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Darwinism in economics: from analogy to ontology*

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Abstract. Several social scientists, including 'evolutionary economists', have expressed scepticism of 'biological analogies' and rejected the application of 'Darwinism' to socio-economic evolution. Among this group, some have argued that self-organisation is an alternative to biological analogies or Darwinism. Others have seen 'artificial selection' as an alternative to natural selection in the socio-economic sphere. Another objection is that Darwinism excludes human intentionality. It is shown that all these objections to 'biological analogies' and 'Darwinism' are ungrounded. Furthermore, Darwinism includes a broad theoretical framework for the analysis of the evolution of all open, complex systems, including socio-economic systems. Finally and crucially, Darwinism also involves a basic philosophical commitment to detailed, cumulative, causal explanations. For these reasons, Darwinism is fully relevant for economics and an adequate evolutionary economics must be Darwinian, at least in these fundamental senses. However, this does not undermine the need for auxiliary theories and explanations in the economic domain.

Key words: Darwinism – Evolutionary economics – Self-organisation – Causal explanation

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It is the aim of this article to counter a set of misunderstandings concerning the nature of Darwinism and of economic evolution.[1] These misunderstandings appear sometimes as objections to 'biological analogies' in social science, sometimes with the inference that the economist need have little use for Darwinism and can safely push it to one side. Such attitudes are found even among some 'evolutionary economists'.

This article explains why most of the prominent objections to Darwinism in economics and the other social sciences are misconceived. In addition, it is shown that Darwinism contains a broader and more general set of ideas, whose application is not confined to biology. Darwinism involves a general theory of the evolution of all open, complex systems. Furthermore, Darwinism involves a basic philosophical commitment to detailed, cumulative, causal explanations. In both these senses, Darwinism applies fully to socio-economic systems.

Section 1 critically reviews some prominent dismissals of 'biological analogies' in economics. Section 2 considers the claim that the theory of self-organisation is an alternative to 'Darwinism' or 'biological analogies'. This claim is shown to be mistaken. Section 3 examines the idea that 'artificial selection' is an alternative to 'natural selection'. As well as showing that this claim too is false, the problematic issue of human intentionality is placed within a Darwinian framework. Section 4 focuses on the central role of causal explanation in Darwinism. Section 5 introduces the key concept of 'Universal Darwinism' and the arguments in its favour. Section 6 briefly discusses the questions of determinism and novelty. Section 7 concludes the essay, arguing that the full impact of Darwinism on the social sciences has yet to be fully and widely appreciated.

1 A first catalogue of objections

One of the most famous and important critiques of 'biological analogies' in economics was by Edith Penrose (1952). She argued that neo-Darwinian theories of evolution excluded the deliberative and calculative behaviour that was characteristic of human action in the economic sphere. Penrose raised some probing and fundamental questions about the relationship between economics and biology that still remain on the agenda of both sciences. The particular issue of the relationship between Darwinian theory and human intentionality is so immense that discussion of it will be postponed to other sections of the present essay.

More recent complaints about the inappropriateness of 'Darwinian theory' for economics come in a number of other guises. As an example, Alexander Rosenberg (1994, p. 384) writes:

> To some economists, evolutionary theory looks like a tempting cure for what ails their subject. To others, it looks like part of a powerful defense of the status quo in economic theory. I think that Darwinian theory is a remarkably

[1] Note that the present essay embodies a position that is neither developed nor acknowledged in Hodgson (1993). As noted in Hodgson (2001a), on some questions I have changed my mind since 1993. Section 4 of this present essay makes use of some material from Hodgson (2001a).

> inappropriate model, metaphor, inspiration, or theoretical framework for economic theory.

However, a few years after this spirited banishment of Darwinism from economics, Rosenberg (2000, p. 70) declares: 'Evolutionary theory describes a mechanism – blind variation and natural selection – that operates everywhere and always throughout the universe.' Unless Rosenberg has some new theory of evolution up his sleeve, this later statement can be interpreted as a complete negation of his own earlier dismissal of Darwinism. For if (Darwinian) variation and natural selection apply 'everywhere' throughout the universe, then these mechanisms must also operate in the human economic domain. Either Rosenberg is inconsistent or he has changed his mind.

Matthias Ruth (1996) is similarly sceptical of the use of 'biological analogies' in economics, but he gives no clear nor persuasive reason for his main and essentially speculative conclusion: 'Further pursuit of evolutionary analogies is likely to add little to our ability to analyze the processes in action, and may even stultify scientific progress' (p. 126). A more forceful attempt to reject the use of 'biological analogies' in economics is by John Foster (1997), who argues that:

> This failure of biological analogies to make an impact is not surprising since the unique character of economic evolution lies in its *distinctiveness* from biological evolution. This distinctiveness lies not in competition, but in the creative and co-operative dimensions of human behaviour in the economic domain. (p. 430)

The second sentence ignores competition in the economy, and creativity and cooperation in nature. It is strange that Foster primarily associates economies with cooperation, and the natural world with competition. The fact that some socio-economic systems also foster rivalry and competition should not require further elaboration. Also Foster does not acknowledge the extensive literature in modern biology that points to the importance of cooperative and unselfish behaviour.[2]

This is not to deny, of course, that economic evolution and biological evolution have important differences. But Foster's critique is powered by additional and more prominent arguments, based on his understanding of the nature of Darwinism. Foster sees 'Darwinism' as focussing on 'competition between atomistic units, usually genes' (p. 431). The fact that there are no genes in Charles Darwin's (1859) own theory is overlooked, perhaps with the unwritten assumption that by 'Darwinism', Foster means the evolutionary biology of today, not the evolutionary theory of Darwin himself. But even in modern mainstream biology the individuality and explanatory status of the gene is widely acknowledged as highly problematic. Foster's failure to distinguish the many versions of Darwinism, and his concentration (without detailed references) on cruder versions, plays havoc with his argument. The result is a number of extraordinary statements such as the following:

> The chief deficiency of biological analogies, whether they be neo-Darwinian or Lamarckian, is that they are timeless. Therefore, they cannot address his-

[2] For example: Augros and Stanciu (1987), Lewontin (1978), Sober and Wilson (1998), Wilson and Sober (1994).

