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Darwinian evolutionary theory and the social sciences

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This is an edited transcript of a symposium held by the Academy of Social Sciences and the ESRC and hosted by the University of Bath on 14 March 2007. The question addressed was ‘whether the theory of natural selection has anything to offer present-day studies of culture and society’. Four leading scholars contributed from different disciplinary backgrounds. All focused on the Darwinian evolutionary paradigm of variation, replication and selection and agreed on its powerful contribution to understanding cultural and social entities and change. However, their contributions revealed the wide variety of concepts, frameworks and empirical studies which come under the general evolutionary heading. The seminar also illustrated the important contribution that such ideas can make to overcoming disciplinary boundaries in the social sciences.

Introduction

Ian Gough

The Darwinian evolutionary framework is increasingly being applied to the social sciences, but its role and relevance remains disputed. Does it represent an ambitious new theoretical framework for interdisciplinary understanding of the development of human behaviour, cultural practices and social institutions? Does the natural selection paradigm, in Campbell’s (1974, p. 420) words, provide ‘the universal non-teleological explanation of teleological achievements’? Is Darwinism ‘the only adequate general causal theory of evolutionary change in complex systems with varied entities’, as Hodgson argues below? Or can it contribute at a less exalted level by generating fruitful hypotheses and insights concerning the adaptation of behaviours, practices, artefacts and institutions to the ever-changing encompassing natural and social environment? Here evolutionary reasoning would serve as a useful tool of thought.

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Or is the whole enterprise a return to fruitless grand narratives, indeed the grandest of all narratives, doomed to failure, as post-modernists would contend?

To discuss these issues the Academy joined with the ESRC to promote this seminar, hosted at the University of Bath by the Vice-Chancellor, Prof Glynis Breakwell. It was addressed by four eminent scholars, three with a commitment to apply evolutionary thinking to social entities and practices, and one who engages critically with the paradigm.

Prof Garry Runciman contributed, as President of the British Academy, to an earlier seminar on the evolution of cultural entities, the book of which provides a convenient tour of many central issues (Runciman, 2002; Wheeler *et al.*, 2002). In the second volume of his *Treatise on Social Theory* (1989) he proposes a reformulation of evolutionary sociology and develops an audacious empirical account of the evolution of human practices. Professor Ruth Mace works at the Centre for the Evolution of Cultural Diversity at University College, London and is the author of *The Evolution of Cultural Diversity: A Phylogenetic Approach* (2005). Professor Geoffrey Hodgson is an economist with a long-time interest in evolutionary thinking, his contributions ranging from *Economics and Evolution* (1993) to *Economics in the Shadow of Darwin and Marx* (2006). Prof Michael Rustin's academic interests bridge sociology and psychoanalysis and many more topics besides. Since reviewing Runciman's book (Rustin, 1999; Runciman, 1999) he has retained a critical engagement with the evolution debate.

Runciman upholds a strict interpretation of Darwinian theory in terms of heritable variation and competitive selection. He draws a distinction between the application of natural selection to understanding human behaviour (the realm of evolutionary psychologists and others) and the application of heritable variation and competitive selection to understanding socio-cultural evolution. However, within this latter category he makes a further distinction between 'cultural' selection, through such mechanisms as imitation and learning, and 'social' selection where institutions, rules and roles are selected. He claims that a comprehensive understanding of human warfare requires the contribution of all three evolutionary frameworks.

Mace illustrates from her research the complex interaction of the first two of Runciman's fields of evolutionary explanation. Cultural selection helps understand the limits of males' supposedly universal genetic preferences for women of a particular shape. A universal search for partners with good health can take culturally variable forms. Similarly, life history evolution in conjunction with human genetics helps understand the early onset of the menopause and the role of grandmothers in child care. Distinguishing between proximate and ultimate explanations, she regards the evolutionary paradigm as a fertile source of hypotheses regarding the latter.

Hodgson is concerned with the third of Runciman's selection systems—the social selection of the practices and structures of firms and business organisation, as part of the relatively new field of evolutionary economics. This entails researching the sources of variation in these (including human inventiveness), the modes of inheritance (including deliberate learning) and the selection mechanisms, notably including markets of various kinds. He concludes that this Darwinian three-stage process supplies the most general framework for understanding the evolution of firms, but that it always requires supplementing with auxiliary explanations.

Rustin accepts the relevance of all three fields of evolutionary explanation to certain features of human behaviour, but rejects it as a general explanation. He argues a connection between genetic factors and attachment theories concerning human infants and Kleinian theories of potential conflicts between mothers and infants. He also recognises the contribution of social selection mechanisms to understanding success and failure in producer markets, scientific ideas and innovations in art forms, but rules out Darwinism as a method for explaining states and the strategies of power-holders.

Thus these presentations reveal the great diversity of the field. As Mace stresses there is a wide variety of concepts, frameworks and empirical studies that come under the general evolutionary heading. Nonetheless, we can identify five features of the framework on which all agree. First, Darwinism entails processes of variation, inheritance and selection that can be applied to socio-cultural entities. Second, it provides an analysis of changes at the level of populations: individual intentions 'retreat into the background', although the role of individual inventiveness and creativity is recognised. Third, it is a resolutely non-teleological theory, with the implication that large-scale social reforms will always encounter unintended consequences. Fourth, it provides a fertile source of hypotheses to explain socio-cultural variations and commonalities. Fifth, it always encourages, and frequently requires, interdisciplinary research, or indeed, non-disciplinary research (Bowles, 2003). The Darwinian evolutionary paradigm promises a new route to breaking down the stranglehold of entrenched academic disciplines, and thus potentially contributes to the aims of the Academy of Social Sciences.

