1. Evolution, fitness and adaptations

The ability of humans to attribute significance and meaning to the material world can, I suggest, legitimately be thought of as biological and evolutionary in origin; further, that those origins profoundly inform how that ability works today; and I propose that this ability can be described as an *adaptation,* or more properly, as a suite of inter-connecting adaptations. Some arguments about the characteristics of this ability – arguments which support this proposition, especially insofar as it relates to our engagement with artefacts - will only be developed fully in later chapters: much of direct relevance relating specifically to human evolution – especially the brain - is discussed in the chapter after this; the evolutionary origins of our reflexive, sensory and perceptual biases, and the technical and aesthetic sensibilities these support is examined in chapter three; chapter four examines the role of artefacts as symbols, or symbolic elements in narratives; while chapter five describes how this ability may work in practice. Inevitably, issues attached to the loose and still emerging concept of *evolutionary psychology* – the proposition that the human psyche is, in part, a product of our genetic inheritance - will be explored.

The intention at this preliminary stage is to articulate a broad, evolutionary framework into which this more developed model of our engagement with the material, including artefacts, will eventually be slotted. This is not without its difficulties: as noted in the introduction, we are emerging (2004) from a debate (most of whose themes were identified by Darwin himself) about just how, in general terms, biological evolution works. On the one hand, there are figures such as George Williams, Richard Dawkins, E. O. Wilson, the late John Maynard-Smith (and, among commentators on evolution and art and design, Thornhill), characterised by their opponents as 'Ultra-Darwinists', because of their apparent insistence on the gene as by far the most important locus at which natural selection operates.[1] On the other, the 'Naturalists' such as Niles Eldridge (who, even if he did not coin the term, willingly embraces it[2]), Elisabeth Vrba, and the late Stephen Jay Gould,[3] make an attractive case for allowing the importance of the organism as the principal 'unit of selection'.

Given the vituperation, invective and downright unpleasantness which has accompanied much of this debate,[4] a broad framework based on consensus might seem unlikely; yet I suggest that for the purposes of this argument many of the apparent discrepancies between the two camps, whilst strongly held, tend towards differences of emphasis and expression, rather than – in comparison with say, the 'creationists' of the religious right and scientific opinion on evolution as a whole – major differences of substance.

The framework articulated here arises out of a network of interconnecting debates. It would be inappropriate and unnecessary in a work with these particular objectives to review all areas of potential controversy, and so I have selected only those judged relevant. Apart from recognising Darwin as the chief progenitor of the debate as a whole, and with a few other, minor exceptions, I have omitted histories of the key ideas. So too, the origins of biological life on Earth, speculations on punctuated equilibria,[5] or the workings of genetics at the molecular level, which are mentioned rarely, or not at all. By contrast, working definitions are teased out from the debates surrounding *natural selection* (including *variation, heritability*, and what constitutes *success*, in evolutionary terms); the debate surrounding the *units of selection*, mentioned above, is relevant, and is, therefore, explored; questions as to what *fitness* (including *inclusive fitness*) is, are also pertinent; also what can be meant by *environment*; and, critically, what exactly an *adaptation* (or, indeed, an *aptation* or an *exaptation*) might be. Finally, tests suggested by Mark Ridley, and by Randy Thornhill (plus one of my own devising) are applied to the proposition that the ability to attribute significance and meaning to the material world is an adaptation, to establish whether or not that is either likely, or true.

1.1 Darwin and natural selection

By the time Charles Darwin published *The Origin of Species* in 1859, others were independently reaching similar conclusions to his own, notably Alfred Russel Wallace. Each of them presented preliminary papers (with Darwin's, prepared in 1844, coming first) at a joint address to the Linnaean Society in 1858. Darwin had been familiar since 1838 with the work of the Reverend Malthus, and after years of observation of the natural world around the globe

was unequivocal about the competitive nature of evolution. He developed elegant, if not always ultimately durable models for the workings of natural selection, adaptation and fitness. In the introduction to *The Origin of Species* he wrote:

> As many more individuals of each species are born than can possibly survive; and as, consequently, there is a frequently recurring struggle for existence, it follows that any being, if it vary very slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving, and thus be *naturally selected*. From the strong principle of inheritance, any selected variety will tend to propagate its new and modified form.[6]

As even this short extract makes clear, apart from asserting that biological life represented a struggle for existence, Darwin introduced four other major concepts which, in various guises, figure in aspects of evolutionary debate today. These include the idea of *natural selection* working on *variations* in the form or behaviour of organisms which might or might not confer advantages. Those possessing an advantage, provided it were *heritable*[7] from one generation to the next, would, by the process of natural selection, tend to flourish at the expense of those organisms less well adapted, and therefore less fit for their environment. Evolutionary success, in this model, is measured by reproductive success (but linked to survival), where this takes into account not only absolute fecundity, but also the viability of offspring to reach the age of reproduction as well as the effects of nurture. Critically, for Darwin, the whole process, though miraculously subtle in its workings, was a blind, unseeing and undirected one. As Stephen Hurry notes:

> ...earlier evolutionary theories...tended to assume that variation somehow arose in response to an organism's needs or because of some innate tendency towards complexity...In contrast, variation, according to the Darwin-Wallace theory, was undirected, that is, it was not necessarily produced in response to needs, nor as a result of some inherent

> tendency towards an end, nor in response to an external directing agency.[8]

These concepts, differently expressed, run through most contemporary debate. Although Darwin's main aim (as the title of his book suggests) was to provide an explanation for the origin of species, as Peter Skelton notes, in this narrow particular, the explanations Darwin offered were almost certainly wrong.[9] Even so, it is difficult to over-state the importance of *The Origin of Species* in laying the foundations of today's debates.

1.2 Units of selection: the background

The struggle for existence and natural selection survive as key themes. Unknown - or at least, unacknowledged - in Darwin's time, the operation of genes has helped explain much that then remained unresolved, regarding 'the strong principle of inheritance'.[10] For the Ultra-Darwinists, it often seems as if genes are of overwhelming importance, and that other levels at which natural selection might be thought to operate such as the organism (as in Darwin's account), the population or group, or the species, are demoted. Wilson puts it simply:

> In a Darwinist sense, the organism does not live for itself. Its primary function is not even to reproduce other organisms; it reproduces genes, and it serves as their temporary carrier. Each organism generated by sexual reproduction is a unique, accidental subset of all the genes constituting the species. Natural selection is the process whereby certain genes gain representation in the following generations superior to that of other genes located in the same chromosome positions. When new sex cells are manufactured in each generation, the winning genes are pulled apart and reassembled to manufacture new organisms that, on average, contain a higher proportion of the same genes. But the individual organism is only their vehicle, part of an elaborate device to preserve and spread them with the least possible biochemical perturbation.[11]

By contrast, Eldredge[12] and others (among them, those readily armed with accusations of 'genetic determinism' or 'reductionism') argue for alternative views of the workings of evolution, where what happens at other levels can be seen as more than merely the consequences of, or having consequences for, this apparently all-important genetic 'battle'. He accuses:

> Ultra-Darwinians see all competition, including competition for food and other economic resources, as fundamentally an epiphenomenon of the real competition for reproductive success...Dawkins...in his *The Selfish Gene* proclaiming that it is actually genes, not organisms, that are locked in a titanic competitive struggle to leave copies of themselves behind to the next generation.[13]

...whereas Eldredge argues that

> Natural selection is basically a filter. Organisms [not genes] compete for resources. As a side effect of such competition, those who make out better have a somewhat greater chance of reproducing successfully - and their offspring will tend to inherit the genetic information underlying their parents' success.[14]

For the purposes of this inquiry, these and some further differences of emphasis and interpretation need investigating. The debate about what the units of selection are matters because, in broad terms, it seems to hold out at least two alternative frameworks which may accommodate the idea that the ability to attribute significance and meaning to the material world is, indeed, an adaptation.

At first sight those who, like Eldredge and others, accord greater significance to natural selection at the level of the organism and the population might seem natural allies in mounting this present argument. The human ability to attribute significance and meaning to the material world self-evidently operates at the level of the organism and, as will be argued more fully later,

would seem, in evolutionary terms, to work 'for the good of' the organism. Moreover, the 'Naturalist' account directly refers to the operation of organisms *in relation to their physical environment*, precisely the subject of this inquiry. How much more appealing such a picture is, especially when it seems to accord with common experience, compared with the suggestion that all life, ourselves included, are but impersonal expressions of the fates of armies of mindlessly competitive, genetic automata.

Yet this quiet seduction may be at the expense of truth. Good science is often distinguished by findings which run counter to 'common sense'. Eldredge's opponents, such as Dawkins, argue it is wilful to think of natural selection as operating 'for the good of' anything, except genes.

