequential control is not. Motivational control makes *learning* possible, in ways in which sequential control does not. On this view, then, feeling and desire are at the core of sentience, and sentience evolves so that actions of animals can be specified in an open-ended, flexible way, allowing for learning, and for actions to be adapted to circumstances.

It is often remarked that what matters, from a Darwinian perspective, is what you *do*, how you *act*, not what your inner *feelings* and *desires* are. Darwinian evolution thus seems peculiarly ill-equipped to help explain how and why sentience and consciousness have come into existence. From a Darwinian perspective, acting *as if* sentient or conscious is just as good as actually *being* sentient or conscious (assuming that sentience and

consciousness confer some selective advantage). From a Darwinian perspective, it seems, we might as well all have been zombies.

This echoes the problem we encountered in the last chapter, in connection with free will. The solution put forward there must be employed here. In our world, zombies are not possible. Brains that perform sufficiently sophisticated motivational control are automatically sentient.

It may be asked: Which comes first, evolution by cultural means or sentience? Does learning and imitation, of the kind required for evolution by cultural means, presuppose sentience? My guess is that it does (although it would seem to me possible to design non-sentient robots able to participate in evolution by cultural means).

Darwin(7). From sentience there emerges consciousness. Conscious action begins to play a role in evolution, in ways specified by Darwin(3) to Darwin(5) for purposive action. That is, conscious action replaces unconscious - even insentient - purposive action. Conscious beings choose mates, rear offspring, make discoveries and imitate the discoveries of others, aware of what they are doing.

Comments. What factors are behind sentience evolving into consciousness, as we human beings know it? I suggest three: (a) imagination, (b) personalistic (or empathic) understanding of others (and so of oneself), and (c) language. Let us take these in turn.

(a) To imagine you are climbing a mountain (when you are not doing anything of the kind) is to give yourself experiences somewhat like what you would have were you actually to be climbing a mountain. It is, in other words, to make occur in your brain neurological processes somewhat like those that would occur if you were actually to be climbing a mountain. Being able to imagine clearly has potential survival value. It means you can try things out in the imagination, thus learning from imaginative failure and success, far less risky, far less time and energy consuming, than trying things out in reality. Better to die in the imagination, than die in reality. I have suggested that it may be the function of dreaming to develop the capacity to imagine in the

individual who dreams. Imagination makes possible a vast increase in the arena of action. As a result of imagining one is at other places, other times, it becomes possible to become aware of distant places and times - both the distant past and future. The discovery of the inevitability death becomes possible - something likely to have had a big impact on human evolution and history. It may well be that it is the development of the capacity to imagine that is the crucial step from sentience towards human consciousness. For it is this that makes inner action possible - doing things in the imagination. This would seem to be the crucial distinction between consciousness and sentience - whether one can do things internally, in imagination - act, explore, think, ponder, question - or whether one is condemned merely to feel, to desire, to experience sensations. We can perhaps see, however, how imagination could develop from motivational control. To have actively present in your mind the goal you seek to achieve - food, a mate - is already close to imagining you are doing what you are not: eating freshly killed prey, mating. On this view, motivational control first spawns sentience, then imagination, then consciousness.

(b) Being able to imagine you are doing things that you are not doing makes it possible to imagine that you are a person that you are not. It makes personalistic understanding possible, in other words.[29] Being good at understanding others can clearly have survival value when animals or humans are living socially. It is needed to divine the intentions of others, to form alliances and friendships, and perhaps to mate and reproduce. As a result of

[29] One might think that personalistic understanding of others is a straightforward specific use of imagination. It may be, however, that understanding others develops separately from the development of the ability to imagine, and uses different parts of the brain. The discovery of so-called "mirror" neurons, used to understand others "empathically" or personalistically, would seem to suggest that this is the case – although this role of mirror neurons has been called into question. That being able to imagine is distinct neurologically from being able to understand others is further suggested by autistic people, who may have vivid imaginations, and yet be poor at understanding others (imagining they are other people).

understanding others, one understand that others understand one's self, which in turn can create an awareness of discrepancies between how others see one, and one's own experiences of one's self. It is this awareness of this discrepancy, I suggest, which creates self-consciousness. As a result of becoming aware of others' awareness of oneself, one becomes are of what those others are not aware of and do not experience: one's own experiences. Thus one acquires self-consciousness.