Darwinian explanations of socio-cultural evolution

Garry Runciman

I feel bound to begin by voicing my surprise that the question which this meeting has been invited to address should be 'whether the theory of natural selection has anything to offer present-day studies of culture and society', rather than 'how much?'. Even social scientists less favourably disposed than the present speakers to a neo-Darwinian approach to the study of human behaviour are bound to acknowledge that a Kuhnian paradigm-shift has been under way for the past 20 years or more, extending all the way from psychology to archaeology and including not least evolutionary game theory, whose extensive literature should be more widely known than it is among social scientists other than economists. The central idea is what Darwin himself called 'descent with modification', but is nowadays better phrased as 'heritable variation and competitive selection'. To the question 'variation and selection of what?', the short general answer is 'information affecting behaviour in the phenotype'. In the theory of natural selection, the information is transmitted biologically from organism to organism by strings of DNA that encode the instructions for making protein molecules. But as the American psychologist Donald T. Campbell was perhaps the first to grasp fully, the theory of natural selection is only one special

case of a more general evolutionary theory which covers not only the evolution of plant and animal species and the evolution of the chemical elements which preceded it but the evolution of human cultures and societies which is continuous with it.

I am a sociologist, and I have often wondered why it is that so many of my fellow sociologists are among those whom Kuhn, in his well-known book of 1963, calls the 'die-hards'—those who simply refuse to acknowledge the paradigm which is displacing the one in which they were brought up and which they continue to teach their students. There are, I think, two main reasons. The first is that they associate the current neo-Darwinian approach to the study of behaviour with the long outdated and thoroughly discredited 'Social Darwinism' of the late-19th and early-20th century. The second is that they are afraid that if they sign up to the neo-Darwinian approach they will be committing themselves to a research programme which will reduce sociology to applied biology, a fear which, although unfounded, is in part a reaction against some of the more exaggerated claims made on behalf of so called 'sociobiology' during the 1970s and 1980s. I do not know how long this state of affairs will continue. It may be that, as Kuhn explicitly envisaged, the die-hards have literally to die off and be succeeded by a new generation, which has by then consigned them to the history books. But for the moment, there are some within the social-scientific community who take a neo-Darwinian approach as a matter of course, at the same time that there are others who seem unable (or perhaps unwilling) to understand what neo-Darwinian theory actually says.

However, it is important to draw a clear distinction between the contribution which the theory of natural selection itself can make to the explanation of human behaviour and the extent to which it provides a model for theories of cultural and social selection which have both significant analogies and significant disanalogies with it. On the one side there are the behavioural ecologists (as the sociobiologists now call themselves), the behaviour geneticists (who study innate within-group differences), the evolutionary psychologists (who study the naturally selected features of the human brain which influence behaviour cross-culturally), the developmental and cognitive psychologists (who are concerned with the interaction between innate predispositions and the environment), and the brain scientists (who are increasingly able to explain at the molecular level differences identified by the behaviour geneticists at population level). On the other side are the theorists of cultural and social selection who do not accept that the collective human behaviour-patterns which they study are explicable, except to a limited degree, by direct reference to the theory of natural selection, but who seek to explain them by reference to other mechanisms of heritable variation and competitive selection of information affecting phenotypic behaviour. Ironically, it is from the theory of natural selection itself that there has come the conclusive refutation of the racist sociology which the Social Darwinists claimed to have derived from it. But the neo-Darwinians have been slow to recognise that 'sociocultural' evolution—the term used by Donald Campbell and many others—needs to be split in two and analysed at the separate levels of the cultural and the social.

At the cultural level, the heritably variable and competitively selected information affecting behaviour is transmitted from mind to mind by imitation and learning: the

members of different human populations acquire and transmit to their children, pupils and peer-groups (and sometimes, in reverse, to their parents and teachers) the beliefs and attitudes which distinguish one culture or sub-culture from another. But something else goes on when it comes to behaviour at the social level—the level that is of class conflict, slavery, government, bureaucracy, law-courts and so forth where people behave as they do because of information encoded in rule-governed practices which define the institutional roles which they occupy and perform. If, for example, you are a soldier conscripted into the army of the state of which you are a citizen, your behaviour is governed by sanctions which your superiors can bring to bear whatever the genes you have inherited and whatever the beliefs and attitudes you are carrying around inside your head. You may, of course, refuse to accept the rules and follow the practices that define your role even if the sanction is imprisonment or death. But those rules and practices are the outcome of a history of heritable variation and competitive selection that have made them what they are independently of any individual decision or action of yours. Only at rare times of constitutional choice are we, or some of us, in a position to design the roles which make the society of which we are members the kind of society that it is.

If there is any single feature of the neo-Darwinian paradigm which categorically differentiates it from those which were on offer to sociologists when I was a graduate student, it is its repudiation of teleology in any form. Evolution involves by definition a change out of one state of the world into a new and different one. But it is not a change along a trajectory leading to a predetermined destination. In this, it parts company not only with Marxist theory and its presupposition of a dialectical process emerging out of contradictions between the forces and social relations of production, but also with Weberian theory and its presupposition of an inexorable process of what Weber called rationalisation. It is true that Weber disagreed categorically with Marx in that he saw social evolution as driven by autonomous ideological and political forces interacting with, but not reducible to, economic forces. But Weber, although he more than once discussed the concept of selection, rejected it on the mistaken grounds that it implies a circular definition of competitive success. It does not, for reasons fully accommodated within neo-Darwinian theory. But neo-Darwinian theory also rules out neo-Weberian theories of ‘modernisation’ in which the story of social evolution is a story of the predetermined triumph of ideas and institutions originating in the so-called ‘West’. ‘Success’, whether of a distinctive species, culture or society, means no more (but no less) than that the continuous process of heritable variation and competitive selection causes some of them to go extinct while others persist and generate new forms in a continuous, path-dependent but open-ended sequence.

Behind all this there still lurks the deeper question why the world should work the way that Darwinian theory says that it does. Some, such as Archbishop Temple of Canterbury and former President Bill Clinton, say that it is because God chose to design the world to work this way. But if so, those of us who are trying to explain what goes on in it have to find non-teleological explanations at the biological, cultural and social levels alike. We cannot fall back on ad hoc appeals to what Darwin’s

opponents called 'special provision' without closing our eyes to the results of a century of scientific discovery confirming that Darwin got it right.