1.3 The 'Ultra-Darwinist' perspective

Although, perhaps, still best known for his work *The Selfish Gene* which appeared in 1976, one of Dawkins' most closely-argued, mature expositions of the possible consequences of the gene-centred model of the workings of evolution is contained in his later 1982 study, *The Extended Phenotype*.[15] In the years separating the two publications 'gene', lamented Dawkins, had become a four-letter word. He is at pains to distance himself from the genetic determinism which had figured (and still sometimes figures) so vividly in much journalistic output. A 'gene for...' something is, he reminds us, only a form of words, a linguistic convenience to describe something more complex. A 'gene for' really means a genetic combination, a pattern of genes which may be distributed at different points on the chromosome. The relationship between the genotype - the genetic make-up - and the phenotype, the expression of that genetic make-up, represents for Dawkins a complex interaction of factors. Even if a particular genetic make-up might predispose an organism to exhibit this or that character (which in this sense, might include a physiological feature, or a behaviour), the environment or other factors may alter or prevent its phenotypic expression. Environment is taken to mean not only the physical environment in which the organism lives but, where appropriate (and with significant consequences for this study), the social environment as well. In

addition, at the other extreme of scale, it also refers to the genetic 'environment'. Genes are competing for a position on the chromosome with other genetic alternatives, its *alleles*. A particular genetic combination (a 'gene for') may or may not be expressed in the phenotype, partly because of its genetic neighbours on the chromosome. Some, for example, may 'turn the gene on', while others may have the opposite effect.[16] This more complex definition of 'environment' has profound consequences for concepts of fitness. For Dawkins, the gene is not the dictator that some want to attribute to the Ultra-Darwinist camp, and almost routinely, to him:

> Genetic causes and environmental causes are in principle no different from each other. Some influences of both types may be hard to reverse; others may be easy to reverse. Some may be usually hard to reverse but easy if the right agent is applied. The important point here is that there is no general reason for expecting genetic influences to be any more irreversible than environmental ones.[17]

At one point, Dawkins seems to hold out the possibility that alternative ways of looking at evolution, in the kind of language Naturalists might use, are equally valid, but this impression quickly fades:

> It is always possible to talk about the natural selection of a behaviour pattern in two ways. We can either talk about individuals with a tendency to perform the behaviour pattern being 'fitter' than individuals with a less strong tendency. This is the now [1982] fashionable phraseology, within the paradigm of the 'selfish organism' and the 'central theorem of sociobiology'. Alternatively and equivalently, we can talk directly of genes for performing the behaviour pattern better than their alleles. It is always legitimate to postulate genes in any discussion of Darwinian adaptation and…it is often positively beneficial to do so. Objections such as I have heard made to the 'unnecessary geneticizing' of the language of functional

> ethology, betray a fundamental failure to face up to the reality of what Darwinian selection is all about.[18]

And later, in a similar vein:

> The statement, 'genes for performing behaviour X are favoured over genes for not performing behaviour X' has a vaguely naive and unprofessional ring to it. What evidence is there for such genes? How dare you conjure up *ad hoc* genes simply to satisfy your hypothetical convenience! To say, individuals that perform X are fitter than individuals that do not perform X' sounds much more respectable. Even if it is not known to be true, it will probably be accepted as a permissible speculation. But the two sentences are exactly equivalent in meaning. The second one says nothing that the first does not say more clearly.[19]

In this Dawkins underestimates, perhaps, the effect such language is likely to have. Both sentences might be true. Both might not run contrary to facts, but the second by including the word 'fitter', immediately suggests that the living organism *and its interaction with its environment* has a significance, and that the level of natural selection which acts on organisms interacting with their environments needs to be acknowledged. The first is only the equivalent of the second if the many caveats he himself makes about the relationship between genotype and phenotype are taken as read.[20] Hardly surprising then, that in a debate which is largely about types of description, such language is sometimes thought wanting.

Even so, if the ability to attribute significance and meaning to the material world *is* an accumulation of adaptations, it would, in this model, have to be seen as behaviour which is the phenotypic expression of genetic patterns. As Dawkins reminds his readers, Richard Lewontin - an adversary where other aspects of evolution are concerned - is at one with him in requiring a genetic origin for a given trait, if that trait is to be regarded as an adaptation. In 1979, Lewontin wrote 'In order for a trait to evolve by

natural selection it is necessary that there be genetic variation in the population for such a trait'.[21] Dawkins is clear how such a possibility should be viewed:

> ...natural selection is the differential survival of genes. If we are so much as to discuss the *possibility* of a behavioural pattern's evolving by natural selection [such as the ability to attribute significance and meaning to the material world], we have to postulate genetic variation with respect to the tendency or capacity to perform that behaviour pattern. This is not to say that there necessarily *is* such genetic variation for any particular behavioural pattern, only that there must have been genetic variation in the past if we are to treat the behaviour pattern as a Darwinian adaptation. Of course the behaviour pattern may not be a Darwinian adaptation, in which case the argument will not apply.[22]

This last observation, insofar as it might relate to this ability, will be pursued later in this chapter.

1.4 Fitness and 'success'

With such importance attached to genes as 'replicators', the means by which information is transmitted from one generation to the next, and language which speaks of natural selection as 'the differential survival of genes', where does that leave the possibility that the ability to attribute significance and meaning to the material world might improve 'fitness', if the organism is seen only as a vehicle for the replicator? Further, how, in this context, is fitness, and by implication, 'success', to be measured?

Interestingly, Dawkins dislikes the term 'fitness', believing it a verbal conceit for permitting evolution to be discussed in terms of individuals (organisms) rather than, in his preferred language, 'true replicators'. The classical biological definition of fitness, beloved, he asserts, of ethologists and ecologists, in which 'success' is 'a property of an individual organism, often expressed as the product of survival and fecundity',[23] is problematic

according to Dawkins, because it cannot be measured mathematically (unlike the genetic alternative). When and how do you measure it?

> If it is measured as the number of children born, it neglects juvenile mortality and fails to account for parental care. If it is measured by number of offspring reaching reproductive age it neglects reproductive success of the grown offspring. If it is measured as the number of grandchildren it neglects...and so on, *ad infinitum*.[24]

Dawkins says this definition leads to an 'all or nothing' judgement having to be made: either, after many generations, all have inherited the character from that 'fit' individual, or none have.

With his gene-centred model, he is in no doubt that the true test of evolutionary success is the transmission of genes from one generation to the next. 'The reason reproductive success matters, as opposed to mere individual survival, is that reproductive success is a measure of success in passing on genes.'[25] Naturally, given his multi-layered account of 'environment', Dawkins acknowledges the importance of 'genetic fitness': Two genotypes compete for a single locus on the chromosome; the genotype most 'fitted' to that locus 'succeeds'.

However, he also favours another definition of fitness which embraces organisms and their behaviour: *inclusive fitness*. Dawkins defines it (interestingly, at the level of the organism) as follows:

> The inclusive fitness of an organism is not a property of himself, but a property of *his actions or effects* [emphasis added]. Inclusive fitness is calculated from an individual's own reproductive success plus his *effects* on the reproductive success of his relatives, each one weigh[t]ed by the appropriate coefficient of relatedness. Therefore, for instance, if my brother goes to Australia, so I can have no effect, one way or the other, on his reproductive success, my inclusive fitness does not go up each time he has a child![26]

In this scenario, 'effects', such as the consequences of being able to attribute significance and meaning to the material world, can only be measured for evolutionary 'success' by comparing them with other effects, or with their absence. An assessment can then be made as to the extent to which such behaviour might facilitate or hinder the accumulated reproductive success of a person; to this is added (in decreasing significance according to genetic relatedness), the effects of the behaviour on the reproductive success of genetic relatives. In this sense, inclusive fitness is always a relative measure of success (relative to the reproductive 'success' of those under scrutiny) rather than an absolute one. As noted, for Dawkins, to speak of the 'fitness' of an organism is really only, in his terms, a verbal trick.

Potentially, then, from an Ultra-Darwinist perspective, a plausible description of the ability to attribute significance and meaning to the material world as a potential adaptation might run thus: the ability to attribute significance and meaning to the material world originated in a genetic variation, favoured by natural selection because the average effect of the genetic pattern on the organism (allowing for the average effects of mediation by genetic and other types of environment) is to contribute to that organism's inclusive fitness and thus its, and its genetic relatives' reproductive success in passing their genes on to succeeding generations.

Just so.

1.5 The Naturalists

An alternative account can be arrived at by considering the alternative point of view, that of the Naturalists. Gould wrote:

> Selection cannot see genes and pick among them directly. It must use bodies as an intermediary. A gene is a bit of DNA hidden within a cell. Selection views bodies. It favours some bodies because they are stronger, better insulated, earlier in their sexual maturation, fiercer in combat, or more beautiful to behold...If, in favouring a stronger body, selection once acted directly upon a gene for strength, then

> Dawkins might be vindicated. If bodies were unambiguous maps of their genes, then battling bits of DNA would display their colors externally and selection might act on them directly. But bodies are no such thing...bodies cannot be atomized into parts, each constructed by an individual gene. Hundreds of genes contribute to the building of most body parts and their action is channelled through a kaleidoscopic series of environmental influences: embryonic and postnatal, internal and external.[27]

As we have seen, Dawkins is quite prepared to allow the importance of the environment at a number of different levels. Having quoted this passage from Gould in *The Extended Phenotype,* Dawkins himself asserts that individual organisms are 'obviously functional units of great importance',[28] but rejects Gould's argument, claiming Gould is confusing genetics with embryology. Gould persists:

> So parts are not translated genes and selection doesn't even work directly on parts. It accepts or rejects entire organisms because suites of parts, interacting in complex ways, confer advantages. The image of individual genes, plotting the course of their own survival, bears little relationship to developmental genetics as we understand it. Dawkins will need another metaphor: genes caucusing, forming alliances, showing deference for a chance to join a pact, gauging probable environments. But when you amalgamate so many genes and tie them together in hierarchical chains of action mediated by environments, we call the resultant object a body.[29]

By this view, it becomes legitimate to consider the human ability to attribute significance and meaning to the material world primarily as a property of an organism, and that it is the organism which competes in the environment.[30] But competes for what? If the transmission of genes between generations is not to be the measure of 'success' (i.e., reproductive success), then what is? For Eldredge, genetic reproduction and ancestry is a structural

hierarchy which informs the characteristics of organisms, groups and species. Alongside that structural hierarchy is the functional one relating to energy transfer, the getting of food and so on, 'economic' considerations in this terminology. The manners in which life may be organised for reproduction and for the transfer of energy might differ and *not* be directly linked. So, for example, an organism can belong to one group - a *deme* - for reproduction purposes and, at other times, be part of an economic, resource seeking group or *avatar*.