(c) It has been shown by Paul Grice[30] that human communication involves, quite essentially, multi-layers of mutually understood intentions. If I am to communicate with you by means of language, I must intend this, you must understand that I intend it, and I must understand that you understand. These multi-layers of implicitly understood intentions will have evolved gradually from their beginnings in primate, one layered animal communication. Let us suppose A communicates to B. Human communication, I conjecture, has evolved by means of the following steps:

(i) A acts in its own interests, for example goes rapidly into flight to avoid a predator; B takes this behaviour as an indication of something (in this case danger), for him, and acts accordingly.

(ii) In addition, A does something which is such that the sole purpose of it is to communicate to B, even though A has no such conscious intention. Here A might squawk as it goes into flight in a manner characteristic for that species in such circumstances; B reacts accordingly.

(iii) In addition, A has the purpose of signalling to B since, if A knows that it is on its own it will not signal (e.g. squawk).

(iv) In addition, A has the purpose of communicating the message of the action to B, so that, in the case of the squawk, the bird squawks in order to warn B. If B is present but in no danger then the bird does not squawk.

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30. Grice, H.P., 'Meaning', *Philosophical Review*, 66, 1957, pp. 377-388; reprinted in Grice, *Studies in the Way of Words* (1989, Harvard University Press, ch. 14). Grice makes no attempt, however, to indicate, as I have done here, the manner in which the multi-layered character of human communication can be seen as having emerged gradually as a result of Darwinian evolution.

(v) B understands the message, the meaning of the squawk.

(vi) A has the purpose of B understanding the meaning of the message.

(vi) B understands this too.

(vii) A intends B to understand this.

And so on (the multi-layers of mutual understanding, initially profoundly significant, as one goes on further, becoming increasingly insignificant).

Communication and language evolve in tandem with the evolution of consciousness and personalistic understanding (or empathy), each requiring, but also enriching, the other two. Communication up to (iii), or perhaps (iv), does not require conscious intention and personalistic understanding, but from (iv) or perhaps (v) onwards, the kind of communication involved does require consciousness and personalistic understanding.

One profoundly significant consequence of imagination is that it enables the imagining creature vastly to increase the arena of its actions. As a result of imagining one is doing what one is not doing, it becomes possible to imagine one is doing things at other places and times: one can become aware of distant places, the distant past and future. The discovery of the inevitability of death becomes possible. Long term conscious planning becomes possible. All this will be further strengthened and enriched by the associated development of personalistic understanding, language and communication and, with these, the development of a common, shared public world. These developments make possible:

Darwin(8). Ways of life evolve as the outcome, in part, of conscious actions. Darwinian evolution gives rise to history.

Comments. In order to understand how and why human affairs evolve as they do, one must take note of the conscious intentions and actions of people. This is not to say that what happens is invariably the outcome of what people intend. People's intentions and plans conflict: there are winners and losers. Often there are no winners, and the outcome is intended by no one. And quite apart from conscious intentions and actions, natural phenomena also play their part: storms, droughts, plagues, earthquakes. There are

also the unintended consequences of human actions to be taken into account as well: traffic congestion, depletion of natural resources, extinction of species and environmental degradation, climate change.

There is a tendency to think that history is associated exclusively with human beings. There are grounds for holding, however, that this is not quite correct. Even chimpanzees produce history, to a limited extent. Groups of chimpanzees engage in power struggles, alliances, long-standing disputes, and even war.

Among the dramatic consequences that the emergence of consciousness has for the evolution of ways of life, two that deserve to be highlighted are (1) the discovery of the inevitability of death, and (2) conflict over control of way of life. Let me take these in turn.

(1) The discovery of the inevitability of death. It seems likely that most mammals, being confined to the here and now, do not realize that their eventual death is inevitable. Once our imagination has roamed far and wide, however, we can foresee a time in the distant future when we will grow old and die. Imagination has expanded the arena in which we act and live sufficiently to encompass our future death. Granted that evolution assigns to us survival and reproductive success as our fundamental goals in life, all other gaols being means to these ends, the discovery of our inevitable death must be traumatic indeed. Imagination, which made the discovery, quickly steps in and seeks to find ways to evade the grim news. It is our imagination that creates the possibility that death is but the beginning of a journey to another, and possibly happier, place. Anthropologists take burial remains as a good indication of early human culture. Often, burial remains include pots of food to help the traveller on his or her way to life after death. As history has unfolded, people have found other ways to try to cheat death, besides having children: memorials, pyramids, enduring art, contributions to science, thought and literature, fame, conquest, institutions and corporations. Death remains a potent problem in human life. Discovering how to cope with its inevitability is no doubt important if one is to achieve a happy, mature way of life.