> tory except through the contrived use of Newtonian comparative statics, with the force of competition acting as the equilibriating mechanism. . . . Time irreversibility, absence of equilibrium, structural instability and fundamental uncertainty are features of historical processes, as stressed by many evolutionary economists, but they are not to be found in ahistorical biological analogies. (Foster, 1997, pp. 448–449)

The striking character of this passage is its attempt to identify the 'chief deficiency of biological analogies' in the perceived terms of their Newtonian character, their timelessness, their equilibrium orientation, their time reversibility and so on. Both 'neo-Darwinian' and 'Lamarckian' analogies are alleged to have this defect. Not only is any difference between 'neo-Darwinian' and 'Lamarckian' approaches unclear in Foster's article. But also, more crucially, Foster (1997) does not admit, and does not seem aware of, any other approach in biology that might not suffer from the listed defects.

It is not difficult, however, to find contrasting approaches in modern mainstream biology that offer explanations of process, time irreversibility, the importance of history, structural change, non-equilibriating dynamics, non-Newtonian frameworks, fundamental uncertainty and more.[3] Notably, Ludwig von Bertalanffy (1971) – one of the leading theoretical biologists of the twentieth century – saw time reversibility and equilibrium as the antithesis of evolution and life. As another example, Ernst Mayr – one of the leading pioneers of the 'neo-Darwinian' synthesis – wrote extensively on 'how biology differs from the physical sciences' including an explanation of how Darwin himself broke from the Newtonian paradigm (Mayr, 1985, 1988, 1992).

In particular, Darwin's 'population thinking' demarcates Darwin's theory from the essentialist mechanics of Newton. While Darwin came from a Newtonian starting point, in some important respects his mode of explanation was very different:

> Darwin abandoned the Newtonian model of dynamical explanations in important respects and came to a novel conceptualization of dynamics for biological systems. ... Living systems were infinitely more complicated than Newton's planetary system. Biological 'elements' had characteristics that were changing in time: they had a history. All the interactions of organisms whether with one another or with the environment were non-additive, non-instantaneous and exhibited memory. It was the ahistorical nature of the objects with which physics dealt that gave the Newtonian scheme the possibility of a simple, mathematical description. It was precisely the *historical* character of living objects which gave biological phenomena their unique and complex features. (Schweber, 1985, pp. 48–49)

Foster's blanket mischaracterization of 'biological analogies' is confounded by statements such as the above. More specifically, even if some so-called 'Darwinians'

[3] Consider, for example, Campbell (1965), Cohen and Stewart (1994), Dennett (1995), Gould (1985, 1989), Kohn (1985), Plotkin (1994) and even Dawkins (1986).

embrace equilibrium, they are not representative of Darwin or Darwinism as a whole.[4]

Foster (1997, p. 444) argues that economists should 'abandon biological analogy in favour of an economic self-organisation approach'. This alleged 'alternative' to the type of selection mechanisms found in biology is discussed in the next section below.[5]

From a different viewpoint, Ulrich Witt (1992, 1999, 2001) is also sceptical of 'biological analogies'. Witt (1999, p. 22) says that 'serious objections may be raised as to whether analogies to natural selection and genetic adaptation are, indeed, a reliable basis for developing the evolutionary approach in economics.' Much of Witt's argument is based on the observation that there is no clear or close analogy to the gene in the socio-economic sphere. Like Penrose, he emphasises the role of human intentionality, particularly in the selection of technologies and routines. Witt (1999, p. 24) thus concludes: 'For these reasons, reference to something like "natural selection" in an economic context does not seem more than metaphorical.'

Nevertheless, any use of biological metaphors is no slight or superficial matter. A number of philosophers have shown, that metaphor in science is much more than a 'literary frill'. Metaphor in general has a deeply constitutive and subterranean presence in science (Black, 1962; Hesse, 1966, 1980; Klamer and Leonard, 1994; Lewis, 1996; Maasen, 1995). Metaphor is different from, and prior to, any analogy. Metaphors make connections between different domains of discourse. Analogies involve more detailed formal similarities using the broad connections established by metaphor. By doing this vital work, and by helping to form analogies, the influence of metaphor is neither superficial nor merely preliminary.

Witt does not entirely dismiss biology or its metaphors, even if he does not fully acknowledge their constitutive significance for science. Significantly, he is willing to allow biology to play a limited role within the social sciences. He makes direct use of Darwinian theory when it appears to provide an explanation of particular socio-economic phenomena. Hence Witt (1996, p. 714) argues that 'Darwinism may even become a fruitful part of evolutionary economic theorising, not through metaphorical use, but through direct application', that is in terms of understanding the biological evolution of human preferences (Witt, 1999, p. 27). Here Witt opens the door to evolutionary biology, but only to admit *biological* mechanisms of variation, inheritance and selection among human individuals.

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[4] Notably, and contrary to Foster's interpretation of Darwinism, Veblen (1919, p. 417) saw that: 'In Darwinism there is no such final or perfect term, and no definitive equilibrium.'

[5] However, in a personal email to the author, dated 27 April 2001, Foster writes 'I have always accepted that both selection and self organisation operate in economic systems'. Also Foster (2000, pp. 324–325) acknowledges that 'the self-organisation approach is in the process of being integrated with natural selection to define a "new" evolutionary biology'. Foster (2000, p. 311) now complains more that 'the biological analogies used tend to be outdated', rather than dismissing *all* 'biological analogies'. Incidentally, contrary to Foster (2001, p. 123), I have never argued that the word 'evolutionary' must always to be used in the senses of biological or Darwinian evolution. The term has a wide set of meanings and the point is not to claim it as exclusively biological territory but to urge precision in all its particular usages (Hodgson, 1993). For instance, I have made it clear that in a broad (but non-biological) sense the description of Schumpeter as an evolutionary economist is quite legitimate (Hodgson, 1997).

For Witt, Darwinian notions of the replication or 'natural selection' of institutions, routines or other *social* units are not so welcome in his schema. He believes in the direct use of biology only when biological phenomena intrude into the social sphere. He argues that there is nothing at the social level that resembles the gene, that the processes and criteria of selection are dissimilar, and so on. These dissimilarities are fairly obvious and can be accepted. In detail, biological and socio-economic evolution *are* very different.[6]

Significantly, Witt (1996, 1999) also recognises that 'Darwinism' involves some quite fundamental and general theoretical precepts. This might open the door to some version of 'Universal Darwinism' as discussed below. But what Witt has so far failed to do is to embrace the possibility of evolutionary selection processes working simultaneously on multiple levels, including the selection of institutions or routines.