Let me take as an example of the three levels of selection the sociology of warfare. If we think of the proverbial anthropologist from Mars who comes to study the behaviour of the human beings who inhabit Planet Earth, that person will not fail to notice the extent to which young adult males periodically confront each other in systematically organised combat between groups armed with lethal weapons. That lethal violence is something which is far more often done by young adult males than by either older males or coeval females is one of the best-attested cross-cultural findings of recent decades. But we also know that some peoples documented in the anthropological and historical record are much less warlike than others, even when there is no significant difference in either their genetic make-up or their ecological environment. Although courage in battle is generally admired, victories celebrated, and rituals performed in commemoration of the fallen, culture, i.e. information transmitted by imitation and learning, exercises an unmistakable influence on the readiness of different human populations to go to war and the manner in which, and methods by which, they do so. But there is more to it than that. We also know that the men (and occasional women) who do the killing do so to very different degrees of effectiveness and from within very different systems of social organisation. This is a matter not of individual psychology but of the information encoded in the rules that govern the way in which soldiers are trained, deployed and disciplined. It is not just that some individuals are more pugnacious than others and some cultures more bellicose than others, but that some societies are more successful than others in waging war because of institutional differences between them. Sociologists of warfare who are interested in comparing different human populations down the ages and across the globe are studying patterns of collective behaviour which are the outcome of a process of biological *and* cultural *and* social evolution in which the mechanisms of variation and selection are very different at each of the three levels.

The final point I should like to make is that theories of natural, cultural and social selection alike all operate at the level of populations and not of individuals. They explain why distinctive patterns of behaviour emerge and persist in the aggregate, on average and over time. It is not a question of denying the reality of the individual differences between members of the same species or culture, or society, or of the separate decisions and choices which they make: Darwin himself was explicit that, as he put it in *The Descent of Man* (1883, p. 66), 'instinctive actions . . . may be replaced by others pursued with the aid of the free will'. But in the evolution of species, cultures and societies as such, the individuals recede, so to speak, from view. They are seen as the carriers of the heritably variable and competitively selected bundles of genetic, cultural and social information, which determine their collective behaviour-patterns in their different local environments. That does not make us into helpless automata. Our genetic inheritance does not predetermine our individual development in interaction with our environment; our cultural inheritance does not prevent us from modifying and reinterpreting the beliefs and attitudes transmitted to us by parents and mentors; our social inheritance leaves us with ample scope to renegotiate the

practices which define the roles which we occupy and perform. That is what Darwin's 'descent with modification' is all about. But it is the heritable variation and competitive selection of biologically *and* culturally *and* socially transmitted information which has made our human world what it is.

The evolution of cultural diversity

Ruth Mace

I want to give a brief overview of evolutionary approaches to human behaviour. The field is actually very diverse; there are several different types of questions and each can be answered at different levels. I will try to give a whistle-stop tour of some examples of these kinds of studies because I do not want you to think there is only one way of studying the evolution of human behaviour. It is a very complex field.

Proximate and ultimate explanations

I distinguish at the beginning between proximate and ultimate evolutionary explanations. When asked 'Is this something caused by this or caused by that?', there are different ways of answering. Proximally, one can answer it with respect to mechanisms, hormones, mental modules in the brain, development or the whole nature-nurture debate. These are the 'how' questions, the proximate questions, about what leads someone to behave in a particular way. Then there are the ultimate questions, which could include the evolutionary history that led up to that point or it could include the adaptive function. In other words, what selective pressures, what evolutionary pressures led that behaviour to be selected?

These questions are not mutually exclusive. In many of the arguments between social scientists and natural scientists, someone is putting forward a proximate explanation, someone is putting forward an ultimate explanation, and they could both be right or wrong. To give an example of a question I am interested in: Why do people in modernising societies have so few children? Proximally, we have acquired ideas and values that cause us to allocate our resources to other things. Ultimately, it is possibly because people with these ideas have had more influence at transmitting these ideas on quantity-quality trade-offs and it is only children who are heavily invested in that are successful in a highly competitive world. We want our children to succeed so we are investing heavily in each of them and having very few. Right from the start, there is more than one possible explanation or more than one way of asking that question.

Three schools of thought

I want to briefly outline three main schools of thought within the contemporary evolutionary paradigm.

- Evolutionary psychology;

- Gene-culture co-evolutionary theory, sometimes referred to as cultural evolution (I also have interests here);
- Human behavioural ecology or evolutionary ecology (the camp I most strongly affiliate with).

According to evolutionary ecology, natural selection is efficient. It works on phenotypic strategies including behaviours, which are optimal to a species' niche. By contrast, evolutionary psychologists are more interested in the brain as an organ selected by natural selection. Cultural evolutionists are interested in ideas, memes, cultural variance, whatever you want to call them, which are transmitted in different ways from genes. Thus the schools tend to study different kinds of things. Evolutionary ecologists are trying to work out the fitness consequences of behaviour whereas evolutionary psychologists are more interested in mental modules and psychological adaptations. Cultural evolutionists have not, on the whole, done much empirical work, but when they do they are interested in changes in the frequencies of ideas.

One area where the three schools of thought differ is in their approach to studying mal-adaptation. Evolutionary ecology is basically an adaptationist paradigm, assuming that natural selection on cultural variation is efficient. Evolutionary psychologists assume it is not very efficient because they say we evolved as hunter-gatherers and utilise the concept of the EEA, the environmental of evolutionary adaptiveness. It is as though we have a hunter-gatherer brain on our shoulders and, therefore, do not necessarily behave in an adaptive way in a modern environment. The third group of cultural evolutionists are also interested in mal-adaptation because memes can be transmitted in a non-Mendelian way very different from genes. Therefore, one can get different outcomes when studying cultural evolution from purely genetically determined behaviour.