> Standing natural selection on its head, claiming that direct competition for reproductive success leads to competition for resources, which in turn governs all interactions between avatars within ecosystems is needlessly Byzantine. Organisms seek resources simply because organisms require such resources.[31]

Eldredge will have none of the *Sturm und Drang* of relentless genetic competitive warfare, as if our genes are all striving to get themselves replicated, nor the determination to evaluate all other activities as consequences of that battle, or interesting only in that they have consequences for it. For Eldredge, genetic reproduction is *not* the exclusive measure of 'success'. Nature can, he argues, be seen as an arrangement of hierarchies. Each level operates according to its own rules and these rules may not necessarily refer to one another. Interestingly, Dawkins suggests something similar: 'When explaining the workings of a motor car, we forget atoms and van der Waal's forces as units of explanation, and prefer to talk of cylinders and sparking plugs.'

> …living matter introduces a whole new set of rungs to the ladder of complexity: macromolecules folding themselves into their tertiary forms, intracellular membranes and organelles, cells, tissues, organs, organisms, populations, communities and ecosystems…At every level, the units interact with each other following laws appropriate to that level, laws which are not conveniently reducible to laws at lower levels.[32]

Eldredge suggests the rules at each level need not refer to one another, whereas Dawkins notes only that it is not convenient, or easy for us to express the laws at one level in the language of another. His position neither precludes such a unity, nor its potential value.[33] For Eldredge, as for Gould, the idea that natural selection operates on genes alone is unsatisfactory or at best, incomplete. In Eldredge's model, the most important link between the economic and genetic hierarchies is the organism: 'Only organisms actively seek energy and materials in order to be alive: to differentiate, grow and maintain a living corpus. Only organisms reproduce.'[34]

> Dawkins, articulating the ultra-Darwinian perspective, sees competition for reproductive success as the driving force behind the organization of ecological systems. He has it exactly backwards. Dawkins has the vector running the wrong way. It is the fate that organisms, with their heritable features - their economic [as opposed to reproductive] adaptations - face in the economic arena that acts as the filter determining what proportions of genetic information are passed along to the succeeding generation. Natural selection is that filter.[35]

According to Eldredge, 'True natural selection...arises from competition for resources: economic competition'.[36]

1.6 Who is right, and does it matter?

I have provided a sketch of the recent histories of these two opposing points of view, because – eventually – it is my intention to consider an aspect of human behaviour in the evolutionary context. In order fully to appreciate quite why this debate has been prosecuted for so long and with such vigour (not to mention – as noted - invective), one has to appreciate something of the consequences each side have imagined their opponents' understandings have for our understandings, not just of evolution as a whole, but most especially of ourselves. E. O. Wilson's *Sociobiology*[37] and those sympathetic to his undertaking provoked a storm of outrage throughout the 1980s for just this reason; a similar, though marginally less tempestuous furore has followed its successor

'evolutionary psychology', which will be considered in due course. Critically, the debate has hinged as much, perhaps, on what each point of view and choice of language seemed to symbolise, as on the merits of their purported substance. At their core is the possibility of the human condition arising, in part, from, as critics would have it, unbridled competition among faceless, mindless, invisible genetic entities, It is surely no accident that these arguments should have occurred at just that time in Western politics when the post-war liberal social consensus broke down in the U.S.A. and Britain in the face of a visceral, libertarian, capitalist onslaught. The competition of the marketplace was proffered by some as a near-universal, indeed, 'natural' panacea for the ills of society, with its 'organic' 'natural' rigour 'selecting' that which was healthy and would prosper, from that maintained by the 'unnatural', 'artificial' meddling of the state. More immediately, some took Dawkins' and others' work on genes, and crudely deployed it to support controversial, often reactionary views on race or sexual behaviour, provoking understandable hostility from liberals.[38] This mapping of the scientific onto the political has been unhelpful and had unfortunate consequences for the quality of some of the debate.

Arguably, the truth of this observation is nowhere better demonstrated than in the collection of essays edited by Hilary Rose, the sociologist and Steven Rose, the biologist, published in 2000 under the self-explanatory title, *Alas, Poor Darwin: Arguments Against Evolutionary Psychology,*[39] The Roses adopt a version of the 'Naturalist' perspective. Steven Rose in his introductory essay is alert to the relevance of the political when he writes:

> The last decades of the twentieth century have been a period of almost unprecedented social, economic and cultural turbulence. Many of the old seeming certainties and indeed hopes for a more socially just future have crumbled. The collapse of communism, the end of the Cold War and the bloody regional nationalist and ethnic struggles that it has unleashed, the weakening of the welfare state and growing fears of ecological catastrophe have been matched by a shaken belief in the inevitability of progress. In this climate the

> search for new apparent certainties…has become urgent, but extraordinarily diverse.[40]

In this search for new certainties, he cites the different varieties of religious fundamentalism and notes – more pertinently, given the subject of this co-edited book – the spectacular 'defence of green nature, trees, land and water [which] have largely replaced the great industrial working class struggles.'[41] It is in this context of the decline of 'traditional' class politics and the substitution of concerns about nature, that he argues evolutionary psychology has taken hold, as a substitute 'certainty'. Determinism, in Rose's account, is everywhere identified:

> This new determinism takes two apparently antithetical forms. On the one hand, it claims our biology is our destiny, written in our genes by the shaping forces of human evolution through natural selection and random mutation. This biological fatalism is opposed by Promethean claims that biotechnology, in the form of genetic engineering, can manipulate our genes in such a way as to rescue us from the worst of our fates.[42]

Rose has recently expanded on this latter theme.[43]

Not everyone agreed with the Roses' diagnosis, however, and vituperation has been duly traded. Geoffrey Miller (whose views are considered elsewhere in this study) wrote:

> Tiresome, predictable and badly researched, this 15-essay collection offers no coherent arguments against evolutionary psychology, but reveals instead the collective intellectual bankruptcy of its editors and contributors. The "evolutionary psychology" castigated here is not the modern science of human nature as it is actually developing, but a simplified, out-dated, third-hand version that focuses too much on the writings of the field's best-known popularisers…[44]

Unlike Robert Kurzban, in another indignant review of the Roses' work which appeared in *The Human Nature Review* in 2002, Miller makes no direct reference to the political dimension in his criticism. Kurzban shares Miller's outrage, but channels it into a meticulously-argued critique. Firstly, he gives an indication of the issues of apparent substance, as well his own indication of the tenor of the Roses' volume:

> In "Alas Poor Darwin"…Steven and Hilary Rose and the other contributors to this edited volume accuse evolutionary psychologists of sins both scientific and political, in prose filled with self-righteous rage, smug dismissals, and unremitting invective. Evolutionary psychologists, they say, are wedded to genetic determinism, a view simplistic in conception, fatalistic in outlook, and flatly mistaken. Further, they argue that evolutionary psychologists indulge in post-hoc, "Just-so" story-telling, the seediest kind of scientific promiscuity. If evolutionary psychology were guilty of the sins of which it was accused, the Roses and their contributors could be considered to have produced an important work, helping to prevent the spread of flimsy science and distasteful politics. [45]

Kurzban then cites a catalogue of examples where the Roses or their contributors systematically coarsened, wilfully misrepresented or even manufactured the views of their opponents. For present purposes, it would be unproductive to re-rehearse each of these disputes here and I refer the reader who requires this material in detail to Kurzban's excellent article.