It is argued below, however, that the relevance of Darwinian principles is quite general. These principles are logically independent of specific apparatuses of reproduction and selection, such as those involving genes and DNA. This more general interpretation of Darwinism, plus a discussion of the general 'Darwinian' ontological issues, is raised later below.

2 Is self-organisation an alternative to evolutionary selection?

In different ways, both Foster (1997) and Witt (1997) propose that the theory of self-organisation provides a basis for evolutionary thinking in economics. For Witt (1997, p. 489): 'The theory of self-organization . . . provides an abstract, general description of evolutionary processes.' Foster went further, to argue that self-organisation is an alternative to any 'biological analogy'. Foster (1997, pp. 444) writes:

> Once we abandon biological analogy in favour of an economic self-organization approach . . . then we are no longer interested in the microscopic details of selection mechanisms, but in the endogenous tendency for acquired knowledge and skills to interact to create increases in economic organization and complexity.

For Foster, the 'economic self-organization approach' somehow suspends our interest in 'microscopic' selection mechanisms in favour of endogenous processes of increasing complexity. Foster alludes to modern versions of such an approach, as found in the works of Daniel Brooks and E. O. Wiley (1988), David Depew and Bruce Weber (1995), Stuart Kauffman (1993), Weber and Depew (1996), Weber et al.(1989) and Jeffrey Wicken (1987).[7]

[6] See Loasby (2001) for a useful discussion of selection processes in economics.

[7] In an unelaborated genuflection to positivism, Foster makes the additional claim that an advantage of this approach is that it focuses on 'observable' processes, and it 'can be used in empirical settings' (1997, p. 449). What is odd about this statement is that it contains no acknowledgement of the modern, post-positivist contention that observability cannot be the be-all and end-all of science (Quine, 1953; Caldwell, 1982) and it also contains the unwarranted implication that theories involving 'biological analogies' are less amenable to empirical illustration, observation or measurement.

It is clear that several of the authors within this research tradition are critical of some presentations of Darwinian theory. For example, Depew and Weber (1995) note the changing agendas and shifting emphases of Darwinian enquiry over the years. Others, like Brooks and Wiley (1988), Weber et al. (1989) and Wicken (1987) are keen to generalise evolutionary explanations and integrate insights from thermodynamics such as the entropy law. Kauffman (1993) makes a powerful argument that natural selection alone cannot explain the origin of complex organisms. Systems involving non-linear interactions involve a large number of possible states, most of which would have little survival value. Kauffman argues that processes of self-organisation channel systems into more restrictive possibilities, some of which can have evolutionary benefits.

However, if we inspect this literature further then we come to a quite different conclusion from the one proposed by Foster (1997). *Not one of these modern authors cited above sees his argument as an alternative to Darwinian theory.* Wicken (1987) writes of 'extending the Darwinian paradigm', not exterminating it. Depew and Weber (1995) write of 'Darwinism evolving', not Darwinism abandoned. Weber and Depew (1996, p. 51) write:

> the very concept of natural selection should be reconceived in terms that bring out its dynamical relationships with chance and self-organization. In our view, Kauffman's recent work, as expressed in *The Origins of Order*, does just this.

Note here that what is involved is a revision of natural selection theory, not its negation. Similarly, Kauffman (1993, p. 644) himself relates:

> I have tried to take steps toward characterizing the interaction of selection and self-organization. . . . Evolution is not just 'chance caught on the wing.' It is not just a tinkering of the ad hoc, of bricolage, of contraption. It is emergent order honored and honed by selection.

The last sentence is worthy of reflection and emphasis. Once again, Kauffman does not conceive of his theory as an alternative to Darwinism (Lewin, 1992, pp. 42–43). On the contrary, once self-organised systems and subsystems emerge, natural selection does its work by sorting the more adapted from the less. Kauffman explains this in detail. Natural selection acts upon these self-organised structures once they emerge. Far from being an alternative to natural selection, self-organisation requires it, in order to determine which self-organised units have survival value. As Gary Cziko (1995, p. 323) argues:

> the laws of physics acting on nonliving entities can lead to spontaneous complexity, but nothing in these laws can guarantee *adapted* complexity of the type seen in living organisms . . . Of all the complex systems and structures that may self-organize due to the forces of nature, there can be no assurance that all or any of them will be of use for the survival and reproduction of living organisms.

In a sense, Witt (1997, p. 489) is correct in his assertion that self-organisation 'provides an abstract, general description of evolutionary processes' but natural

selection is no less abstract, nor less general. Indeed, self-organisation involves an ontogenetic evolutionary process, in that it addresses the development of a particular organism or structure. This does not rule out the possibility that ontogeny can also involve the natural selection of entities *within* the organism. For example, the growth of many organisms involves the natural selection of immunities, neural patterns and (often beneficial) bacteria in their gut (Edelman, 1987; Plotkin, 1994). Likewise, the growth of a firm may involve the internal selection of habits or routines (Nelson and Winter, 1982). Hence some descriptions of self-organising processes involve some (phylogenetic) selection of constituent components of the emerging structure.

However, accounts of self-organisation or ontogeny do not *necessarily* involve selection or phylogeny. By definition, phylogeny involves the existence of a whole population, in which selection can occur. Hence natural selection is *always* phylogenetic as well as ontogenetic, in that it addresses the evolution of whole populations of organisms or structures. In general, ontogeny *may* but does not necessarily incorporate phylogeny; but phylogeny *always* incorporates ontogeny.

Furthermore, from the point of view of the overall evolutionary process, complete evolutionary descriptions require a phylogentic account of the selection of ontogentically developing units. Hence while self-organisation is important (and perhaps essential), it cannot provide a *complete* evolutionary description. This must involve phylogeny as well as ontogeny. If we are confined to ontogeny then our description of the overall evolutionary process is incomplete; it does not address the differential survival and fecundity of different (self-organised) structures or organisms.

In another sense elaborated later below, natural selection is more general, in that it provides evolutionary principles applying to all complex evolving systems. Kauffman has noted the importance of self-organisation in this process, but not that it has the same degree and kind of universality. In short, some self-organisation may be an important part of evolution but it cannot replace natural selection.