Evolutionary psychology and human universals

Evolutionary psychologists tend to be interested in human universals, for example in explaining mate choice or sex differences. Despite their emphasis on the EEA, they do not normally study hunter-gatherers. Rather ironically they are much more likely to be doing lab experiments on undergraduates, although, as I will show, these kinds of studies are now broadening out into much wider populations and getting very different results.

One supposedly classic human universal studied by evolutionary psychologists is the attractiveness to men of women with different body shapes. When presented with pictures of women with different waist-hip ratios, most men say they find the women with 0.7 WHR more attractive than the women with 0.9 WHR. Studies across universities all over the world have yielded very similar results so the conclusion was drawn that this was a human universal. However, we do not know what men in EEA wanted. We do not have much art from that period, but what we do have does not necessarily suggest that thin women were greatly valued then.

In fact when asked, few hunter-gatherer populations there are left in the world cared about the waist-hip ratio. They regarded the fattest women on the sheet as the most attractive, completely at odds with Western populations. Another rather interesting experiment in the Amazon studied four different populations: A was far away from contact with Western media, living in the remote forest; two were further down the river with C being on the coast and D being American university students. The more remote populations preferred the fatter women and the university students preferred the thinnest women, and the ones in-between preferred the ones in-between.

A similar experiment of preferred BMI (body mass index) found the preferred BMI in UK populations peak at around 20, which is quite thin, but very thin women were not really preferred and fatter women were also not particularly preferred. However, in a Zulu population in South Africa there was a dislike for thin women but being fat was not considered a disadvantage at all, similar to the Amazonian results. However, the preferences of South Africa Zulus who had migrated to Britain started to change towards the UK preference. Finally, the children of South African parents of Zulu origin born in Britain expressed preferences almost indistinguishable from the native British population (Tovee *et al.*, 2006).

So the idea that these preferences are human universals has really gone out of the window. Evolutionary psychology is now having to engage with the idea of cultural evolution, and the findings of huge cultural variation. Perhaps the underlying principle is that people look for partners with good health but the definition of good health is culturally variable. I think that is a question that remains to be answered.

Dual inheritance

The second school of thought, gene-culture co-evolutionary theory, develops dual inheritance models of genetic and cultural inheritance and explores how this can lead to different patterns from simple genetic evolution (Boyd & Richerson, 1985). It tends to be very mathematical area of study because it is very difficult to test these things empirically. To give one example, this school is interested in how different non-Mendelian routes of transmission affect cultural behaviour. For example, if it is Mendelian, genes are inherited from parents and no one else. With cultural variation, there is what Boyd & Richerson called biased transmission. People can choose their cultural models, prestigious people for example. Imagine we have an innate disposition to copy teachers, rock stars and people who have prestige. Maybe people vary in success at attaining influential roles and this variation is affected by their beliefs. Cultural variants that lead to success in attaining influential roles will tend to spread. Perhaps this explains things such as famous climbers taking horrendous risks or, going back to the waist-hip ratios, supermodels getting dangerously thin. These types of models can take us to things which look, on the face of it, clearly mal-adaptive from a classic genetic Darwinian perspective.

One critical difference is that it is possible to get a form of group selection to work in a way that you cannot in genetic evolution. Genetic selection does not work at the level of the group, but at the level of the individual or the gene. This is because even only a

small amount of migration between groups (a necessary condition of being the same species) destroys the genetic integrity of groups and makes it hard to maintain variation between groups. However, in cultural traits, forces such as 'conformist bias' and 'altruistic punishment' can enforce group level differences (as individuals are forced/induced to change their cultural make-up in a way that they cannot do with their genetic make-up); this enables some form of cultural group selection to favour behaviours that favour coordinated or cooperative groups as they can out-compete other groups. It has been suggested such forces might underpin a diverse range of complex human social traits, from warfare to religion. However, the empirical work necessary to support or reject these models is still only in its infancy.

Evolutionary ecology and life history evolution

This third school of thought, with which I am most closely associated, tends to study natural fertility populations, including subsistence strategies, reproductive strategies, parental investment and life history theory. It is often carried out by anthropologists such as myself working in more traditional populations, although it is again now expanding its area of study to include modernising and urban societies. I will give two examples from life history evolution approaches.

The grandmother hypothesis. Compared with our nearest relatives, the other great apes, the human life history differs in many ways. We have a long period of time before we reproduce but once we start reproducing we actually do so at a rapid rate and then females stop reproducing long before they die. Compared to other animals, the reproductive part of the female life history has been squashed into the middle of the lifespan with long non-reproductive periods both before and after. Human females have births about every three years in natural fertility populations compared to the Orang-utan, with not dissimilar body weight (and normally birth rates scale quite well with body weight), which have offspring every eight years. Gibbons, which are less than 25 per cent of our weight, have babies every three years, so we are really churning out offspring for an ape of our size.

The reason we think human females can do this is a division of labour. The female Orang-utan does it on her own; no one is feeding her and it is her own energy going into reproduction, whereas in a human system several people are contributing to raising offspring. Some anthropologists have argued that the father is the main contributor and that is why we have evolved a division of labour and very strong pair bonds in human societies. Others have argued that it is not the father but the grandmother that is crucial. This explanation could account for the long post-reproductive lifespan. We could have evolved after a certain age to stop trying to produce children of our own and concentrate on helping our daughter to reproduce and raise children. This is the grandmother hypothesis for the evolution of menopause.

Cooperative breeding. This hypothesis suggests that we are evolved as a cooperatively breeding species, an interesting idea that I decided to test. There is in the Gambia a

study of demographic records of births and deaths going back to 1949 in four villages that has enabled us to measure the importance of communal efforts to raise children. One way of testing which relatives really matter is to statistically analyse the effect of a certain relative dying on the probability that a child will die. What difference does your mother, your father or your grandmother dying make to your own survival? Since this historical dataset covered a period when about 40 per cent of children died before the age of five, there was a lot of data to work with.