(2) It is reasonable to hold that most mammals do not consciously plan their way of life. They consciously[31] plan what they do from minute to minute, but the way of life is planned by an unconscious master control system, which directs consciousness to seek appropriate goals – food, shelter, mating, fighting, rearing of young – by planting into consciousness relevant desires and feelings of hunger, fear, desire, by means of hormones, sugar content in the blood, etc. The master control system pulls the strings, and consciousness leaps to obey. Consciousness is the slave of the master control system, and remains so as long as imagination is not sufficiently developed to enable consciousness to become aware of what lies beyond the immediate here and now. But the moment imagination, helped out by personalistic understanding and language, becomes aware of the distant past and future, and other places, it becomes possible for consciousness to attempt something evolution has not equipped it to do: take charge of, and plan, the way of life. As long as people lived in hunting and gathering tribes, living from day to day more or less as chimpanzees do, the potential conflict between the master control system and consciousness would not have been too pronounced. It is when humanity departed from the hunting and gathering way of life by taking to agriculture, which requires conscious action directed towards long-term goals (planting, weeding, growing and harvesting of crops), that the conflict would have become active, consciousness grappling with and seeking to over-ride the master control system, and all too often failing in the attempt. This conflict lies at the heart of our existence today. The master control

[31] I am employing "consciously plan" somewhat ambiguously here. I assume sentient animals may, in some sense, be said to "consciously plan" actions, from moment to moment, even if these animals are not fully self-conscious in the way we human beings are. I also assume that animal moment-to-moment "conscious acting" is a precursor of our "conscious acting", ours having evolved from the more primitive version to be found in animals. This is, perhaps, the key to consciousness. At its most primitive, it is what controls action, in ordinary circumstances, from moment to moment, in sentient animals. It is this that is enriched with the evolution of (a) imagination, (b) personalistic understanding and (c) language, to become human self-consciousness.

system is especially good at tricking consciousness into thinking it is in charge when actually it is the master system which controls the action. Rationalization, in other words, is rife in human affairs. Distorted versions of the conflict emerge in religions, and in psychoanalytic theory. We have still failed to get it properly into perspective. What is required, of course, is that we acknowledge the existence and nature of the conflict, and find the best way to resolve the conflicts that will inevitably arise as we live.[32]

Darwin(9). History is under conscious control in pursuit of life of greater value, in so far as such a thing is possible.

Comments. For this to come about, it is essential that humanity adopts and implements wisdom-inquiry and its methodology, aim-oriented rationality.[33] Seen in this light, wisdom-inquiry and aim-oriented rationality complement and complete Darwinian theory. Darwinian theory, properly understood, brings graphically to the fore that the fundamental task that lies before humanity is (1) to get conscious control of history, and (2) to discover how life-aims, bequeathed to us by evolution and history, can be transformed into the aim of discovering and realizing what is of value in life. Crudely put, our fundamental problem is to transform the Darwinian life-aims of survival and reproductive success into the life-aims of survival, reproduction and enrichment of *life of value*. Our evolutionary and historical past has ill-equipped us for this task. Evolution manufactures species in great abundance able to adopt a great variety of means to realize a *fixed* aim: survival and reproduction. Nothing in evolution has equipped us to *transform* our basic life aim. Our culture, inherited from the past, is not designed to help. Far from helping us progressively *improve* our life aims towards promoting *life of value*, all too often it disguises from us the real nature of our aims. This is true even of one of our

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[32] My comments on Darwin (4) to Darwin(8) are based on, and develop, earlier remarks of mine on evolution: see works referred to in note 8.

[33] See N. Maxwell, *From Knowledge to Wisdom* (1984, Blackwell; 2nd ed., 2007, Pentire Press); *The Comprehensibility of the Universe* (1998, OUP); *Cutting God in Half - And Putting the Pieces Together Again* (2010, Pentire Press); and *How Universities Can Help Create a Wiser World* (2014, Imprint Academic).

most successful endeavours, science – as we saw in chapter 5. As yet, we have not even appreciated the nature of our problem: to transform our basic life aims – personal, institutional, global. We have failed to grasp what we require to help solve this fundamental problem, namely wisdom-inquiry, and aim-oriented rationality. Even philosophers ignore the fundamental problem: *What kind of inquiry can best help us make progress towards as good a world as possible?. What kind of inquiry can best help all of value in our human world to flourish embedded as it is within the physical universe?*[34]

During the time that it has taken me to write this book, three global issues have demonstrated graphically just how disastrous is our failure to put aim-oriented rationality and wisdom-inquiry into practice – our failure, indeed, even to have the idea that this is what we need to do!

