DARWINISM AND METAPHOR

Thomas Hobbes deplored "the use of metaphors, tropes, and other rhetorical figures, instead of words proper. For though it be lawful to say, for example in common speech, the way goeth, or leadeth hither and thither, the proverb says this or that, whereas ways cannot go, or proverbs speak; yet in reckoning, or seeking of truth, such speeches are not to be admitted" (Leviathan, 1, 5). The twentieth century saw a strong attack on this dismissive view of metaphor. Literary theorists and philosophers and others argued strongly that metaphor is not just a convenient way of condensing material – theoretically dispensable and generally misleading and dangerous (Black 1962; Lakoff and Johnson 1980). They argued that metaphor is an integral part of our thought processes and that one simply cannot eliminate metaphor nor should one try. One of the groups most strongly supportive of this new perspective on metaphor came from the philosophy of science community. It has always been recognized that science is highly metaphorical – force, work, power, attraction, repulsion, not to mention fancier notions like the charm of certain subatomic particles and, at the other end of the scale, the big bang that started it all (was there any noise?). Traditional opinion has it that this is all either preliminary or convenience. The well-known philosopher Jerry Fodor writes: "When you

actually start to do the science, the metaphors drop out and the statistics take over" (Fodor 1996, 20). Not so, argued these metaphor-endorsing philosophers of science. In science, metaphor is not only used – it is indispensable (Hesse 1966; Ortony 1993).

I am on the side of those that think metaphor indispensable (Ruse 1999). I think that metaphor is widely used in science, I do not think it can be eliminated without great loss of content (if indeed it can be eliminated at all), and that one should not even think of trying to do so. However, I realize more and more that in endorsing this view of metaphor, one is creating (as so often happens in philosophy) a new set of problems. In particular, one raises the issue of the objectivity of science. If metaphor is indispensable, then in some sense one is arguing that metaphor is involved in the creation of understanding and not merely in discovery. But if this is so, then in some significant sense – the more significant the more one promotes the importance of metaphor – one is arguing that science is not objective knowledge but something subjective, dependent on the individual scientist. Metaphors are making scientific meaning rather than just finding it. More than this, if metaphors reflect societal norms and interests and customs and achievements – and they surely do– then science becomes (some would say is reduced to) an epiphenomenon of society. To use a

phrase, science becomes something of a social construction.

This is my problem in this essay. And as is my wont, I will address issues through a concrete example, namely Darwinian evolutionary theory – primarily the theory of Charles Darwin himself, but with reference to the subsequent developments of the theory in the century and a half after Darwin published his great *On the Origin of Species by Means of Natural Selection* in 1859. First, I shall show that metaphor is important for Darwin. Then I shall argue for its intrinsic necessity. Finally, I shall address the objectivity/subjectivity issue.

Organisms as designed

The *Origin* aims to do two things – although, as it happens, the two aims are intertwined through the book. First, the *Origin* argues for the plausibility of an evolutionary picture of organic origins. All organisms, living and dead, are the end results of a long, slow process of development, governed by natural law (that is, no miracles), from just a few, perhaps even just one, original forms. Second, the *Origin* argues for a mechanism, natural selection brought on by a struggle for existence. As he strives to evolution *per se*, Darwin's thinking is deeply metaphorical – think of the way that he interprets evolution as a tree of life. Here, however, I want to focus on the second of Darwin's aims, to introduce and establish his mechanism or cause of natural selection.

This mechanism has at its centre a root or core metaphor – like "time is a river," and "argument is a battle." In Darwin's case it is: "organisms are designed." Darwin's mechanism does not just explain change, but change of a particular kind. Change to adaptive advantage, to adaptation – the eye, the hand, the ear, the leaf, the shell, the fin, the scale are treated as objects of design, and the aim of natural selection is to explain this design. And so it continues to the present: In one of the most highly regarded books by a still-living evolutionist, American ichthyologist George Williams is explicit beyond doubt.