In *Alas, Poor Darwin,* I suggest the essay by Annette Karmillof-Smith is, perhaps, the most valuable; it is considered in the chapter following this. For the rest, one illustration of the unedifying obfuscation of the scientific by the personal and political will suffice. In a subsequent letter to the editor of the *Review,* Matt Ridley gave the following account:

> In the first edition of the book, Hilary Rose stated (page 125) `Right-wing libertarian Matt Ridley sees Darwinian theory as pointing to the

> unnaturalness of the welfare benefits for lone mothers, which therefore should be abolished.' There was a footnote to my book 'The Origins of Virtue'. I wrote to Hilary Rose pointing out gently that neither in that book, nor anywhere else have I called for the abolition of welfare benefits for lone mothers. In fact I have not even mentioned lone mothers, let alone their welfare benefits. In reply, Hilary Rose huffed that it was the kind of thing I would believe (I don't) and therefore her remark was justified. She did eventually agree to change it in the paperback edition. This now implies that I believe in the abolition of the National Health Service, which is news to me.[46]

So, what differences of substance remain and how should the present undertaking accommodate them? Few within the credible scientific community now [2005] would dispute the central role of genes in understanding how evolution and human beings work, nor under-estimate their role in profoundly informing, if not actually determining both the physical and behavioural characters of all creatures, including *Homo sapiens*. Yet the case made by Eldridge, Gould and others for continuing to reflect on the role of the organism alongside that of genes was well made, especially with so many crudely deterministic arguments flying around. With so much of such apparent importance, so much that remained (and remains) unknown, and so much scope for intelligent (or otherwise) speculation, small wonder that there has been ample scope for friction.

Differences of substance – once hyperbole and mis-representation are eliminated – rarely preclude a broad, working consensus. So, for example, in the narrow matter of the locus of natural selection, a view which allows importance *both* to genes and the organism is perfectly supportable. Granting some importance to the organism requires *as a matter of course* that adaptations be seen in the wider context of that organism and its life; and further, that they be considered in terms of their interaction both with each other – as is to be proposed here – rather than in isolation, as well as invariably attaching significance to their collective interaction with the environment (principally,

the physical environment), rather than admitting each of these factors by means of a sequence of necessary caveats. Thus, in principle, it is now quite possible to come up with a working definition of what an adaptation is, and thereafter, to make the case for seeing the ability of humans to attribute significance and meaning to the material world as representing a subtly inter-dependent suite of them.

1.7 Defining a 'real' adaptation

If the ability to attribute significance and meaning to the material world is to be considered a collection of adaptations, some working definition of what is and what is not an adaptation is needed. As Caroline Pond notes, 'It is very difficult to establish universally applicable procedures for identifying structures as adaptations to particular functions...'[47] Superficially, the concept might seem simple enough: an adaptation is a physical or behaviour character arising from natural selection which increases fitness. But, as Pond notes, 'difficulties arise when we try to identify adaptations and to quantify their relative importance to the organism's survival and reproduction.'[48] This is an understatement. As even this apparently innocuous observation shows, the questions already touched on about the level at which natural selection operates and criteria by which 'success' is to be measured persist. As noted, for Dawkins, the competition is among genes to replicate (and therefore, by implication at least, among organisms to reproduce). Eldredge emphasises competition among organisms for resources to ensure survival. In practice, Pond's 'survival *and* reproduction' correspond to such consensus as there is. To replicate, the gene must survive in the organism and the organism must reproduce; to reproduce, the organism must survive. Survival of either genes or organisms – setting aside Dawkins' reservation about fitness being discussed at all - hinges on fitness for the environment. Fitness for an environment is increased by an adaptation. An adaptation is a character which can plausibly be cited as being for the good of – for the good of what? That depends on the level being considered. For Mark Ridley,

> Adaptations can exist for the benefit of genes, cells, organisms, kin, or groups of unrelated individuals. Genic adaptations...are rare. Cell-line adaptations are very rare...On the other hand, organismic adaptations are common. The number of examples of kin-selected adaptations is increasing [in 1996], while group adaptations are probably rare.[49]

And later, he reminds us,

> Maynard Smith has pointed out that the units [of selection] in nature are the units that show heritability...Mutations that influence the phenotype of a unit (whether a cell, organism or group) must be passed on to the offspring of that unit in the next generation. In such a case, natural selection can act to increase a mutation's frequency.[50]

Accordingly, heritability is strong at the level of the gene and the organism, but less strong, he argues, at the level of the group, species or higher level such as mammal or reptile. In this way, Ridley offers a useful 'rough guide' to the levels at which it might be reasonable to speculate on a feature conferring 'advantages' or increased fitness. It is plainly well worth contemplating organisms - which Eldredge, Gould, Cain, Pond, and (in a limited way) Dawkins, and others would have us do - without excluding many aspects of Dawkins' gene-centred perspectives, nor even, perhaps, as Ridley suggests, levels above that of the organism, to which Eldredge is particularly drawn. If those higher levels are set aside for the moment (as they are the more contested of the levels at which natural selection is said to occur), it can be suggested that an adaptation is genetic in origin, and, typically, it confers on the phenotype a character which favours survival, reproduction, or both.

How, then, is an adaptation to be identified? Both Dawkins and Eldredge criticise the habit of creating 'Just So' stories, accounts like Kipling's modern fables which, having identified a beneficial characteristic, promptly set about constructing an evolutionary explanation for its presence. Yet inevitably, to some extent, much of the literature consists of just such speculations; and, as

explained in the introduction, for perfectly defensible reasons, this study is avowedly of that type.

A. J. Cain, in a well-known paper written in 1964, argued strongly that far more characters are truly adaptations than observers are given to admit:

> …it is gradually being realized that if we personally cannot see any adaptive or functional significance of some feature this is far more likely to be due to our own abysmal ignorance than to the feature being truly non-adaptive selectively neutral or functionless[51]

This is an attractive, indeed, panglossian, 'catch all' idea, holding out the prospect of much yet-to-be-discovered order in the world; but it is not widely accepted. Darwin's position prefigured contemporary reservations about the relative degrees of fitness which may be expected, when he wrote:

> As natural selection acts by competition, it renders the inhabitants of each country perfect only in relation to the other inhabitants; so that we need feel no surprise at the species of any one country, although on the ordinary [creationist] view supposed to have been created and specially adapted to that country, being beaten and supplanted by the naturalised productions from another land. Nor ought we to marvel if all the contrivances in nature be not, as far as we can judge, absolutely perfect; and if some of them be abhorrent to our ideas of fitness...The wonder indeed is, on the theory of natural selection, that more cases of the want of absolute perfection have not been observed.[52]

Dawkins is alive to the potential constraints on evolutionary 'perfection' as far as adaptation is concerned. Notoriously, evolutionary time operates over enormous periods. Perfection would make for a dangerous inflexibility. Significantly, genetic variability arising from mutation carries with it the possibility that natural selection could lead to change, should environments alter, as over these long periods of time, they often do. Any organism today almost certainly embodies physiological or behavioural characteristics

evolved by its genetic ancestors adapting to an environment which may have vanished long ago.[53] He calls this apparent anomaly, the 'time-lag problem'. According to Dawkins, the contribution to inclusive fitness of adaptations can only really be assessed by taking a long-term view of the extent to which they have contributed to genetic, reproductive success, as outlined above. Fitness and success become averages over time.

He advocates a parallel exercise in considering the life of an individual organism:

> However well adapted an animal may be to environmental conditions, those conditions must be regarded as a statistical average. It will usually be impossible to cater for every conceivable contingency of detail, and any given animal will therefore be frequently observed to make 'mistakes', mistakes which can easily be fatal. This is not the same as the time-lag problem already mentioned. The time-lag problem arises because of non-stationarities in the statistical properties of the environment: average conditions are now different from the average conditions experienced by the animal's ancestors. The present point is more inescapable. The modern animal may be living in identical *average* conditions to those of an ancestor, yet the detailed moment to moment occurrences facing either of them are not the same from day to day, and are too complex for precise prediction to be possible.[54]

Arguably, the supple flexibility of the human brain as a whole - and, it is specifically argued here, the ability to attribute significance and meaning to the material world - has evolved in order to enable us to respond flexibly to just such unscheduled contingencies.

1.8 Adaptation, aptation, exaptation or non-adaptive accident?

As the examination of the Ultra-Darwinist and Naturalist views of evolution above has illustrated, there is debate over the extent to which judgements about what is and is not an adaptation should hinge on historical (that is,

phyletic), or contemporary, functional criteria. A character may emerge which fulfils a function - say, as some speculate, feathers originally emerged as a means of increasing an organism's ability to regulate body temperature. Over time the character might well end up fulfilling other purposes, such as contributing to the ability to fly, in the case of those thermo-regulatory feathers. Should feathers, in such circumstances, be considered adaptations? Ridley warns against attaching much importance to the historical, structural dimension:

> First, most study of adaptation is not concerned with the past history of function changes, but with how natural selection maintains the adaptation in its modern form. It only confuses the issue if the problem of historical reconstruction is added to the problem of current function. They are separate problems…Second, organs can undoubtedly change their functions during their history, and the reason why natural selection may be maintaining an organ now may not be the same reason why it initially evolved. These changes are worth recognizing.[55]

Inevitably, for the evolutionary palaeontologist it is the historical dimensions which are chiefly of interest. The limbs of mammals may be traced back to those of reptiles, of amphibians; back, indeed, to the locomotive fins of wholly aquatic, lobe-finned fish, which may have used the fins to scuttle along the bottoms of lakes. Similarly, as will be shown, elements which go to make up the modern ability to attribute significance and meaning to the material world originated as the responses of ancient, simple ancestor species of our long-vanished environments; yet they survive in us, performing additional or quite different functions.