Self-organisation theorists have shown how complex structures can emerge without design, but these structures are themselves subject to evolutionary selection. Some will survive longer and be more influential than others: selection will operate. We have every reason to see these issues as relevant to economic evolution. Conscious choices, competitive pressures, market forces or environmental constraints operate on technologies, institutions, regions and even whole economies. All of these contain self-organised structures, but this does neither preclude nor demote the role of evolutionary selection.

3 'Artificial' selection and human intentionality

Yngve Ramstad (1994) also argues that biological analogies are inappropriate for economics. One of his reasons is based on the argument of John Commons that institutional evolution involves 'artificial' rather than 'natural' selection. In several of his works, Commons (1924, p. 376) argues that: 'Economic phenomena, as we know them, are the result of artificial selection and not of natural selection.'[8]

[8] See also, for example, Commons (1934, pp. 45, 120, 636, 657–658, 713).

Here Commons is entertaining a notion established by Darwin himself. 'Artificial selection' occurs when a human breeder selects strains of a plant or animal, on the basis of their attributes, for further propagation.[9] On this basis, Ramstad (1994, p. 109) conjectures that:

> Commons would in all likelihood have concurred completely with the view that espoused shortly after his death by Edith Penrose, namely, that since economic evolution can best be understood through concepts rooted in human volition, it would be the wisest course to avoid biological metaphors altogether.

Let us look at the issues involved. The essential characteristic of artificial selection is that humans manipulate the criteria or environment of selection. The 'artificiality' of the selection process stems principally from the fact that it is under the control of a human agent. But it would be a misunderstanding to see artificial selection as an *alternative* to natural selection. After all, the human who is doing the selection is also a product of natural evolution. There is nothing that privileges humans above other animals in this respect. In addition, other animals make selections too. Ants collect and keep live aphids. A tiger selects its prey. A cow first eats the tastiest grass.

Furthermore, the dispositions, aims and criteria that the human uses in selecting specimens for 'artificial' selection are also the products of processes of cognitive and cultural evolution. Accordingly, in criticising Commons, the institutional economist Morris Copeland (1936, pp. 343–344) pointed out that Commons's 'artificial selection' of institutions depended on the prior 'natural selection' of the guiding ethical or other principles that were used in the selecting process. Copeland's valid point was that the evolution of the criteria used in any 'artificial' selection must also be explained.

In a useful critical discussion of artificial selection, Daniel Dennett (1995, p. 316) considers, what if Earth was set up as a 'theme park' by some unseen aliens, who populated it with life and occasionally tinkered with its evolution?[10] In this case it would be 'artificial selection' but there would be no obvious way of distinguishing it from 'natural selection'. As another example, in the science fiction comedy by Douglas Adams, *The Hitch Hiker's Guide to the Galaxy*, it is proposed that humans are the third most intelligent species on Earth, after the white mice and the dolphins. The white mice are performing a complex experiment on humans, while just pretending that the humans are performing simple experiments on them. In this imaginary case, who is artificially selecting whom? As Dennett (1995, p. 317) reports: 'all the biologists I have queried on thus point have agreed with me that

[9] Darwin (1859) writes of selection 'applied methodically' by humans to domesticated animals. This was primarily to convince his readers that descent with modification was possible, and thereby to introduce the concept of natural selection. Darwin does not suggest that 'artificial' and 'natural' selection are mutually exclusive.

[10] In response to a critic, it must be emphasised that the use of a quotation does not imply agreement with every statement made by its author. For example, in this present paper I have cited some good arguments made by Dawkins and Dennett. However, I disagree with them in several other significant respects. See Hodgson (2001c; forthcoming).

there are no sure marks of natural, as opposed to artificial, selection.' Most conceptions of 'artificial selection' artificially and anthropocentrically presume that humans are choosing agents, but other species are not.

In reality, in contrast to science fiction, it may be true that humans are the most intelligent species on Earth and that they have the greatest capacity for conscious prefiguration, deliberation and choice about alternatives. We imagine possibilities of choosing and acting in advance. But these capacities exist to some extent in other species. As Darwin (1859, p. 208) himself wrote: 'A little dose . . . of judgement or reason often comes into play, even in animals very low in the scale of nature.' To assume that no trace of judgement or reason existed with other species would be to raise a difficult question: when and how in evolutionary time were these cognitive privileges bestowed upon humans? To avoid a religious or mystical answer, we have to assume that these cognitive attributes themselves evolved through time, and existed to some degree in pre-human species.

Furthermore, even when 'artificial selection' does take place, that is not the end of the story. Different institutions or societies, in which artificial selection is involved, sometimes compete against each other. Hence some additional processes of evolutionary selection may be involved. In no way can artificial selection replace or demote a broader concept of evolutionary selection in human society.

4 Darwinian ontology and causal explanation

An important point emerges here. As John Dewey (1910, p. 15), Ernst Mayr (1988, 1992) and Dennett (1995) explain, it is part and parcel of Darwin's underlying philosophy that all intentionality has itself to be explained by a causal process. This causal explanation has to show how intentions are formed in the psyche and also how the capacity to form intentions itself gradually evolved. For Darwin, natural selection is part of this explanation. There can be no 'uncaused cause'. However, the fact that intentions are somehow determined does not mean that human agency is any less substantial or real (Vromen, 2001; Hodgson, 2001c).

In principle, all outcomes have to be explained in an interlinked causal process. There is no teleology or goal in nature. Everything must submit to a causal explanation in scientific terms. This is a key part of Darwin's ontological outlook, to which in general terms we shall again return below. As Dennett (1995, p. 205) put it, Darwin turned the traditional doctrine of intentionality upside down: 'intentionality doesn't come from on high; it percolates from below, from the initially mindless and pointless algorithmic processes that gradually acquire meaning and intelligence as they develop.'

Accordingly, Penrose (1952) and others were wrong to suggest that Darwinian theories of evolution excluded deliberative and calculative behaviour. On the contrary, Darwin insisted that calculations and intentions had to be explained.[11] For Darwin, every event and effect had a cause. This ontological commitment was recognised long ago by the influential biologist and friend of Darwin, George Ro-

[11] In conversations with the present author before her death in 1996, Penrose had revised her opinion. She was deeply fascinated with evolutionary and other explanations of human consciousness.

manes, who insisted that Darwinism above all meant causal analysis. Instead of taxonomy and the accumulation of facts, 'causes or principles are the ultimate objects of scientific quest' (Romanes, 1893, vol. 1, p. 5). Darwin's commitment to universal causal explanation was logically independent of, and additional to, his theory of natural selection. But in his concern to explain descent with modification and the comprehensive 'tree of life' – as well as the emergence of humans and their intentions – Darwin was persistently invoking a universal causal principle.