Whenever I believe that an effect is produced as the function of an adaptation perfected by natural selection to serve that function, I will use terms appropriate to human artifice and conscious design. The designation of something as the means or mechanism for a certain goal or function or purpose will imply that the machinery involved was fashioned by selection for the goal attributed to it. When I do not believe that such a relationship exists I will avoid such terms and use

words appropriate to fortuitous relationships such as cause and effect. (Williams 1966, 9)

This was Darwin's central problem. Organisms as objects of design is a metaphor. This design-metaphor was the *raison d'être* for Darwin's mechanism of natural selection – itself a metaphor (Young 1985). Animal and plant breeders use selection to fashion just the kinds of organisms that they want. Nature does the same. More organisms are born than can survive and reproduce. This leads to a struggle for existence. Organisms differ in their features or characteristics. Some survive and some do not. Those that survive and reproduce on average have features (not possessed by their losing competitors) that enable them to succeed.

Let it be borne in mind in what an endless number of strange peculiarities our domestic productions, and, in a lesser degree, those under nature, vary; and how strong the hereditary tendency is. Under domestication, it may be truly said that the whole organization becomes in some degree plastic. Let it be borne in mind how infinitely complex and close-fitting are the mutual relations of all organic beings to each other and to their physical conditions of life. Can it, then, be thought improbable, seeing that variations useful to man have

undoubtedly occurred, that other variations useful in some way to each being in the great and complex battle of life, should sometimes occur in the course of thousands of generations? If such do occur, can we doubt (remembering that many more individuals are born than can possibly survive) that individuals having any advantage, however slight, over others, would have the best chance of surviving and of procreating their kind? On the other hand we may feel sure that any variation in the least degree injurious would be rigidly destroyed. This preservation of favourable variations and the rejection of injurious variations, I call Natural Selection. (Darwin 1859, 80-81)

Expanding the metaphor

There are many other metaphors used by Darwin and by subsequent evolutionists, some more and some less connected with this core metaphor of design, and of selection being the designer. Let us stay here with this central metaphor. Darwin himself expands on the metaphor in various ways. For instance, he often ties in the notion of design – or organisms as though they are functioning machines – with Adam Smith's idea of a division of labour. Sometimes Darwin thinks at the level of the individual. Thus, in the case of humans Darwin writes: " for many actions it is indispensable that

the arms and whole upper part of the body should be free; and he must for this end stand firmly on his feet. To gain this great advantage, the feet have been rendered flat; and the great toe has been peculiarly modified, though this has entailed the almost complete loss of its power of prehension. It accords with the principle of the division of physiological labour, prevailing throughout the animal kingdom, that as the hands became perfected for prehension, the feet should have become perfected for support and locomotion" (Darwin 1871, 1, 2, "natural selection"). Sometimes Darwin thinks at the level of the group. The division of labor metaphor was a key factor in his explanation of the evolution of different species. Darwin argued that such species would be able to exploit ecological niches much more efficiently, if they were in fact designed for the different niches, and not identical.

The advantage of diversification in the inhabitants of the same region is, in fact, the same as that of the physiological division of labour in the organs of the same individual body -- a subject so well elucidated by Milne Edwards. No physiologist doubts that a stomach by being adapted to digest vegetable matter alone, or flesh alone, draws most nutriment from these substances. So in the general economy of any land, the more widely and perfectly the animals and

plants are diversified for different habits of life, so will a greater number of individuals be capable of there supporting themselves. (Darwin 1859, 158-9)

Today also we find that the idea of a division of labour is one which plays a crucial role in biological thinking. For instance, following Darwin explicitly, the Harvard entomologist and sociobiologist Edward O. Wilson (1980a, b, 1983a, b) has performed sterling labours showing how the social insects, particularly the ants, are highly specialized users of a division of labour, with the workers doing one thing, and the soldiers doing another, and the queen doing yet another role.

A key feature of *Atta* social life disclosed by these data is the close association of both polymorphism and polyethism with the utilization of fresh vegetation in fungus gardening....