Gould and Vrba[56] favour strict definitions. All beneficial characters are 'aptations'; those serving their original purposes, true 'adaptations'; those serving new or unconnected purposes, 'exaptations'.[57] Such fastidiousness is useful in reminding researchers to speculate carefully when constructing potential narratives to explain why characters may have evolved, yet, ultimately (palaeontologists aside), it is little more than a linguistic nicety. Natural selection is blind to the historical routes by which the effects of these

characters may have been arrived at, but is very much alive to the immediate functional advantages to the bearer that this or that character may secure in terms of survival and reproduction. And as Ridley reminds us, it is those which count.

Yet considering the ontological background to a character might, according to Gould and Lewontin, throw up a further possibility: the character may not be an adaptation at all; it might not have been selected for; and the 'advantages' may be the products of over-fertile, yet narrow imaginations. The urge towards creating a 'Just so' story is driven, surely, by the desire to have a satisfying explanation for why something is as it is, and thus, to deliver a sensation akin to discovering order. It is a pleasurable activity. A character is identified. Immediately, it is assumed that it must have evolved by natural selection, and that it must be there 'for the good of' the organism (or in order for the genetic variation, of which it is an expression, to replicate itself in a succeeding generation of chromosomes). The researcher sets about speculating what the advantages are, sketching in a plausible sequence of evolutionary circumstances, by which a process of natural selection arrives at the functioning of the modern character. In sufficiently skilful hands, the result, almost inevitably, is an adaptation. Gould and Lewontin express their reservations to such an approach:

> Often, evolutionists use *consistency* with natural selection as the sole criterion and consider their work done when they concoct a plausible story. But plausible stories can often be told. The key to historical research lies in devising criteria to identify proper explanations among the substantial set of plausible pathways to any modern result.[58]

In a sustained attack on what they characterise as the 'adaptationist programme or Panglossian paradigm', Gould and Lewontin urge caution before asserting that a character has a beneficial effect and then immediately concluding that it is, of itself, an adaptation. If the ability to attribute significance and meaning to the material world were *not* an expression of a group of adaptations, what alternative explanations could be marshalled to

explain its existence? Gould and Lewontin offer a provisional catalogue: these include '*genetic drift*, a kind of random genetic sampling error',[59] that is, an accident of evolutionary history, rather than a genetic variation persisting through natural selection. Alternatively, the form of a part (or by implication, the nature of a behaviour) could be the side-effect of natural selection operating, not on the part itself, but elsewhere. Thus, *pleiotropy,* the phenomenon of a gene or genetic pattern having consequences for a whole variety of characters.[60] By contrast, *allometry* - the emergence of a character in a particular form as the epiphenomenon of some more general trend – might help explain the apparently constant ratios of brain to body size in numerous species.[61] They, like others, suggest the possibility of adaptation *without* selection, in other words, 'adaptations' which represent variations arising from environmental factors, which they describe as the result of 'phenotypic plasticity'. Brains and still more, their capabilities, would seem potential candidates. Yet Gould and Lewontin seem reluctant to attribute this flexibility even partly to genes and prefer to assert that these variations are 'purely phenotypic'[62] in origin. Could not the element of natural selection of genes be re-introduced if it could be demonstrated that selection sometimes favours just such flexibility; if the genes which do not *cause* the variations, but *permit* them when environmental factors emerge are the ones natural selection might favour?

Indeed they allow change may often be mediated by selection, but insist, rightly, that selection has to operate within phyletic, that is, historical constraints. Thus human bodies are imperfectly adapted to bipedal posture as our ancestry lies with quadrupeds. Other constraints on selection could be developmental in character. Many characters which may have emerged for historical, phyletic reasons, when considered together, favour an organism's survival through the early stages of its development from, say, embryo to adult. Between them, Gould and Lewontin suggest not only alternative accounts to explain the origin of characters, but alternatives to the constraints on adaptationist 'perfection' explored by Dawkins and others. A character might persist not, for example, because the environment in which it initially evolved as an adaptation has long since vanished ('time lag', as above), but because it is the result of historical, 'architectural' constraints. The character may not be

an adaptation at all; it might never have been an adaptation nor is it, in their strict sense, one now. They add, reassuringly:

> We do not offer a council [counsel?] of despair, as adaptationists have charged; for non-adaptive does not mean non-intelligible. We welcome the richness that a pluralistic approach, so akin to Darwin's spirit, can provide…Too often, the adaptationist programme gave us an evolutionary biology of parts and genes, but not of organisms. It assumed that all transitions could occur step by step and underrated the importance of integrated developmental blocks and pervasive constraints of history and architecture. A pluralistic view could put organisms, with all their recalcitrant, but intelligible complexity, back into evolutionary theory.[63]

Such strictures were originally delivered some twenty-five years ago. Meanwhile, countless new adaptationist accounts have been, to use their term, 'concocted'. In truth, such accounts – of which this study is but one example – perform a useful function which Gould and Lewontin neglect: they are provisional hypotheses, intended from the first to prompt further reflection and research. Many may perish under scrutiny, yet some will remain persuasive, and persist. It might be unwise invariably to rely on 'consistency with natural selection' as the sole criterion by which a character may or may not be judged an adaptation, but despite their reservations, it remains a valuable and useful test. If the character can be shown to be consistent with natural selection, then it may, indeed, be an adaptation; and if the story to support such an assertion is not only persuasive but, as in the present study, consistent with evidence drawn from many quarters, then the chances are increased of that story corresponding to genuine truths. In which case, it could prove durable as well. As Randy Thornhill puts it:

> Four natural processes are known to cause evolution or changes in gene frequencies of populations, but selection is the only one that

> can create an adaptation. The other three – mutation, drift and gene flow – lack the necessary creativity because their action is random relative to [an] individual's environment. Selection is not a random process.[64]

First, then, consistency with natural selection.

1.9 An adaptation? Some tests:

Thornhill – with his focus on beauty and aesthetics - proposes four (or five – see below) tests by which an adaptation might be identified; Ridley, whose interests range more widely, suggests three. As Ridley's rest on what might probably (but not unarguably) be thought of as a consensus view as to the workings of evolution, I will apply them all here, augmenting, supplementing and qualifying them by considering Thornhill's alternatives, as well as some reflections of my own. Ridley himself is at pains to point out the limitations of his tests (and, by implication, any others), in the sense that no set of criteria will invariably deliver an unequivocal judgement. But while no one matrix may be the last word on the matter, such tests can, nonetheless, usefully be applied here to measure something of the strength of the argument that the ability to attribute significance and meaning to the material world is, indeed, an inter-connected suite of evolved adaptations.

I begin with a straightforward test of Thornhill's: an adaptation is 'species-typical, i.e., possessed by all members of the species'[65]. Thornhill asserts that, with few exceptions, all humans possess sensibilities towards beauty and aesthetics. I argue that the wider proposition mounted here unambiguously passes this preliminary test; in other words, that barring accident or disability (and sometimes, even then), all humans attribute meaning and significance to the material world. Secondly, Ridley suggests, adaptations 'can be recognized as characters that appear to be too well fitted to their environment for the fit to have arisen by chance.'[66] At first sight this is, it must be said, a curious suggestion. The fins of a fish, for example, may be exquisitely shaped and structured out of bone, cartilage and skin, each precisely calculated (or so it might seem) to take account of the size, shape and weight

of the fish from which they spring, as well as the density and dynamics of the water through which they wave, so as to enable the fish more effectively to manoeuvre; yet, like everything else in biological evolution, it has, indeed, precisely 'arisen by chance' because, as repeatedly noted, evolution has no purposes. It is blind. Nonetheless, Ridley is suggesting, surely, that having identified that a character is 'fit for purpose' (or represents 'purposeful design'[67] – Thornhill's fifth, unlisted criterion) in the sense that the fin of the fish recognisably seems to be fit to manoeuvre the fish through its watery environment, some further judgement has to be made as to the degree to which a character may be supposed to be *favoured over time by natural selection*, because it is genuinely adaptive, rather than representing only some short-lived, 'chance' expression of an 'accidental' mutation. Thornhill puts it succinctly: 'An adaptation is a phenotypic feature that is so precisely organised for some apparent purpose that chance cannot be the explanation of the feature's existence.'[68]

The fin of the fish, by Ridley's criterion (slightly re-cast, as above), is often exquisitely well-fitted to its environment, and has persisted over millions of years. It qualifies. Even so, Lewontin has some salutary remarks for those apt to see an over-neat distinction between organism and environment, remarks which acquire added significance once we move from fish to ourselves. He favours a model which places still greater emphasis on the intimate inter-relatedness of organism and environment, to the point where some of the cruder assumptions which support the very idea of an 'adaptation' may be called into question:

> The concept of an adaptation is the notion that there is a pre-existing problem and that an organism solves it by adapting to the problem. For example, fins are an adaptation for swimming, so what we mean is swimming was a problem before fish had fins. The problem with looking at evolution that way is that swimming is a problem for trees too!
>
> Things only start to find these problems and adapt when they interact with the world. So adaptation cannot be a case of organisms going into pre-existing problems because organisms make the problems by

> their very existence and change. The real issue in evolution is that *organisms are in constant construction of their own worlds* [emphasis added], posing the problems which they then have to solve.
>
> Natural selection does not cause adaptations to solve problems given by nature. Natural selection means the improvement in the way in which organisms interact with the world, when they've already started to interact that way.[69]

The ability of humans to attribute meaning to the material world is a behaviour, rather than a physical attribute. Bearing in mind Lewontin's strictures regarding the extent to which organisms are in the constant construction of their environments, how well-fitted is this behavioural character to our environment? Partly, this must depend on what constitutes our environment; I suggest that it includes not only the physical, but the social as well.