To summarise our results from this Gambian village, briefly, death of a mother enormously increases the risk a child under the age of two dying, although interestingly not children over the age of two. The only other people that affected survival chances were maternal grandmothers and elder sisters. Thus matrilineal relatives all influenced survival, but death of fathers or other patrilineal relatives did not make any difference (Mace & Sear, 2005). One can then develop models to calculate if these effects have been big enough to actually drive the evolution of the menopause. In brief, they more or less do. Assuming that grandmothers, by stopping reproduction, can actually help their daughters' children survive, and speed up their daughters' reproductive rate, then it is possible that menopause can evolve as an adaptation (Shanley *et al.*, 2007). Since our study, and another on the Ache in Paraguay, a huge number of other studies have taken place. Again, like our own, the data was largely out there already, but people just had not thought to look at it in this way until they started taking an evolutionary perspective.

Energy balance

In another demographic study in Ethiopia a development agency had installed water pumps and we were interested in the effect of such an energy saving initiative on life history. Previously women had to walk great distances to collect water, carrying really heavy pots that I could not even lift. Comparing different villages we found as predicted that infant mortality fell as a result of this very welcome improvement. But we were also interested in the effects of the changing energy balance of women. As evolutionary biologists, we suspected that having more energy might speed up the rate at which women had babies, which is exactly what happened. Before the taps, 70 per cent of women had not given birth again before within two years, but after the taps, 50 per cent had. This quite significant hike in fertility actually precipitated some malnutrition. If we look at height for age for children up to the age of about five, the higher birth rate was associated with a slight and measurable increase in malnutrition (Gibson & Mace, 2006). This side effect is not intuitively obvious but if taking a life history approach enables us to explain it.

Conclusion

Why use an evolutionary approach? It generates testable hypotheses. I am not arguing that any one hypothesis is true or not true. I am saying that we have to test them. Moreover, the answers to these questions do not lie in what people think is going

on; they are not about individual interpretations. Even though I said there were three schools of thought, I realise that is already out of date. I like Sam's phrase about non-disciplinary science because I realise that what started off as socio-biology then grew into these other things (Evolutionary demography, which I just talked about, Evolutionary economics, which Gary mentioned earlier). Sociobiology has grown up and 20 minutes is not long enough to tell you everything that is going on and what it gave rise to, but hopefully I have given you enough to convince you that it is an interesting and expanding field.

Darwinism and the social sciences

Geoffrey Hodgson

Evolution

Since the early 1980s I have described myself as an institutional and evolutionary economist. I shall explain later how institutions and evolution are connected. Evolutionary economics is a wide and diverse field of enquiry. Even more broadly, evolutionary labels and ideas are increasingly popular in the social sciences. I wish to make some points about the value of Darwinism and its importance for social scientists. These points go further than the recognition of the biological aspects of humanity and the fact of human evolution.

The term 'evolution' encompasses a variety of meanings and Charles Darwin did not use it very often. It was Herbert Spencer rather than Darwin who popularised the term. Etymologically, the word refers literally to the unrolling of something like a scroll, but in the modern context it means virtually anything connected with change. I am quite happy using an inclusive term such as 'evolutionary economics' but such labels do not convey more than a minimal meaning.

I wish to promote a more refined meaning or type of evolution. Darwinism is one of several different evolutionary paradigms that have appeared over the centuries, and it is the only successful one in my view. Others rely on unexplained processes, presumed sequences of stages or teleological ends. Whether the Lamarckian inheritance of acquired characteristics does or does not occur, Lamarckism is not a complete theory of evolution because it relies on Darwinian principles including selection (Dawkins, 1983; Hodgson & Knudsen, 2006a, 2006b). Darwinism is the only adequate general causal theory of evolutionary change in complex systems with varied entities. However, within evolutionary economics the promotion of Darwinism is a minority standpoint, and it has been subject to criticism and dispute.

Genetics

As my economic historian friend Joel Mokyr remarked at a recent conference, 'Darwinism is too important to be left to the biologists'. As a biologist, Darwin did a lot of empirical work. His papers and books contain an enormous amount of detailed

information. With inspiration from economics and other disciplines, he developed his theory of natural selection. Darwin also hinted at the possibility that his core set of theoretical ideas have a wider relevance and usage: they apply to other evolving systems. This has been subsequently recognised by a number of authors including Thorstein Veblen (1899, 1919) and Donald T. Campbell (1965).

Generalising Darwinism does not mean genetic or biological reductionism. The term 'gene' was introduced after Darwin's death. Darwin did not have any inkling about how the inheritance mechanism worked, yet he developed a general theory of evolutionary change. Darwinism is the only systemic theory of evolution we have to help explain a wide variety of evolutionary phenomena. On Planet Earth of course, genes are important in biological transmission. However, the core message of Darwinism does not depend on genes. As Richard Dawkins (1983) put it in an interesting thought experiment, one can imagine another planet where there is no DNA. Instead there are organisms running around and reproducing by some other mechanism. Nevertheless, as Dawkins argued at length, Darwinian principles would still apply.

Core Darwinian principles

Let us elaborate this argument. Darwinian theory refers to populations of entities. These populations could be of biological organisms or even relatively sophisticated robots. Imagine a science fiction world of robots that learn and adapt in their struggle to survive. To avoid degradation and overcome problems, they receive information, and absorb energy and matter from their environment. They can also reproduce themselves. No two robots are identical (at least in terms of the information they hold), so some have relative advantages in some circumstances over others. Robots develop solutions to problems and environmental challenges. Problem solutions, like using an umbrella to protect them from rain and rusting, can be communicated from robot to robot. Some robots fail and cease functioning.

With this population there is an imperative to survive, a capacity to replicate, some local scarcity of resources and competition over those resources between these robots. Obviously these principles also apply, in general terms, to biological organisms. The next step is to ask if they also apply to human social entities such as social institutions.