An additional but closely related major feature is the 'assemblyline' processing of the vegetation, in which the medias cut the vegetation and then one group of ever smaller workers after another takes the material through a complete processing until, in the form of 2-mm-wide fragments of thoroughly chewed particles, it is inserted

into the garden and sown with hyphae... (Wilson 1980a, 150)

Through and through, Wilson's thinking goes back via Darwin to Adam Smith. Wilson's thinking is metaphorical: there is no question of anybody in the ant world consciously articulating and following the division. And the metaphor clearly relates back to the metaphor of organism as designed. The question again and again is how did nature make organisms in such a way that they might function most efficiently.

But are they necessary?

The question now arises about the necessity of metaphor – the design metaphor for Darwin specifically. Does Darwin – does a Darwinian – have to have the metaphor of design? Ask first: Could Darwin have got natural selection without design? I mean, could Darwin have got the mechanism of natural selection were he not thinking of something like the eye as a product of a designing intelligence. I suppose logically it is possible. Darwin in fact did not get natural selection without design – he was acutely conscious of design and spent some eighteen months working hard in order to explain it in a naturalistic fashion, finally hitting upon natural selection. But let us agree to a counter factual. He could have been dreaming one day, and suddenly natural selection popped into his head. Natural selection without design.

But this proves virtually nothing. Without design, natural selection would have been a solution without a problem. Why would Darwin have taken any notice of natural selection had he not been troubled by design? If design had not been his obsession, natural selection would have been an irrelevancy. If the eye was not like a telescope, why bother to explain its telescope-like nature? We have the interesting case of Darwin's great supporter, Thomas Henry Huxley. He was as ardent an evolutionist as one could wish, but always a bit indifferent to natural selection (Ruse 1979). Why? Because design was not his problem! Huxley was much more interested in homology – the isomorphisms between organisms – than in adaptation. Design was not his problem, and so natural selection was never his solution.

Immanuel Kant

Without the metaphor of design, natural selection would have been a mechanism without a purpose, without a use, and no one would ever have thought it worth bothering with. Darwinian evolutionary theory – that is, a

selection-based and selection-focused evolutionary theory – could not be as it is without the metaphor of design. This raises a second question. Ask now: Is a Darwinian-type of evolutionary theory the only adequate evolutionary theory? Is the only adequate evolutionary theory one that makes central the metaphor of design?. Although he was no evolutionist, this would have been the position of Immanuel Kant (1790). He thought design-type thinking (what, following Aristotle he called "final cause" type thinking) an absolutely necessary aspect of thinking about the organic world. "It is common knowledge that scientists who dissect plants and animals, seeking to investigate their structure and to see into the reasons why and the end for which they are provided with such and such parts, why the parts have such and such a position and interconnexion, and why the internal form is precisely what it is, adopt the above maxim as absolutely necessary." Scientists cannot do biology in any other way. Design-type thinking – teleological thinking – is not a luxury; it is a necessity. Life scientists "say that nothing in such forms of life is in vain, and they put the maxim on the same footing of validity as the fundamental principle of all natural science, that nothing happens by chance. They are, in fact, quite as unable to free themselves from this teleological principle as from that of general physical science. For just as the abandonment of the latter would leave them without any experience at all, so the abandonment of the former would leave them

with no clue to assist their observation of a type of natural things that have once come to be thought under the conception of physical ends" (p. 25).

For Kant, teleological thinking is a regulative principle, it is a necessary heuristic. It is not a condition of rational thinking in the way that the mechanical philosophy is. We cannot think of the world except as causally, for instance. We can certainly look at organisms without thinking of final causes. But as soon as we start to study them, to understand them, final-cause thinking comes into play – has to come into play. For Kant, the final causes are part of the filter, the lens, through which we study the world. They are our doing: similar to things like causality in that we impute them to the world, but less strong than causality because we can think without them even though we cannot work without them. They are regulative. "Strictly speaking, we do not observe the *ends* in nature as designed. We only read this conception *into* the facts as a guide to judgement in its reflection upon the products of nature. Hence these ends are not given to us by the Object" (p. 53).