At one level, organisms may – literally – create their environment. Dawkins argues that a genotype can express itself as an organism of cells with highly differentiated functions – such as ourselves – but that, alternatively, it may give rise to highly differentiated social structures, such as that of a swarm of bees (thus, the social environment). Further, it can be argued that the structure and form of a beehive which accommodates and facilitates this social structure (as an anthill does for ants), are also phenotypical expressions of the genotype, hence, in part, his assertions as to the 'long reach'.[70] These two points are important: what might be termed 'social' aspects of behaviour can be genetic in origin; and some physical features which go to make up an environment, are there because they are created by virtue of genes on chromosomes (that is, they are genetic in origin); and because they are evolutionarily advantageous (that is, the hive or anthill, are adaptations, or an aspect of adaptations).

Yet Lewontin's point is surely this: it wrong to think of organisms as merely embodying adaptations which, *post hoc,* are thought of as solutions to problems which reside in the character of the environment. As one of Eldredge's 'Naturalists', he is reflecting primarily on the interaction of the organism with that environment. Some random genetic variations may lead to characters which advantageously alter how an organism interacts with its

environment and, over time, be favoured by natural selection. Yet, equally, some random variation in the environment may affect which characters in the organism are selected for. They both affect each other; neither is a given, nor fixed.

In the first, literal sense given above, we humans are undoubtedly engaged in 'the constant construction of our environment', although plainly, our buildings, towns and cities, not to mention the Egyptian scarab, the Roman coin, the Persian carpet, English watering pot, wood screw and laptop computer are not such direct, unmediated expressions of genetic make-up as beehives or anthills. We, after all, have consciousness; we can reflect on what we create, or do not create, and determine at will (or so it seems) aspects of form and finish; and further, we can attach significance and meaning to that which we fashion. Conventionally, these aspects of our physical environment and of our mental representations of it have been regarded as the products - more or less - of cultural change alone. Yet, building on Lewontin's model for a moment, I suggest that 'constant construction' of the environment might indeed embrace not only the physical, but also the mental (and thereby, partly, the social). Indeed, as will be shown, for humans it is possible to argue that, to some extent, both physical and mental owe their existence, as well as many detailed aspects of their configuration, to evolutionary imperatives. Until those arguments are mounted, the 'close fit' demanded by Ridley's criterion (and inherent in Lewontin's remarks) must remain a distinct possibility for the suite of adaptations which collectively constitute our ability to attribute significance and meaning to the material environment, rather than a case proven.

As noted, for humans (and to a lesser degree, quite a few other species) there is an alternative to biology as both the source of a behaviour, and the means by which it is sustained: culture. For this reason, irrespective of the degree of fit which may or may not ultimately be demonstrated, in order to determine whether such behaviour is, indeed, an adaptation in the strict biological sense or not, an additional test must be introduced, which runs something like this: 'a character can be considered an adaptation, *only* if it is genetic in origin, *and* is maintained by genetics in the modern organism'. Indeed, as noted, Dawkins and Lewontin both insist that for a behaviour to be

considered as having evolved by natural selection, it must have originated as a genetic variation.[71] Thereafter, in humans, it may be sustained by that genetic variation being replicated in succeeding generations or, even allowing for its genetic origins, it may be sustained by succeeding generations acquiring it by the example and observation of others – culture, in other words.[72] In such circumstances, what may have begun as a biological, Darwinian adaptation, has ceased to operate as one.

As will subsequently be shown, archaeology provides evidence that cognitive faculties and behaviours which seem to be the precursors to the suite of adaptations proposed here, were exhibited by our ancestor species; and that once the recognisably modern ability to attribute significance and meaning to the material world emerged some 50,000 to 100,000 years ago (a debate surrounding this timing follows in chapter four), it has – as noted in the first of these tests - remained a human universal, found everywhere, among all peoples and at all times. This remains true today. While not conclusive proof,[73] ubiquity and universality can both be cited as indicators that, like sex and eating, the ability to attribute significance and meaning to the material world is not only genetic in origin, but that even now, like them, however much culture may define its precise, contingent practice, considered as a *mechanism,* it is maintained by genes. If true, then this ability passes this additional test.

To proceed, then, to Ridley's next test: 'Adaptations are characters that help their bearers to survive and reproduce'. Does a fin do that for a fish? In isolation, it cannot be said directly to further either. Its immediate functions are to enable the fish to move and steer; but obviously, in combination with other characters which enable the fish to identify and move towards food, or move away from danger, or move towards mates, it plainly does help the fish both survive and reproduce. Indeed, as noted, it is foolish to try to determine whether any character may amount to an adaptation by considering it in isolation. Ridley, echoing Dawkins, writes:

> The adaptations of organisms are a set of trade-offs between multiple functions, multiple activities, and the possibilities of the present and the future. If a character is viewed in isolation it will often seem poorly

> adapted; but the correct standard for assessing an adaptation is the contribution to the organism's fitness in all the functions it is employed in, through the whole of the organism's life[74]

Accordingly, the ability of humans to attribute significance and meaning to the material environment which, it is argued, represents a coherent grouping of adaptations, yet which might superficially seem much more remote from the ultimate objectives of survival and reproduction than even the fins are for the fish, can, nonetheless, be plausibly accorded such recognition, once the ability is considered in relation to other behaviours we exhibit, as well as the opportunities and vicissitudes of a human life. Once again, the full extent to which this ability actually contributes to our capacity for survival and reproduction is the subject of much of the balance of this study. For now, I will cite just one, interim argument to support the general assertion that it does.

Artefacts support survival and reproduction

For fish, the benefits enjoyed, on average, because of collective 'shoal intelligence' are the fruits of generations of evolution by natural selection. Compared with fish brains, those of humans are spectacularly more complex, including those aspects which regulate our behaviour. Inevitably for so social an animal, these include those affecting our behaviour towards one another. For hotly-contested reasons, it would seem that an aspect of this evolved complexity is our capacity for *consciousness*.[75] Setting aside (only temporarily) controversies surrounding its nature for a moment, I am convinced that the absolute corollary to human consciousness is the overwhelming urge to construct identity, that is, to navigate our way through our social environment towards constructing a satisfying 'social location'. I further suggest that we humans do this, more or less, in our every conscious action. While I do not want to enter into a debate about the consciousness, or otherwise, of fish, it would be fair to say that fish, in their evolved reactions to each other (including mating), to predators, to food sources, to their environment, and their responses to the cues, variously, of temperature, smell, light and dark and so on, have behaviours which are advantageous to them. Separately or in

combination, these can be cited as adaptations which improve the fish's chances of survival and reproduction.

Setting aside for a moment those direct, fundamental nutritional and reproductive factors, and physical dangers which we, like other species must successfully negotiate to survive, perhaps peculiarly to fully-conscious *Homo sapiens*, it can be argued that identity is critical in maintaining the will to survive. As countless historical, not to mention mental health examples can testify, when identity breaks down, the desire to survive can be seriously, sometimes fatally impaired, precluding, in some cases, even the possibility of reproduction. By contrast, a strong sense of identity has the opposite, and, from an evolutionary perspective, desirable effect, enhancing the will to live, and increasing the chances of reproducing.

Among humans, one means, among others, of reinforcing a sense of identity, is through the significance and meaning which may be bestowed on places and objects in the physical environment. Social relationships are thereby expressed, mediated and codified. Some of these material features may be physically modified or constructed for practical, or for emotional reasons. I would argue that emotion is *never* absent and that – to take an extreme example from the bore-hole objects, even a wood screw has to deliver the appropriate aesthetic experience, if it is to be engaged with at all on a practical level. This duality of the practical and emotional is more immediately self-evident in the fabric of our shelters, villages, towns and cities, the other bore-hole artefacts, such as the scarab, the coin and so forth, which are (or have been) intrinsic to our daily lives.

Humans, to return to Lewontin's assertion, are, indeed, like any other organism, in the constant construction of their environment; and that construction is, of necessity, both physical, *and* mental. I propose that one reason why the ability to attribute significance and meaning to the physical environment, including such artefacts as may be introduced by us into it, is that doing so serves significantly to reinforce a sense of identity, and that for *Homo sapiens*, as noted, a strong sense of identity is among the most critical mental factors which foster survival and reproduction; in other words, that it is, indeed, a character which helps its bearer better to survive, and therefore

reproduce. Once again, when measured against Ridley's further test, the ability to attribute significance and meaning to the material world can plausibly be described as adaptive.