Rare among social scientists, Thorstein Veblen understood this point very well (Hodgson, 2001c). For Veblen (1919, p. 238), writing in 1909, intentionality or 'sufficient reason' had itself to be explained in terms of cause and effect:

> The modern scheme of knowledge, on the whole, rests, for its definitive ground, on the relation of cause and effect; the relation of sufficient reason being admitted only provisionally and as a proximate factor in that analysis, always with the unambiguous reservation that the analysis must ultimately come to rest in terms of cause and effect.

While the 'element of discriminating forethought . . . distinguishes human conduct from brute behavior', this element is itself caused and must also be explained. Veblen then pointed out that 'economics has had the misfortune' to allow explanations in terms of intentions to supplant causal explanations as 'the sole ultimate ground of theoretical formulation'. Regrettably, because Darwinism is still not widely understood, this 'misfortune' still affects the whole of the social sciences today. It is still taken for granted that the existence of a human intentionality is sufficient to explain human action, without probing the causes behind intentions themselves. Darwinism does not deny belief, purposeful behaviour or foresight: it simply assets that they too are caused.[12]

5 Universal Darwinism

We now come to a vital stage in the argument. The critics of 'biological analogies' seem unaware of some important conceptual developments in biology that undermine their case. Dating back over a century, a number of prominent thinkers, including Walter Bagehot (1872), William James (1880), David Ritchie (1890, 1896), Samuel Alexander (1892), Charles Sanders Peirce (1992) in 1898, Thorstein Veblen (1899, 1919) and James Baldwin (1909) have argued that the Darwinian principles of natural selection apply not simply to biology but also to mental, epistemological, moral, social or even cosmic evolution. They argued that Darwinism had a wider application than to biology alone. One of the major later developments along this road was an article by the great polymath Donald Campbell (1965), in which he suggested that Darwinism contained a general theory of the evolution

[12] Khalil (2000) upholds that Darwinism involves 'blind' agents, acting without purpose, and tries to reinstate Lamarck instead. But essentially he instates a causal dualism, with purpose itself unexplained and unrelated to any other type of cause. For an excellent critique of dualism see Bunge (1980). Furthermore, contrary to widespread supposition, Lamarck himself was a causal materialist: like Darwin he saw intention or volition as rooted in material causes (Boesiger, 1974).

of all complex systems. Campbell (1965, p. 24) made the point that the appropriate analogy for social evolution is not biotic evolution, but the more general processes of evolution of complex systems 'for which organic evolution is but one instance'. Subsequently, Richard Lewontin (1970) also suggested that the domain of application of Darwinian theory could be broadened.[13]

Then Richard Dawkins (1983) coined the term 'universal Darwinism'. Dawkins argues that if life existed elsewhere in the universe, it would follow the Darwinian rules of variation, inheritance and selection. Even if there were a very different system of inheritance, including one that allowed the 'Lamarckian' inheritance of acquired characters, a coherent account of the evolutionary process would still require the key elements of the Darwinian theory.[14]

As long as there is a population with imperfect inheritance of their characteristics, and not all of them have the potential to survive, then Darwinian evolution will occur. Significantly, Cziko (1995) describes the acknowledgement of such a 'universal selection theory' as 'the Second Darwinian Revolution'.

As such, Darwinian evolution is not tied to the specifics of genes or DNA: essentially it requires some mechanism of inheritance. On planet Earth, we find that DNA has the capacity to replicate. But other 'replicators' may exist, on Earth and elsewhere. One possible and relevant example is the propensity of human beings to communicate, conform and imitate, making the replication or inheritance of customs, routines, habits and ideas a key feature of human socio-economic systems. Richard Nelson and Sidney Winter (1982) have famously applied the principles of variation, inheritance and selection to routines in firms.

'Universal Darwinism' is not a version of biological reductionism or 'biological imperialism' where an attempt is made to explain everything in biological terms. On the contrary, Universal Darwinism upholds that there is a core set of general Darwinian principles that, *along with auxiliary explanations specific to each scientific domain*, may apply to a wide range of phenomena. Such an idea has been suggested by Winter (1987, p. 617):

> In sum, natural selection and evolution should not be viewed as concepts developed for the specific purposes of biology and possibly appropriable for the specific purposes of economics, but rather as elements of the framework of a new conceptual structure that biology, economics and other social sciences can comfortably share.

[13] However, Fracchia and Lewontin (1999) have been critical of some Darwinian theories of cultural evolution, pointing out that some theories of cultural evolution lack an adequate concept of social structure, treating populations rather as aggregates. But they do not show that a Darwinian approach to social evolution would necessarily exclude an adequate treatment of social structures.

[14] Hodgson (2001a, forthcoming) and Knudsen (2001) argue that social evolution is *both* Lamarckian and Darwinian. Lamarckism and Darwinism are neither opposites, nor even mutually exclusive. Darwin (1859) himself flirted with Lamarckian ideas. The most important thing that is wrong with Lamarck's theory is that it does not provide an adequate causal explanation of how the inheritance of acquired and beneficial characters may occur. The additional question of whether there is a Weismann barrier, ruling out 'Lamarckian' phenotypical interference with the replicating genetic code, is partly empirical in nature. Arguably, with other replicators, such as human habits and routines, such interference is possible.

As a result, Universal Darwinism is not a doctrine in the genre of the 'economic imperialism' of neoclassical economists such as Gary Becker (1976) or Jack Hirshleifer (1982). Such 'imperialisms' involve the claim that a wide range of phenomena can be explained *completely and exclusively* in terms of a single set of principles. By leaving an opening for domain-specific, auxiliary explanations, Universal Darwinism does not necessarily involve such a claim.