Constraints

Substituting natural selection for God, I confess to considerable sympathy for the Kantian position. But I am not quite sure that it works – or rather I am not quite sure that it works in every possible sense, although I myself do think that it works in the only worthwhile sense. If it works in every possible way, then it is only possible to have an evolutionary theory that makes central the design metaphor. So one has to have a Darwiniantype theory, one that makes natural selection central. Or, let us say more strictly, one has to have a theory that makes an adaption-producing mechanism central. So let us ask whether one can have an evolutionary theory that does not focus on the design metaphor?

The late Stephen Jay Gould (2002) would be one sympathetic to this countermove. He stood in a long tradition going back through and beyond Thomas Henry Huxley to the German morphologists at the beginning of the nineteenth century, the *Naturphilosophen* (Richards 2003). For them, homology was all important, and design – final cause was secondary, if that. Darwin recognized homology – he called it Unity of Type – but he while he thought it important proof of the fact of evolution, he did not think it that important when it came to causes or mechanisms.

So really now what we have to ask is not whether there can be non-

design-focused evolutionary theories, but whether there can be *adequate* non-design-focused theories. Any fool can come up with a theory. The question is whether any fool can come up with a theory that knocks Darwinism out of the ring of active science. Let us pick up on the kind of argument that Gould used to make, and to do this consider what have been labelled structural constraints (Ruse 2003). Sometimes, it is argued, the very task of putting together a functioning organism that constrains nature in such a way that design is impossible – in the language of today's evolutionists, you simply cannot expect to optimize everything in an animal or plant. Structure dictates otherwise. In a celebrated critique of a guarter century ago, Gould and his Harvard colleague Richard Lewontin (1979) drew attention to the triangular decorative aspects of the tops of pillars in medieval churches. They argued that although such "spandrels" seem adaptive – areas for creative outpourings – in fact they are just by products of the builders' methods of keeping the roof in place. "The design is so elaborate, harmonious, and purposeful that we are tempted to view it as the starting point of any analysis, as the cause in some sense of the surrounding architecture." This, however, is to put the cart before the horse. "The system begins with an architectural constraint: the necessary four spandrels and their tapering triangular form. They provide a space in which the mosaicist worked; they set the quadripartite symmetry of the dome above"

(Gould and Lewontin 1979, 148). Perhaps, argue our two authors, we have a similar situation in the living world. Much that we think adaptive is merely a spandrel, and such things as constraints on development prevent anything like an optimally designed world. Perhaps things are much more random and haphazard – non-functional – than the Darwinian thinks possible. An adequate evolutionary theory would recognize this.

Metaphor as heuristic

Now what does the Darwinian say in response to all of this? We can follow Kant – and, incidentally, other philosophers of science enthused by metaphor. We can refer to the heuristic power of metaphor in general and of the design-metaphor in particular. We can show that the design metaphor, and selection-type explanation, can lead to some magnificent discoveries about the organic world. And we can challenge the critics to do likewise. Put up, or shut up! Let me make the Darwinian's case with one example, namely the stegosaurus, that peculiar dinosaur with the truly remarkable series of bony plates that ran down its spine from front to back, finishing with spikes at the end of the tail. Why did it have these plates? Given their rather ferocious appearance, the obvious answer is that the plates served in some fashion to protect the apparently otherwise

defenceless stegosaurus. However, detailed analysis of the bone making up the plates shows that it was simply not of the kind – tough and strong – that one associates with fighting and combat generally. It tended more to the side of the fragile, and was in any case fairly porous (de Buffrénil et al 1986). Defence is still certainly a possibility of the spikes at the end of the tail, and more generally it is also possible that the plates were used to frighten would-be predators.