Finally, Ridley suggests, adaptations 'are purposive [meaning *appearing to* serve a purpose] and often complex: the sorts of characters that before Darwin would have suggested the existence of God.[76] Here we return to a refinement of the second requirement – that the character be identifiable as more than the results of random factors. He probably has immediately in mind data drawn from the conventional sources of evidence in biology and palaeontology; or is referring obliquely, perhaps, to William Paley's argument in the early nineteenth century, that such was the complexity of - for example - the eye, no purely random process could have brought it into being; but rather that, like the delicate workings of a watch, one is contemplating the results of intelligent, purposive labour (in the other sense of a goal deliberately and consciously aimed at). Bishop Paley took this to be evidence for the existence of God. Yet quite apart from complex physical characters of this kind, the test may also be applied to attributes from the more problematic area of human behaviour. The complexity of the phenomenon is unarguable, but is it (in the first sense) purposive? I have begun to suggest above that it is. As for the last element in this criterion, little can be said of associating the particular ability to attribute significance and meaning to the material world as suggesting something which, in the past, might have been taken as evidence for an apparent intervention of the divine. Even so, it may be worth remembering in passing that Shakespeare was only restating a commonly understood, long-standing 'truth' (and with a resonance, the extent of which will only become clear later in this study) when he makes Hamlet speak of human complexity as a whole, as if it were divinely *created:*

> What a piece of work is Man! How noble in reason! how infinite in faculty! in form, in moving how express and admirable! in action how like an angel! in apprehension how like a god! the beauty of the world! the paragon of animals![77]

For this last test, reluctantly, I must cite the analysis of evidence found in the remainder of this study, and thus, once more delay the argument. Nonetheless, I claim in advance that once these arguments are laid out, by Thornhill's first criterion,[78] by all three criteria suggested by Ridley (and the additional one introduced by me), the ability to attribute significance and meaning to the material world will be found unambiguously to be adaptative.

Conclusion

Evolution just is; our dilemma is how best to describe it. We delight in contemplating the subtlety and sophistication of both its workings and its works. We long to understand evolution thoroughly, because in doing so, we come to appreciate the true nature of the world in which we live, of our own place in it, of our origins, and understand more fully our modern selves. Darwin had a profound sense of the significance of the ideas proposed in his *Origin of Species*, as well as an understandable sense of excitement at the prospects they might, eventually open up:

> In the distant future I see open fields for far more important researches. Psychology will be based on a new foundation, that of the necessary acquirement of each mental power and capacity by gradation. Light will be thrown on the origin of man and his history...And as natural selection works solely by and for the good of each being, all corporeal and mental endowments will tend to progress towards perfection.[79]

Arguments about evolution today are of four main types: Has it occurred? How does it operate and which aspects of its operation should be the focus of attention? What has evolved from what? And is there anything about humans which, in an evolutionary sense, makes us special? In this chapter, I have reflected on the all but the first (because the answer to that question is: it has). The last, as Darwin implied, considers the special relevance of evolution to humans, asking how much of what we are and what we do can be thought, even in our 'advanced' cultured state, still to embody its workings?

As shown, such disagreements as there have been on the second point have often been of emphasis, differences heightened somewhat by the types of language deployed by each side, by what each side has thought the other has meant, not to mention what each argument has been thought to represent. I have explored something of these differences both of substance and emphasis, and in doing so, I have sought to define key terms, in order to ask the question: in contemplating the relationship of evolution to ourselves, can it be argued that the human ability to attribute significance and meaning to the material world should be regarded both historically as a product of it, and as a function maintained today by genes? Further, if both are so, can it be thought a suite of adaptations? I have shown that both Ultra-Darwinist and Naturalist accounts can, potentially, accommodate this suggestion.

Although they must remain, at this stage of this study, more suggestive than conclusive, I have also introduced Thornhill's and Ridley's tests for identifying an adaptation (and another of my own). This is partly because Ridley's position can - in broad terms - be taken as that of the consensus viewpoint. The full extent to which the ability to attribute significance and meaning to the material world passes these tests will only become apparent in succeeding chapters. Thus, at this stage, the case for it being 'well-fitted' to our physical and social environment remains unproven, although I cite the fact that it has been a human universal across place, time and culture as supporting the suggestions that it originated as a genetic variation, and that it remains sustained by genes now. By his second test, that a character must help its bearer survive and reproduce, I have mounted an interim argument, proposing that the effect of this behaviour is to help us navigate the social environment by contributing to a satisfying sense of identity which, in turn, contributes in no small measure to the will to survive; and that survival is a necessary precursor to sustaining the chance, at least, of reproduction. The result of the last test demands that an adaptation be purposive, complex, and among 'the sorts of characters that before Darwin would have suggested the existence of God.'[80] The full arguments about its purposive character will follow; its complexity is beyond doubt; the extent to which it resembles what in the past might have been taken as the work of a divine agency will, like those other aspects as yet

unproven or unresolved, be formally returned to in the conclusion to this study as a whole.

It is to those aspects of evolution which have coloured and shaped our own, peculiarly human existence that I will now turn.

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[1] The term 'Ultra-Darwinists' implies, I think, that they are beyond, or further than Darwin, rather than extreme exponents of the Darwinism Darwin himself propounded.

[2] Eldredge, N., *Reinventing Darwin: The Great Debate at the High Table of Evolutionary Theory,* John Wiley & Sons Inc., New York, 1995

[3] So famous, he even made a guest appearance in *The Simpsons*.

[4] To take just one example: *Alas, Poor Darwin* edited by Hilary and Steven Rose. The ill-feeling it both embodied and provoked is examined a little below. Rose, H., and Rose, S., (eds.), *Alas, Poor Darwin: Arguments Against Evolutionary Psychology,* Jonathan Cape, London, 2000

[5] Niles Eldredge is probably best-known for introducing, with Gould, the concept of *punctuated equilibria*. Gaps in the fossil record had been identified by Darwin as an area of potential weakness, in terms of the support that record could lend to the idea of evolution. Darwin repeatedly emphasised that evolution involved gradual change over immense periods of time, but was aware that gaps existed in the fossil record where evidence of this change might be expected. He thought these 'gaps' would, eventually, be filled, and for about a century, palaeontologists obliged by presenting their fossil findings in terms of just such expectations (while 'the missing link' became a staple of popular journalistic reportage). Eldredge and Gould rejected this model – which they termed 'phyletic gradualism' - in favour of one which accepted these gaps as real, suggesting instead that new species arose rapidly in particular circumstances among semi-isolated populations of a species, and that for long periods, the evolutionary process was a story of a succession of 'homeostatic equilibria' punctuated by these successful speciation events. The longed-for intermediate fossil remains would simply not appear in this scenario, as these periods of intense activity were, in evolutionary time, short-lived. Mark Ridley reminds us that, as Dawkins has argued, Darwin was categorically *not* a phyletic gradualist, in the sense that Gould and Eldredge have asserted. Darwin's model of gradual change is rehearsed most often in connection with the emergence of complex adaptations, that many steps are required for a complex adaptation to emerge. Darwin himself suggested something akin to *punctuated equilibria* (the suggestion that species may remain unchanged for long periods, punctuated by periods of change) when, in *The Origin of Species,* he wrote 'Many species once formed never undergo any further change…; and the periods during which species have undergone modification, though long as measured by years, have probably been short in comparison with the periods during which they retained the same form.' Eldredge, N., and Gould, S. J., 'Punctuated equilibria: An alternative to phyletic gradualism', included in Schopf, T. J. M., *Models in Paleobiology*,

Freeman, Cooper & Co., San Francisco, USA, 1972, pp. 82-115; also included as print-out on, Ridley, M., *Evolution,* Blackwell Science, London, 1996 (CD-ROM). Ridley, M., *Evolution: Second edition*, Blackwell Science, London, 1996, p569. As this study refers to works by both Mark Ridley, as here, and Matt Ridley, below, I will hereafter refer in these references either to 'Ridley, Mark' or 'Ridley, Matt' to prevent the confusion which otherwise might result from strict adherence to referencing convention.

[5] Eldredge, N. and Gould, S. J., 'Punctuated equilibria: An alternative to phyletic gradualism', included in Schopf, T. M. J., *Models in Paleopbiology*, Freeman, Cooper & Co., San Francisco, USA, 1972, p. 84

[6] Darwin, C. R., *The Origin of Species,* Wordsworth Editions, Ware, Hertfordshire, 1998 (orig. 1859), p. 6

[7] That is, heritable, in the sense that it can be passed on to offspring, unlike say, highly developed musculature acquired in the course of an organism's life because of exercise, which cannot.

[8] Hurry, S., 'Introduction to evolution', in Skelton, P., ed., *Evolution: A Biological and Paleontological Approach*, The Open University, Addison Wesley Publishing Company, New York, 1993, p. 4

[9] Skelton, P., ed., *Evolution: A Biological and Paleontological Approach*, The Open University, Addison Wesley Publishing Company, New York, 1993, p. 4

[10] Quoted by Skelton, p. 2

[11] Wilson, E. O., *Sociobiology: The Abridged Edition,* The Belknapp Press of Harvard University Press, Cambridge, Massachusetts, USA and London, 1998, p. 3

[12] Eldredge, p. 57

[13] Eldredge, pp. 4-5

[14] Eldredge, p. 5

[15] Dawkins, R., *The Extended Phenotype: The long reach of the gene*, Oxford University Press, Oxford, 1999 (orig. 1982)

[16] Dawkins, p.12

[17] Dawkins, p.13

[18] Dawkins, p. 27

[19] Dawkins, p. 28

[20] Dawkins' insistence on conducting the discussion in what some might take to be these narrow, genetic terms, seems, in part, to arise from the battle he himself felt he had to fight in the seventies and eighties in order to get a fuller appreciation of the role of genes to be taken seriously. Now (2004) it may be that, having accomplished much that he set out to achieve, discussions which do not immediately invoke the genetic dimension can be conducted, provided that dimension is re-addressed whenever it can further understanding.