Darwin (1859, pp. 422–423; 1871, vol. 1, pp. 59–61) himself suggested that 'the struggle for life' may be going on among such entities as the words and grammatical forms of human language, as well as among organic life. Another example of the extension of the principle of 'natural selection' is the proposal of William James (1880) that ideas themselves are passed on and produce random variations, upon which social and natural circumstances select the survivors. Such a notion is now familiar to us in the form of the 'evolutionary epistemology' pioneered by Karl Popper (1972), Donald Campbell (1974) and others. Gerald Edelman's (1987) idea of 'neural Darwinism' – with selection working on neural connections – also fits within the framework of 'Universal Darwinism'. Furthermore, in the immune system there is selection process working on a regenerating variety of replicating units, known as lymphocytes (Plotkin, 1994, ch. 3). Computer viruses also replicate and evolve (Aunger, 2002). All of these are cases, not merely an evolutionary analogy, but also the existence of multiple processes that are *actually* evolving in accord with basic Darwinian principles of variation, inheritance and selection.

It is important to re-emphasise that devotees of Universal Darwinism do not attempt to explain everything in *biological* terms. The alleged universality of Darwinian mechanisms does not mean that the process involved is always that of *genetic* variation and selection. Furthermore, when genetic evolution does exist, this does not rule out additional evolutionary processes, acting on different entities, at additional ontological levels.

This applies to Universal Darwinists such as Dawkins, as well as to others. Even in his famous book *The Selfish Gene*, Dawkins (1976) proposed a second level of selection operating at the human level: the 'meme'. Accordingly, in two important essays, David Hull (1980, 1981) 'argued that in spite of himself Dawkins had made an important contribution to a hierarchically expanded Darwinism' (Depew and Weber, 1995, p. 384). Later Dawkins (1983, p. 422) himself wrote: 'It is also arguable that today selection operates on several levels, for instance the levels of the gene and the species or lineage, and perhaps some unit of cultural transmission'. In his book *The Extended Phenotype*, Dawkins (1982) outlines a multi-level selection theory at greater length.

Likewise, in his approving discussion of Universal Darwinism, Plotkin (1994, p. 101) himself proposes 'a hierarchically structured evolutionary theory' in which there are different units of selection at each level. Plotkin's anti-reductionism is explicit. He openly rejects the notion that evolution at a higher level can be explained entirely in terms of evolutionary processes at a lower level. Plotkin (1994, p. 176) argues that because of 'selectional processes in the mechanism of intelligence', intelligent behaviour 'cannot be reductively explained by genetics or genetics and development'.

We could explore the possibility of 'Universal Darwinism' even further. The American philosopher Charles Sanders Peirce proposed in 1898 that *the laws of nature themselves evolve* (Peirce, 1992). This controversial idea is being further developed by physicists today, involving the hypothesis that key physical constants take the values they do because alternative universes in which the constants took different values failed to survive (Smolin, 1997).

Leaving such cosmological speculations on one side, it is clear that the Darwinian theory is extremely powerful, because it is the only adequately detailed and general causal account of the evolution of complex systems, including organic life. It apparently provides an encompassing framework within which all the lesser and particular theories can be placed.

Two points are important to note at this stage. First, the question of the adequacy or otherwise of 'biological analogies' is not the fundamental question, as all social systems are subject to essential evolutionary principles by virtue of the existence of variety, inheritance and selection. In particular, by recognition of the ontological priority and replenishment of variety in both natural and social systems, Darwinian 'population thinking' is also highly relevant for social scientists.[15] Accordingly, even if the detailed mechanisms of change at the social level are quite different from those described in biology, *socio-economic evolution is still Darwinian in several fundamental senses.*

Second, while all open, complex, evolving systems may be subject to a core set of Darwinian laws, the notion of Universal Darwinism itself provides no alternative to a detailed explanation of the particular emergent properties and processes at the social level. Acceptance of Universal Darwinism does not provide all the necessary causal mechanisms and explanations for the social scientist, nor obviate the elaborate additional work of specific investigation and detailed causal explanation in the social sphere.

There are several reasons why the precise mechanisms of socio-economic evolution are different from those that apply to organisms on Earth. For example, socio-economic replicators such as habits, routines and institutions make highly imperfect copies of themselves (through imitation or whatever), compared with the high fidelity reproduction of segments of DNA. Also, socio-economic selection and winnowing is not principally from generation to generation but also within the life of socio-economic units. Hence selection in socio-economic evolution does not necessarily always involve the death of some units of selection. The typical lineages of natural evolution separate and diverge, whereas in society there is often transmission of information across lineages, which may then combine and converge (Gould, 1987, 1991). Furthermore, the environment of socio-economic selection is often changing rapidly, compared with the long and often more stable epochs in which much selection in nature takes place. Finally, as noted above, in the socio-economic sphere there is the possibility of the 'Lamarckian' inheritance of acquired characters, and this is largely or completely excluded from genetic evolution.

[15] See Mayr (1982) for a discussion of Darwinian 'population thinking'. The idea is implicit in works such as Penrose (1959) and Nelson (1991), and explicit in Metcalfe (1994, 1998).

Note, however, that none of the points in the preceding paragraph undermines the idea of Universal Darwinism. Although the detailed mechanisms are quite different in each sphere, they both involve the general Darwinian principles of variation, inheritance and selection.

However, it is important to emphasise that neither Universal Darwinism nor the theory of natural selection can give us a full, detailed explanation of evolutionary processes or outcomes. Biological explanations work in a different manner to those in (say) physics. At the centre of Darwinism there is a rigorous theory, but it explains little on its own and it is thus placed in the context of a mass of empirical material (Hull, 1973, pp. 3–36). Darwinian principles cannot themselves provide a detailed explanation of why humans have hair, or why a bird's plumage is a particular colour. Instead, Darwinian principles provide a general explanatory framework into which particular explanations have to be placed. In some cases an unobtrusive appearance may be explained for reasons of camouflage; while in some birds, bright and colourful plumage is there to attract a mate. Hence specific explanations can be very different from one another, while being consistent with natural selection.

Darwinian biology invokes multi-levelled explanations, in which the theory of natural selection is the over-arching and organising theoretical framework. Far from being irrelevant to economics, it is argued elsewhere that such multi-level explanations are also necessary for the social sciences (Hodgson, 2001b). It is possible that some of the reaction against 'biological analogies' is grounded on a mistaken view that theories operate on one level only. The concern is that the invocation of such analogies necessarily means a slavish copying of every detail of biological evolution. On the contrary, Darwinian evolution shares common ground with economics at a much higher level of abstraction, as a result of the fact that both biology and the social sciences address complex, open, evolving systems. Accordingly, the relevance of Darwinism for economics is at a less detailed and more abstract level, concerning the general relevance of variation, inheritance and selection, as well as the Darwinian blanket commitment to causal explanations.