But, none of this really strikes at the heart of the matter. There is now a much more convincing hypothesis about the primary function of the plates. The plates are involved in heat regulation of the stegosaurus. This is a suggestion made readily plausible as soon as one thinks of the plates' analogy with the fins of generators in power stations, where such protrusions are an essential part of the mechanism used to transfer heat from one body to another. Could something similar be true of the stegosaurus? Could the plates on their backs be used to control body temperature? Or more specifically, by analogy with generators, could the plates could be used to cool off the potentially overheated dinosaur (that might be generating huge amounts of heat from the fermentation process of its digestion)?

The answer is "yes." Overall, paleontologists feel that they now have a handle on one of the biggest and most interesting questions in their trade. A triumph of adaptationist thinking. And what I want to say – what any Darwinian wants to say – is that this is the justification for the design metaphor. One has, in the language of philosophers, an ongoing and fruitful research programme. It asks questions about the world and it throws up answers. The challenge to the critics is to do better. Until they do so, Darwinians can ignore them.

Implications for objectivity/subjectivity

Move to our final topic. What does this all add up to about the nature of science in general, and the nature of evolutionary biology in particular? The already-expressed fear will be that, since metaphors are so obviously rooted in their culture – the division of labour is a metaphor of the industrialism of the eighteenth century, no less than arms races are metaphors of the twentieth century – this means that science is nothing but an epiphenomenon on culture (Gross and Levitt 1994). Metaphors are essential; metaphors are part of culture; science is part of culture. It would seem that social constructivism has been given a major support. Rather than seeing science as some objective phenomenon, a value-free description

of disinterested reality, science now seems to be a cultural phenomenon with all the subjectivity that one finds in like phenomena (Collins 1985; Latour 1987). It is on a par with religion, or politics, or even philosophy. Science has lost its distinctive status as the paradigm of objective knowledge: what Sir Karl Popper (1972) referred to as "knowledge without a knower." It has now become little more than a pawn of social or cultural currents. A sad conclusion indeed!

Do not despair yet. My arguments do indeed point to science taking on a cultural aura. Had Darwin not had the natural theology of his day to draw on, then evolution with respect to cause would have been very different from the way that it is. Had Adam Smith not articulated the notion of a division of labour, had the industrialists not embraced it, neither Charles Darwin nor Edward O Wilson would have argued as they did. Agree, then, that evolutionary theory is culturally imbedded. Does this mean that it is just subjective? This conclusion does not follow. Subjectivity means that one can go any way that one wants. Nobody is saying this here about evolutionary thought. What is being said is that one is going to go ways which are, as it were, seen through the lens of our own society (metaphor!) or constrained by the thinking of our society. But this does not mean that we are just free to do whatever we like. The whole point about using

metaphor is that one is trying to generate ideas which are predictively valuable, or fertile. Obviously if the metaphors do not do this, or if the fertility only leads to dead ends, or to incorrect answers – as one discovers by going out and testing generated hypotheses – then one is going to drop the metaphors pretty quickly (Ruse 1999). This has certainly happened in the past, even in the history of evolutionary theory.

Conclusion

My conclusion then is that metaphor is a vitally important element in evolutionary biology, both in the past and today. I argue that in an important sense it is indispensable. Even if it were theoretically eliminable, it would be stupid to remove it, for then the heuristic power of modern evolutionary biology – modern Darwinian evolutionary theory – would be broken right off. Without metaphor, the vital epistemic value of epistemic fertility cannot be achieved. The consequence of this is that in important respects evolutionary theory has been and still is, and will always continue to be, cultural. In this sense, it is specific to the people who produced it and the society or societies in which they live or lived. However, my final conclusion is that this does not mean that evolutionary biology is in some irretrievable or deplorable sense subjective, meaning that it is simply open

to the whims of its practitioners. Nor does it mean that one can and does incorporate any societal or personal values that one wishes. The very fact that metaphors lead to epistemic virtues (like predictive fertility) means that they are going to be checks and balances on the work that is produced. Through this, one achieves the highest level of objectivity that one could hope for in this human-culturally dominated world of ours.

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