One of the central issues in economics is to understand how firms compete. Economists consider what firms are, how they compete, how they survive, the pattern of their life cycles, and so on. Do populations of firms qualify as evolving entities like the robots and organisms considered above? Ostensibly yes. Firms are dissimilar, compete with other firms, and pass on problem solutions. So we have social entities that fit the same abstract description to which Darwinian principles apply.

After taking this first step, we must look at the detailed ways and mechanisms through which these particular entities retain problem solutions, pass them on, replicate and so on. However, as well as looking at the real world, getting our hands dirty and doing empirical research, we need to be clear what the Darwinian principles are.

Variation, inheritance and selection

It is widely appreciated that there are three basic Darwinian principles concerning variation, inheritance and selection. Slightly different terms are used by different authors, but that need not concern us here.

Variation. Darwinism addresses a world of variation, and it requires some explanation of how that variety is created and sustained through time. With evolution at the genetic level, mutation and genetic recombination are the mechanisms that generate and renew variety in the gene pool. The details of how variety is generated with robots, or with alien species on another planet, or with social entities in the human domain, will be very different from the mechanisms applying to genes. But there must be some explanation of how variety is maintained and generated. In the human social domain, writers have considered various mechanisms, such as communication error, individual curiosity and entrepreneurship as possible variety-creating processes.

Inheritance. Inheritance or replication refers to how information and problem solutions are passed on from one entity to another, and through time. There must be some detailed story about how this information is acquired and how it is passed on. For example, addressing firm-to-firm information transmission, do firms learn from one another? Do they copy their production techniques? Do their managers go to Harvard and get MBAs and get their solutions from there? What are the mechanisms by which one firm learns from another? What is the relative importance of diffusion over innovation? What is the role of the entrepreneur? These questions have different detailed answers, but they are prompted by the general Darwinian framework, when applied to social or economic evolution.

Selection. The third Darwinian principle is selection. For Darwin, natural selection was not the only selection mechanism. He discussed sexual selection as well (Darwin, 1871). Selection is a broad concept and it does not necessarily mean that the selection environment is given or constant. Furthermore, selection does not always lead to the survival of the fittest. Biologists have shown that selection can sometimes lead to maladaptive or inefficient outcomes. There are several ways in which this can occur, but they generally involve interactive feedback between individuals, or between individuals and their environments. The peacock's tail is a good example. It results from an interactive processes of sexual selection, and results in outcomes that are highly cumbersome for the male.

Interactions that lead to inefficient outcomes are also commonplace in the social domain. For example, there is a recent literature on institutional complementarities. This shows how firm competition and selection is affected by other institutions, such as banks or state organisations. Globally less efficient firms may prosper because the institutional environment favours them, rather than their globally more efficient rivals.

By contrast, some questionable accounts of Darwinism in economics invoke a narrower and potentially apologetic argument, where the principle of selection is said to demonstrate that the fittest firms are the ones that actually exist. Among others, Milton Friedman promoted this view. Critics within economics such as Sidney Winter have shown that this is not necessarily true. Selection always works in relation to a particular environment. It rarely leads to the global efficiency optimum and often gravitates to local optima instead. Furthermore, given strong interactive effects and changing environments, such local optima can be fragile and transient.

Social evolution

My own work involves the refinement and application of Darwinian principles, particularly in the business and institutional contexts. The idea of applying these principles to social entities goes back to Darwin himself, when he argued that his ideas could also apply to the evolution of language (Darwin, 1859, pp. 422–423; 1871, pp. 59–61). In 1872, the economist and political theorist Walter Bagehot produced a short book that applied Darwinian principles to the evolution of political institutions. In the 1890s, Veblen applied Darwinian ideas to the evolution of social and economic institutions. These earlier attempts were largely forgotten during a period when social scientists reacted strongly against the use of any ideas from biology. Some time after World War II, Campbell and a few others resuscitated the idea of generalising Darwinian principles to social and other domains.

Working within a Darwinian framework, several contemporary researchers uphold that information transmission can occur on multiple levels, including one or more social levels. Robert Boyd & Peter Richerson (1985) have developed a theory of ‘dual inheritance’ with information being transmitted both culturally and genetically. This theory has been enormously successful and it is now being applied to firms and other social institutions.

What do we mean by information, and what is the carrier of information at the social level? In 1976 Richard Dawkins coined the term ‘meme’ to refer to a unit of cultural information. It is a popular term but it does not tell us very much. There is huge confusion about what memes are. Are they behaviours? Are they propensities? Are they pieces of information or memory traces? The confusion has not abated. Unless more is said about what a meme is, and how it is replicated, then the term does not get us very far.

We need also to get behind the notion of information, because it is problematic in both the biological and social sphere. In what sense is DNA information? We need to consider the type of information transmission processes that play a key role in evolutionary change.

A more refined and useful analogy is that of a computer program. The biologist Ernst Mayr (1988) developed the concept of ‘programme-based behaviour’ that has enormous but largely unrecognised implications for the social sciences. Instead of understanding the mind as an all-purpose rational calculator, it is regarded as being driven by conditional psychological mechanisms or ‘programmes’. Such programmes include habits

or instincts. Habits, of course, are culturally dependent. Within this perspective it is fully acknowledged that humans can often modify or over-ride their programmes by conscious will. But our will is not independent of our evolution or our underlying dispositions.

At the firm or organisational level, there are higher-level 'programmes' corresponding to habits or dispositions at the individual level. Ever since the pioneering 1982 book by Richard Nelson & Sidney Winter, these organisation-level programmes have been referred to as routines. Nelson & Winter compared routines with genes, suggesting that that they were both evolutionary replicators despite their detailed differences. There is now a large empirical and theoretical literature on routines, addressing such issues as how they act as repositories of knowledge and how they are replicated from organisation to organisation.

If routines are replicators, then organisations and institutions are their 'vehicles' or 'interactors' (to use the terms of Richard Dawkins (1976) and David Hull (1988), respectively). As Veblen argued over a 100 years ago, institutions are selected in the process of social evolution. It is here that 'institutional economics' and 'evolutionary economics' merge into one.