Clearly, if Darwinian ideas are applied to the social as well as to the natural world then concepts such as replication or inheritance have to be carefully defined. Universal Darwinism requires us to examine detailed mechanisms of variation, inheritance and selection. In principle, if no such mechanisms exist then Universal Darwinism would find its boundary. The limits of Universal Darwinism very much hinge on this issue.[16]

6 Some problems and possible objections

Let us take stock of the argument so far. It has been shown that Darwinism includes not only specific theories that explain particular biological mechanisms, but also a general theory that applies to all open, complex and evolving systems, irrespective of the particular mechanisms of inheritance or replication. Accordingly, Darwinism

[16] See Sperber (2000) and Aunger (2002) for attempts to define replication in a way that challenges the 'memetics' approach to analysing culture. In Hodgson (forthcoming) there is a conceptual analysis of the replication of routines.

has some unavoidable importance, at the general theoretical as well as the specific analogical and metaphorical levels. In addition, Darwinism involves an ontological commitment to the existence of causes, requiring detailed and complete causal explanations of everything from human intentions to evolution itself. It was the latter, ontological commitment that made Darwin's ideas 'dangerous' and corrosive of mystical or religious explanations of events.

Accordingly, blanket dismissal of all 'biological analogies' without recognition of the differences between the different aspects and levels of Darwin's thought is likely to be highly misleading. The strongest reason to be sceptical of 'biological analogies' involves the detailed differences between the types of evolutionary mechanism applying to the socio-economic and to the natural domain. But society and nature also have much in common. Above all, they are both open, complex systems, that evolve through variation, inheritance and selection, even if the precise details of the mechanisms involved are very different. Accordingly, some general aspects of Darwinian theory apply to society as well as nature.

Furthermore, the ontological arguments for causality apply equally and forcibly to both the natural and the social spheres. As well as the principle of natural selection, Darwinism also invokes a commitment to the philosophical idea that regular, scientific laws determine phenomenal outcomes.

Two misgivings may appear in response to this Darwinian commitment. The first is a revulsion against 'determinism' and the second is a concern that the idea of determinacy would deny novelty. Let us deal with these objections briefly and in turn. In truth, there are at least three different versions of 'determinism', as outlined below.

1. Determinism is sometimes defined as the epistemological doctrine that '*any event can be rationally predicted, with any desired degree of precision, if we are given a sufficiently precise description of past events, together with all the laws of nature*' (Popper, 1982, pp. 1–2). We may call this idea 'predictability determinism'.
2. A different definition of determinism is the notion that, any given set of circumstances and state of the world must lead to a *unique* outcome: 'given A, Bmust occur' (Blanshard, 1958, p. 20). We may call this principle 'regularity determinism'. It involves the denial of randomness and chance in the universe. This is an ontological rather than an epistemological notion: it says nothing about what we may be able to know or predict.
3. Another definition of determinism is the notion that *every event has a cause* (Urmston, 1989). This is again an ontological statement about the world, otherwise known in philosophy as 'the principle of universal causation' or sometimes 'ubiquity determinism'. A broader and more refined formulation is provided by Bunge (1959, p. 26). He describes the '*principle of determinacy'* amounting to: '*Everything is determined in accordance with laws by something else*'.

The third version of determinism is central to Darwinism and is adopted here. But there is nothing in Darwinism that involves any commitment to the first two versions of determinism. These three versions of determinism are logically independent: one does not flow from the other. Mario Bunge (1959), Roy Bhaskar (1975) and

John Earman (1986) have rightly argued that predictability determinism is quite different from the principle of determinacy or universal causation. Predictability determinism – the dream of Laplace – is itself countered by the realisation of analytical and computational limits in the face of complexity, and even of the limits of mathematics itself (Gödel's Proof), and more recently by chaos theory. There are non-linear systems with such a high degree of sensitivity to initial conditions that no amount of accurate measurement of the appropriate parameter values can provide a sufficiently accurate prediction (the Butterfly Effect). Predictability in the human domain is also confounded by the logical problem of predicting future knowledge or creativity. If prediction led us to know future knowledge, then it would be present knowledge, not knowledge confined to the future (Popper, 1960, 1982).

As formulated above, the third proposition of law-like determination itself does not rule out the possibility of statistical determination, where outcomes are stochastic but with regular statistical properties. Statistical laws are still laws. If outcomes were statistically determined, and statistical determination was not merely apparent but real, then the second proposition – regularity determinism – would strictly and generally be false.

Even if determination is not statistical but links one set of causes with one set of effects, then there are still objections to regularity determinism. Roy Bhaskar (1975) rightly rejects regularity determinism on the grounds that it would work only if it were confined to a closed system, and most systems are in fact open. The possibility of exogenous disturbances undermines regularity determinism in specific systems.

Would regularity determinism apply to the universe as a whole? Given that the universe is interconnected and systems are open, the regularity 'given A, B must occur' would only work in general if A corresponded to a complete description of all the possible influences on B, from throughout the universe. The statement 'given A, B must occur' will itself be indescribable in its massive scope and complexity. Strictly, with unlimited interconnectedness, the 'given A, B must occur' statement will only pertain if A is a complete description of the state of the universe. Even if we exclude a possible indeterminacy in nature – such as at the quantum level – the idea of regularity determinism cannot apply to any limited description of the world. No manageable form of the statement 'given A, B must occur' can sustain regularity determinism. In terms of any conceivable human discourse, regularity determinism is generally inapplicable. Even if it is valid, it is inapplicable as a principle. In sum, regularity determinism is inapplicable or false.

Having rejected or disabled the first two versions of determinism, the (third) principle of determinacy is retained. Indeed, it is a necessary foundation for science. If science admits the possibility of an event without a cause, then it has abandoned its own mission. We can have quite a broad view of the nature of science, but the quest for meaning and explanation seems indispensable to any version of the scientific enterprise. In contrast, the idea of an uncaused cause forsakes the possibility of an intelligent account or explanation of the event. Of course, we cannot prove the impossibility of an uncaused cause. In general, proofs of causality, or of its absence, are impossible. But science is nevertheless obliged to search for causal explanations, and determinacy must hence be assumed. In many circumstances, prediction will

be impossible. Nevertheless, the quest for some kind of causal explanation must remain. To adopt the notion of an uncaused cause is to issue a licence to abandon the quest.