[21] Quoted in Dawkins, p. 20

[22] Dawkins, pp.18-19

[23] Dawkins, p. 183

[24] Dawkins, p. 184

[25] Dawkins, p. 185

[26] Dawkins, p. 186

[27] Gould, S. J., 'Caring groups and selfish genes', *Natural History* vol. 86 issue 12, 1977, pp. 20-4, quoted by Dawkins, p. 116

[28] Dawkins, p. 112
[29] Gould, S. J., 'Caring groups and selfish genes', pp. 20-4, quoted by Dawkins, p. 117.
[30] Dawkins, characteristically, will have none of it, or rather, wishes to express it in genetic terms. What Gould describes, according to Dawkins, results from 'mutually compatible' suites of genes replicating themselves. Natural selection, while acting on phenotypic expressions, such as the organism, is ultimately working on the 'success' or otherwise of these clusters. While acknowledging it may have limitations, Dawkins maintains his gene-based mode of description is ultimately subtler and more useful. Dawkins, p. 117.
[31] Eldredge, p. 192
[32] Dawkins, pp. 112-3
[33] It is salutary to remember that (arguably) the three most important scientific re-conceptualisations ever - those of Newton, of Einstein, and of Crick and Watson - had the effect of unifying realms previously thought of as separate, with independent sets of rules. E. O. Wilson argued for the convergence of human knowledge in his book, *Consilience*, while string theory, though both controversial and somewhat modish, seeks to push that process of unification yet further. Wilson, E. O., *Consilience*, Little, Brown & Co. (UK), London, 1998
[34] Eldredge, pp. 193
[35] Eldredge, pp. 195
[36] Eldredge, pp. 197
[37] Wilson, E. O., *Sociobiology: The Abridged Edition,* The Belknapp Press of Harvard University Press, Cambridge, Massachusetts, USA and London, 1998
[38] For example, notoriously: Herrenstein, R. J., and Murray, C., *The Bell Curve: Intelligence and Class Structure in American Life,* Free Press, New York, 1994; for a flavour of the debate this work stirred, see Bouchard Jr., T. J. and Dorfman, D. D., 'Two Views of *The Bell Curve*', Contemporary Psychology, vol. 40 issue 5, May 1995
[39] Rose, H., and Rose, S., (eds.), *Alas, Poor Darwin: Arguments Against Evolutionary Psychology,* Jonathan Cape, London, 2000
[40] Rose, H., and Rose, S., (eds.), *Alas, Poor Darwin: Arguments Against Evolutionary Psychology,* Jonathan Cape, London, 2000, p. 3
[41] Rose, H., and Rose, S., (eds.), *Alas, Poor Darwin: Arguments Against Evolutionary Psychology,* Jonathan Cape, London, 2000, p. 4
[42] Rose, H., and Rose, S., (eds.), *Alas, Poor Darwin: Arguments Against Evolutionary Psychology,* Jonathan Cape, London, 2000, p. 4
[43] Rose, S., 'Psychocivilised or a band of neurochemical slaves?' *The Times Higher Education Supplement*, 25.02.05, p?
[44] Miller, G., 'Alas, Poor Darwin reviewed by G. Miller', International Society for Comparative Psychology, July 2000, accessed at http://listserv.tcu.edu/cgi-bin/wa.exe?A2=ind0007&L=iscp-l&T=0&F=&S=&P=7337 on 28.02.05. Is it uncharitable to speculate that it is the Roses' and their authors' concentration on, Steven Pinker, David Buss, Richard Dawkins, Matt Ridley, and Daniel Dennett, rather than Geoffrey Miller, which is, in part, the source of his irritation?

[45] Kurzban, R., 'Alas, Poor Evolutionary Psychology: Unfairly Accused, Unjustly Condemned' *The Human Nature Review*, 2, 14 March, 2002, pp. 99-109, accessed at http://human-nature.com/nibbs/02/apd.html on 28.02.05
[46] Ridley, Matt, 'Alas poor evolutionary psychology[…] by Robert Kurzban', *The Human Nature Review*, 2 18 March 2002, p.118, accessed at http://human-nature.com/nibbs/02/118.html on 28.02.05
[47] Pond, C., 'Adaptation', Skelton, p. 26
[48] Pond, C., p. 25
[49] Ridley, Mark, p. 329
[50] Ridley, Mark, p. 329
[51] Cain, A. J., 'The Perfection of Animals', *Biological Journal of the Linnaean Society*, vol. 36, 1989, pp. 3-29. Originally published in Carthy, J. D., and Dudington, C. L. (eds.), *Viewpoints in Biology, 3:* pp. 36 -63, Butterworths, London, 1964; printed from Ridley, Mark, *Evolution*, Blackwell, London, 1996 (CD-ROM)
[52] Darwin, C. R., pp. 355-356
[53] Dawkins, pp. 35-6
[54] Dawkins, p. 53
[55] Ridley, Mark, p. 348
[56] Cited by Ridley, Mark, pp. 347-8
[57] Eldredge, p. 46
[58] Gould, S. J., and Lewontin, R. C. 'The Spandrels of San Marco and the Panglossian Paradigm: A critique of the Adaptationist programme', E. Sober, ed., *Conceptual Issues in Evolutionary Biology: An Anthology*, The MIT Press, Cambridge, Massachusetts, USA and London, 1993 (orig. 1984), p. 259
[59] Gould and Lewontin, p. 262
[60] Interestingly, Dawkins holds that pleiotropy is the norm, rather than the exception. If one effect is beneficial and the other not, the tendency, according to Dawkins, would be for natural selection to favour either, separating the genetic location of the effects to preserve the good and eliminate the bad. Dawkins, p. 299
[61] Perhaps the weakest of Gould and Lewontin's alternatives to adaptation as the explanation of a character is the suggestion that selection might exist *without* adaptation. They cite Lewontin's theoretical model where a particular mutation doubles fecundity and, as a consequence, sweeps rapidly through a population. If there is no net increase in resources available, the population is thereby disadvantaged; and if predators are more attracted to the population because of the increased availability of juvenile organisms, the survival of the population may be further threatened. This argument can only hold if natural selection favoured increased fertility alone. If, as both Mark Ridley and Eldredge suggest, not to mention Darwin, selection favours adaptations only when - in the context of such other adaptations the bearer may embody - they help their bearers to reproduce *and* survive, then the model is flawed.
[62] Gould and Lewontin, p. 263
[63] Gould and Lewontin, p. 269
[64] Thornhill, R., 'Darwinian Aesthetics Informs Traditional Aesthetics', in Voland, E., and Grammer, K., (eds.) *Evolutionary Aesthetics,* Springer, Heidelberg, 2003, p.12

[65] Thornhill, p.15
[66] Ridley, Mark, p. 365
[67] Thornhill, p.15
[68] Thornhill, p.13
[69] Quoted by Ridley, Mark, *Evolution*, Blackwell Science, London, 1996 (CD-ROM)
[70] Taking the argument further still, Dawkins suggests that coevolution between species, whereby two or more species may evolve in ways both mutually beneficial to and mutually dependent on each other, changes wrought by the natural selection of genes on a genotype residing in one species, may affect the forms of organisms in another. Dawkins, pp. 246-247
[71] Dawkins, pp.18-19; Lewontin quoted in Dawkins, p. 20
[72] As will subsequently be explored in more detail, I am taking culture to be a process thoroughly enmeshed in biology and evolutionary imperatives, while allowing that some of its workings may operate quite outside them.
[73] It could be argued that, because of the 'time lag' problem, a character which evolved in quite different circumstances which pertained in the past, may be present, but become redundant in the much changed environment of the modern world; or it may be declining, and in the process of being eliminated. In this instance, I doubt that either is the case.
[74] Ridley, Mark, p. 363. This is precisely one of the arguments to which Gould and Lewontin took exception in their 'Spandrels' paper, arguing that the phyletic histories of organisms as a whole might offer alternative, valid explanations for the contemporary functioning of characters.
[75] A slippery term returned to in chapter two.
[76] Ridley, Mark, *Evolution*, Blackwell Science, London, 1996 (CD-ROM)
[77] Shakespeare, W., *Hamlet: The Prince of Denmark*, Act 2 Scene 2, from *Shakespeare: Complete Works*, Oxford University Press, Oxford, 1974, p. 883
[78] I defer a discussion of Thornhill's other criteria until the following chapter, in which something of the neural structure of the brain is reflected on and his particular stance can more conveniently be considered.
[79] Darwin, pp. 367-368
[80] Ridley, Mark, *Evolution*, Blackwell Science, London, 1996 (CD-ROM)