Accordingly, part of the current research agenda in this area involves an interaction between the application of Darwinian principles to the evolution of social entities, on the one hand, and the refinement of those principles in the light of their hugely widened domain of application, on the other. The generalisation of Darwinian principles is a very lively area of research that has promoted much current discussion and criticism.

Biological analogies

One criticism is that all this is stretching biological analogies too far. In response, the argument is not about analogies at all. In saying that Darwinian principles apply to evolving social entities, it is not claimed that the mechanisms involved are similar to biological mechanisms. There is nothing at the social level that remotely corresponds to DNA. At the level of detail, the mechanisms are generally very different. This point is important, but it does not undermine the project to generalise Darwinian principles to other spheres, including social evolution.

Philosopher of biology David Hull (1988) has pointed out that these Darwinian principles have a general character partly because of the huge variety of mechanisms within biology itself. Consider the procreation of grasses. They multiply basically by seeds or by underground stems or suckers. Suckers involve the transmission of identical DNA, but it creates a new plant. This method of replication is very different from that involving seeds and fertilisation. There are also different methods of replication for single-cell and multi-cell entities, for invertebrates and vertebrates, and so on. Even within biology it is a misconception to say that Darwinian principles are narrowly focused on one type of mechanism. They are very broad principles which can accommodate a huge variety of mechanisms.

Analogy is different from generalisation. Analogy compares one particular with another. By contrast, generalisation assembles a wide range of diverse particulars, and attempts to make meaningful and useful generalisations that apply to them all.

Darwinism involves a special form of generalisation that combines over-arching general principles with auxiliary explanations that apply only in specific circumstances. It powerfully combines the general with the particular.

Conclusion

This research programme is still in the early stages. It is largely in a pre-empirical, conceptual and exploratory phase, but a great deal of progress has been made. In recent years, philosophers of biology have done a lot of useful work in honing down the key concepts. They have refined, for example, the concept of the replicator and identified its essential features. The concept of selection has also been formalised and greatly clarified. To begin applying these ideas to economic or business phenomena, we need adequately precise general definitions of these terms. Subsequently, we must take in a mass of ongoing empirical research, which helps us further to understand the detailed mechanisms and processes. Hopefully in the near future we shall demonstrate the value of the over-arching Darwinian framework and generate some testable hypotheses.

This research involves multiple disciplines. First, some acquaintance with both biology and the philosophy of biology is required to understand the core Darwinian principles. Second, the social scientist must use insights from psychology and elsewhere to understand how humans learn and replicate information. Third, applications of Darwinian evolutionary ideas are now found in several related disciplines such as economics, politics, sociology, organisation science, anthropology, law, philosophy and archaeology. The social evolutionist has to gain insights from the work of others in several disciplines.

We cannot predict where this line of research will lead us. Nevertheless, we have already made enough progress to show that Darwinism has a great importance as a framework for understanding evolution in the social domain as well as the biological. Social scientists should abandon their fears and misunderstandings concerning Darwinism and get to grips with this burgeoning research programme.

A new social Darwinism?

Michael Rustin

Biological Darwinism

First, I would like to make a distinction between ‘biological Darwinism’ and the transposition by way of analogy or metaphor of Darwinian ideas of variation, replication and selection to the social sphere. Some versions of ‘biological Darwinism’ have been very unwelcome to social scientists, who have defended, often as a radical social constructionism, the idea that the ‘social’ is not determined in any way by biological substrates.

I regard this rejection of Darwinist explanations as wrong—after all, mortality and reproduction are natural facts, and all individuals and societies and individuals have to

cope with these. Biology has a primary causal role in human affairs, mediated by social process as it must be. I also think that some strictly Darwinian ideas, applied to the 'social' *are* illuminating, although I do not think of myself as a 'social Darwinist'.

I have in mind the investigations of the development of human infants and children, as these have been studied by attachment theorists following the work of John Bowlby (1972, 1973, 1988) and by psychoanalysts (of whom Bowlby was originally one: for a comparison of these two perspectives, see Fonagy, 2001). Both of these theoretical approaches draw attention to the similarities between the needs of mammals, in particular primates, in their early nurture, and the needs of human infants. In Bowlby's terms, if human infants are deprived of a secure attachment to a sustaining mother figure in their first year or two of life, some of the capacities which they would develop in those conditions will be damaged in their absence. They will be likely to become more insecure, anxious, dependent or conflictful, and will be more likely to have difficulties in fulfilling the role they may later have as parents. Impressive empirical studies (Bretherton & Waters, 1985) have validated and elaborated these ideas, enabling investigations of the learned modes of attachment of parents, inferred from their descriptions of their own children, to predict the probable modes of attachment of children, even yet unborn. (Current political programmes directed to improving the qualities of nurture in the 'early years' draw on these ideas and findings.)

Sarah Blaffer Hrdy in her book *Mother Nature* (1999) has taken these understandings further, from an evolutionist point of view. She has proposed that the vulnerable conditions of infants in hunter-gatherer societies have led the selection of certain 'survival strategies' to become genetically encoded in the constitution of human infants. They are at risk of abandonment by their mothers, and to competition from siblings, in conditions of scarcity. Furthermore they are at risk should their mother find herself with a sexual partner who is not the infant's own father. Thus, Hrdy argues, human infants have evolved to be highly attractive to their parents, and indeed to adults in general, as well as having a piercing capacity to make any distress or fear they may feel known to all in their locality.