The first is George Bush's disastrous "war against terrorism", a war fought in such a way that it has all-but transformed the USA into a terrorist nation itself, and has acted as a magnificent recruiting agent for terrorists. The failure even to consider that the

[34] In other words, Darwinian theory, properly appreciated, powerfully endorses the point, at present almost universally ignored, that it is of fundamental importance for us to build wisdom-inquiry and aim-oriented rationality into our social world and culture, if we are to enhance our capacity to realize what is of value in life. But this point is also powerfully endorsed by the compatibilist view of free will I argued for in chapter 7. According to that compatibilist view, any free will we possess in excess of that possessed by chimpanzees, let us say, is due in large part to our language and culture, our technology and social institutions. Brought up without these, like Truffaut's wild child, our free will – our capacity to realize what is of value – would not amount to much more than that of a chimpanzee. In order to enhance our free will – and enhance free will in the sense of the capacity to realize what is of value in life – it is vital that our social world and culture is designed to facilitate their flourishing. Darwinian theory, wisdom-inquiry and compatibilism form a kind of interlocked trinity, each component powerfully reinforcing the other two.

aims being pursued might have almost the opposite consequences to genuinely desirable ends could hardly be more obvious.[35]

The second is the global financial crisis of 2008. It should have been obvious, some years before that date, that international banking was being conducted in an unsustainable way. All that would be required to bring the financial system crashing down was a fall in property values, a crisis of confidence. A few voices did indeed cry out that we were heading towards disaster, but they were ignored. There was the most elementary failure to consider the likely dire consequences of pursuing the then current aims of banks a mere ten years into the future. Nothing could demonstrate more graphically our failure to understand the need for, let alone implement, basic ingredients of aim-oriented rationality.

The third global issue I have in mind is global warming. This again illustrates the profoundly problematic character of basic aims. At one time it seemed that the aim of developing modern industry, transport and agriculture on a world-wide basis could only be good. Unfortunately, among other undesirable consequences, it leads to an increase in carbon dioxide in the atmosphere which, in turn, leads to a rise in average global temperatures, the melting of glaciers and polar icecaps and the rising of sea levels. If we continue as we are, we face catastrophe. What once seemed so desirable now threatens our existence. We have known about impending global warming since 1960, if not earlier, but it has taken a very long time for those with the power to determine what we do – politicians, industrialists, entrepreneurs – to begin to consider what needs to be done to cut CO_2 emissions down. A perceived threat from a neighbouring country could galvanize a nation to prepare for war in a matter of months. Global warming, which threatens the very future of humanity is, it seems, too impersonal or unfamiliar to provoke a similar response. So far we have failed to change our lives in the ways required to avoid

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[35] See, for example, N. Maxwell, 'The Disastrous War against Terrorism: Violence versus Enlightenment', Ch. 3 of *Terrorism Issues: Threat Assessment , Consequences and Prevention*, ed. A. W. Merkidze, Nova Science Publishers, New York, 2007, pp. 111-133.

disaster. If wisdom-inquiry and aim-oriented rationality had been in place since 1960, academia would have been shouting from the rooftops for the need to change. Our world would long ago have been alerted to the urgent need to change its ways. Without them, it has taken decades for news of the seriousness of our situation to filter through to those able to take action.

Put our human world into the context of Darwinian evolution and what cries out is the urgent need to put into place, in our human world, strategies and modes of thought designed to help us improve our problematic aims, personal, institutional, global, in the direction of promoting long-term live of value, as we live. First of all, Darwinian evolution selects for the capacity to survive and reproduce in the short term. As Steve Jones has wittily put it, evolution has tactics but no strategy. It does not bequeath to us the life aim of *long-term life of value*. This is an aim we must painfully acquire through modifying progressively what we have inherited from evolution and history. Secondly, Darwinian evolution leaves us peculiarly ill-equipped to transform our life aims in the way we require for, throughout evolution, there is one fixed fundamental aim: survival and reproduction. The basic Darwinian lesson is: *we both must, and are peculiarly ill-equipped to, transform our basic life aims*. How striking it is that the volumes of print produced on the social implications of Darwin have so rarely come up with this simple, stark, vital Darwinian lesson.

There is also, however, a more hopeful message that emerges from a consideration of our human world in the context of Darwinian evolution. What distinguishes us from all other species is the massive extent to which we are the product of evolution by cultural means. We have this unique capacity to learn. There is hope. We may be able to learn how to improve our problematic – even destructive – aims as we live, even though evolution ill-equips us for this task.

In the next, and final chapter, I shall spell out in a bit more detail what in my view we need to do if we are to do better at making progress towards as good a world as possible, thus helping all that is of value, potentially and actually, to flourish somewhat more

luxuriantly within the cold, remorseless embrace of the physical universe.