Darwinism is thus incompatible with the idea of George Shackle (1959) and Ludwig Lachmann (1969) that human intentionality is an 'uncaused cause'. The problem with this position is that it involves an investigatory closure. Once we affirm an 'uncaused cause' we say that science should explain this much, but no more. We may move so far down the causal chain, but no further. We arrive at a causal and explanatory roadblock, policed by the adherents of the 'uncaused cause'. Admittedly, all ontological commitments involve dogma in the sense that they cannot be directly verified by experience. Neither the principle of determinacy nor the 'uncaused cause' can be verified by experience. But the principle of determinacy is preferable to the 'uncaused cause' in that it does not place dogmatic bounds on the scope of scientific enquiry and explanation. The preferable ontological commitment is one that denies any no-go zones for science. The roadblock must be opened, even if the road ahead is treacherous and uncertain.

We may very briefly note that the position here does not rule out some notions of novelty, nor even of 'free will'. A number of philosophers – including David Hume and Jean-Paul Sartre – have argued that an idea of free will is compatible with the principle of determinacy. Even if our choices are determined then that does not rule out the reality of the process of choice. Could we have 'acted otherwise'? Yes, because regularity determinism is undermined. The Darwinian position stated here admits ground for the 'compatibilist' argument that 'choice' and 'free will' can be reconciled with the proposition that every event is determined.

If novelty simply refers to unpredicted outcomes then we have no difficulty admitting such possibilities, even if every event is caused. We now know from chaos theory that even if every event is determined, the world is still often unpredictable. Randomness and apparent indeterminacy remain. Novelty may be caused, but it will often appear as entirely spontaneous and free. Prior causes always exist, but the complexity of the system may make them especially difficult to identify. In open, complex, non-linear systems all sorts of novelties are possible. What are ruled out of the picture are novel outcomes that do not obey scientific laws.[17]

7 Conclusion

The prominent arguments against 'biological analogies' in social science are generally unconvincing. Often they involve misunderstandings concerning the nature and scope of Darwinism. First, it is mistaken to suggest that Darwinism excludes cooperation. Both cooperation and competition exist in both nature and socio-economic systems. Second, the idea that humans are (uniquely) intentional does not rule out

[17] On the compatability of novelty with the principle of determinacy see Bunge (1959, ch, 8). Vromen (2001) rightly argues that evolutionary theory cannot be rejected on the grounds that it fails to predict novelty. Much of that which is described as novelty is unpredictable by *any* theory. There is no space here to address some of the problems that I raised in Hodgson (1999, ch. 6), including the limited capacity of formal models to embrace novelty.

the need or possibility of an evolutionary account of human intentionality. Third, the observation that the mechanisms of evolution are quite different in the socio-economic and the natural domains is valid, but does not rule out more general Darwinian principles that apply to both. Fourth, the idea that Darwin's theory is static or timeless is plain wrong, and amply denied by theorists and philosophers of biology. Fifth, the notion that self-organisation is more general, or is an alternative to Darwinian natural selection, is also mistaken: it is denied even by leading proponents of self-organisation theory. Despite its importance in nature and society, self-organisation can never fully replace evolutionary selection. Sixth, the proposition that 'artificial' selection in the socio-economic domain is somehow an alternative to, or rebuttal of, the application of principles of natural selection to human society does not stand up to close critical examination. In particular, the evolutionary origin of the criteria and capacities used in any 'artificial' selection must themselves be explained.

Another crucial argument here is that even if there are different systems of inheritance, including some that allow the 'Lamarckian' inheritance of acquired characters, a coherent account of the evolutionary process at the socio-economic level would still require the key elements of the Darwinian theory.

Evolution is a multi-level process, and key features of the natural and the socio-economic levels are different. Accordingly, not all mechanisms relevant to biology will apply to the socio-economic level as well. However, the principles of Universal Darwinism suggest that some general features of a Darwinian explanation can be common to all levels, wherever the features of variation, selection and inheritance are present.

Darwinism offers a theoretical framework and ontological precepts, rather than a detailed set of theoretical explanations for all phenomena. Similarly, the social sciences require consistent and complementary theories operating at different levels (Hodgson, 2001b). The evolutionary economist has to provide more specific, extensive, auxiliary theories to fit inside, and be guided by, a more general Darwinian framework.

It has also been argued here that there is another, even more fundamental sense in which Darwinism applies to the socio-economic domain. This is the Darwinian ontological commitment to the principle of determinacy: there is no uncaused cause. For instance, as social scientists, we should probe the causes of beliefs and intentions themselves. This fundamental aspect of Darwinism is not widely understood or acknowledged.

Among economists, the single prominent exception is Veblen. Alone among the leading evolutionary economists, he understood this idea well. For example, Veblen (1919, p. 176) wrote in 1900 that: 'The prime postulate of evolutionary science, the preconception constantly underlying the inquiry, is the notion of a cumulative causal sequence'. Indeed, Veblen's idea of 'cumulative causation' points to the need for a detailed, step-by-step, explanation of causal processes, similar to what Dennett (1995) and Jason Potts (2000) describe as an 'algorithmic' approach. There are several passages in Veblen's works where these ideas are expressed.[18] The

[18] Such ideas are elaborated in Veblen (1919, pp. 37, 61, 77, 176–177, 191–192, 238, 240, 436).

remarkable fact is that it has taken other economists – including those enamoured by evolutionary ideas – more than a hundred years to reach a similar appreciation of the fundamental and irresistible impact of the Darwinian revolution for the social sciences.

In short, Darwinism provides a compelling ontology, it is a universal metatheory in which specific theories must be nested, and it is a rich but optional source of analogy. If the arguments here concerning ontology and Universal Darwinism are correct, then on some of these questions the social scientist has no option but to be Darwinian. However, Darwinism does not provide complete explanations of socio-economic phenomena. Something more is required. The social cannot be reduced to the biological. Darwinism may be universal but economics should not be abandoned to biology.

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