More unexpectedly, Hrdy's evolutionary perspective, drawing on the sociobiological work of Robert Trivers (2002) explains why there is an inherent ambivalence in the relationship between infants and their mothers, and between infants and siblings, and why infants have reason for suspicion of parental sexual activity which is likely to lead to the birth of new babies, and thus competitors. As the philosopher Jim Hopkins (2003) has pointed out, Melanie Klein's description (Klein, 1975) of the anxieties and inner conflicts inherent in the relationships of early infancy, so at odds with sentimental idealisation of the mother-infant bond, finds a new support in these conjectures. In Hrdy's view, even the mother and her and the baby's placenta may be competitors for survival in times of scarcity, as well as later the mother and her newborn infant. Hrdy makes clear why it is that the abandonment of infants at extreme moments has been a rational survival strategy. The potential for conflict between mother and infant, for Oedipal anxieties concerning father, and possible displacement by new babies, and mothers' capacity for anxiety concerning their capacity to sustain their babies (and their need for

support in doing so) are rendered more intelligible if we think ourselves back to the hunter-gatherer era in which human genetic endowments were set down.

The research of Bowlbian attachment theorists, and of psychoanalysts in the British object-relations tradition who share some presuppositions with them, has developed within a particular ethical perspective, linked to a commitment to renewed social integration and community solidarity which was influential in Britain in the post-war period in which Bowlby began his work. Evolutionist arguments about 'human nature' have thus been deployed in support of a preferred conception of social relations. This need not be an illicit procedure, so long as it is recognised that such descriptions of the consequences of different types of social organisation (including patterns of child-rearing) do not replace moral judgements, by conflating fact and value, but do identify some factual constraints on choices between feasible ways of life.

Sociological Darwinism

Let me now look at the application of Darwinist perspectives to sociological and anthropological analysis. I agree with Geoffrey Hodgson that the distinction between genotype and phenotype seems fundamental to making use of the Darwinian analogy for the understanding of social development, since it is so central to Darwin's own theory. (Roughly speaking, in nature, if you are a sparrow there is no point in learning to swim.) In society, what are the equivalent limits to individuals' freedom of action, and how far do Darwinian processes of variation and replication help in understanding them? It was a major contribution of sociology and anthropology to show that there were such limits, or to put this in another way, that choices always have to be negotiated within a field of possibilities. Such limits may be determined by culture (what it is possible to think or feel within a given milieu), by the distribution of power, and by material resources, in various combinations. As Marx put it, 'Men make history, but in circumstances not of their own choosing'. The question is how far do Darwinian ideas improve on the various classical sociological framings of this question, which have tended to focus, within the traditions of the subject (Durkheim, Weber, Marx and their descendants) on one or other of these three 'power dimensions' (Giddens, 1971). The question is whether Darwinism contributes a distinctive new mode of explanation, in addition to explanations by reference to genetic templates (e.g. hunter-gatherer or mammalian dispositions) whose positive value I have discussed above.

The problem seems to be that the more Darwinian accounts seek to accommodate the facts of cultural transmission, and to take account of what in evolutionary debates is termed the 'inheritance of acquired characteristics', the more they depart from the framing of Darwin's own theory, in the direction of the Lamarckian position which Darwin's theory of natural selection defeated. The clarity of the Darwinian programme, which has been maintained throughout its successive stages from Darwin, through Mendel's idea of genes and chromosomes, to the biochemical and informational mapping of the genome, lies in the fact that inheritable characteristics,

what Geoff Hodgson refers to above as replicators, remain conceptually and in reality to a large degree distinct from the processes by which they are selected. ‘Variation’ and ‘selection’ take place so to speak in different conceptual spaces.

How far can this separation be sustained in extensions of Darwinian thinking to the social and cultural spheres? I would like to suggest a distinction between those social forms in which the separation between ‘variation’ and ‘selection’ is strong, and those where it is weak or absent. An example of the former are producer markets in which incremental innovations are ‘selected for’ by competition, scientific activity where variations are ‘selected’ by the decisions of a larger scientific community, and innovations in art forms, where once again selection of successful variants (new genres, forms or techniques) is independent of their production. All of these analogues to Darwinian competition seem, incidentally, to be products of liberal types of social organisation.

Contrast these with systems where power holders successfully control variation (in the economy, in the arts, in ideas) as a primary strategy for maintaining their dominance. State socialism is such an instance. In one system, variation and selection are (deliberately) structured as separate processes, in the other, such separation is vigorously resisted. Very different patterns of innovation, diffusion and selection will obtain in these different systems. In so far as Darwinism is to be seen as a resource for understanding specific patterns of innovation and diffusion (as in the work described above by Ruth Mace) it will have different applications in the two cases. In the first, these may be quite close to its biological and ecological source field, in the latter more remote from it.¹

It can be argued that on a larger social scale, there will be competition between these systems themselves, as in the Cold War between capitalism and communism, or nowadays perhaps in a struggle for dominance between more and less regulated forms of capitalism. But there seem likely to be great differences in the form of application of Darwinist models at these different levels, and where the modes of variation and selection are so differently configured. To call of these forms of contest and competition ‘Darwinist’ seems to achieve an apparent universal scope at the expense of explanatory precision.

It seems an interesting fact about the Darwinist paradigm that its most precise application is to forms of structured competition that occur and are valued within a particular type of social order. ‘Social Darwinism’ in its early 19th century days was mapped on to an ideology of unbridled economic individualism, which led to the rejection of Darwinism by many sociologists, even to this day. But if we see that the application of Darwinist principles to social explanation now requires the understanding not only of the processes of competition, but also of the institutional and regulatory conditions necessary to sustain them, we can see the possibilities for a Darwinism which is more genuinely social than hitherto.

Note

1. The ‘actor network’ theory of Bruno Latour and his colleagues (Latour, 2005) considerably complicates the idealised model which posits a state of ‘perfect competition’ between

scientists and their discoveries. The success and spread of innovative ideas depends on the conceptual links they are able to establish in various fields, and also on the substantive alliances that scientists are able to achieve with, for example, funding sources who can sustain further research. This suggests that modelling the processes of variation and selection in science (and other fields) is much more complex than a classical conception of 'separation' can capture. Agency is assigned to many types of 'actant', human and non-human, in Latour's view. There may be fruitful links to be made here with Darwinian mappings.

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