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REGULAR ARTICLE

Evolutionary social science and universal Darwinism

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Abstract How should social scientists, inclined to an evolutionary theory of aspects of human culture like science, technology, business organization and practice, react to proposals that they embrace a "Universal Darwinism"? The most prominent variety of Universal Darwinism argues for close counterparts between the variables and mechanisms of cultural evolution and biological evolution, for example proposing the concept of "memes" as units of culture. Other Universal Darwinists propose, more flexibly, that human culture and biological species both change over time through a process that involves variation and selection, but that the details of the processes may be very different. This essay argues that the narrower form of Universal Darwinism should not be acceptable to social scientists. The differences in the details of cultural evolution and biological evolution are considerable. On the other hand, if Universal Darwinism provides a roomy intellectual tent welcoming scholars studying a variety of topics, with the unifying element being a dynamic theory involving variation and selection, but with the key variables and mechanisms being recognized as perhaps differing greatly between biology and human culture, we can be happy in that camp. Evolutionary Social Science and Universal Darwinism.

Keywords Evolution · Darwinism

1 Introduction

The last quarter century has seen a renaissance of evolutionary theorizing about economic, sociological, political, and cultural phenomena. Readers of this journal likely are most familiar with the development of evolutionary economics. But in addition to what has been going on in economics, significant interdisciplinary

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research communities have emerged and developed evolutionary theories concerned with scientific knowledge, technology, and business organization and practice. (References to representative writings will be given shortly.) Each of these communities overlaps in part with the community of evolutionary economists, but involves as well scholars whose home disciplines are outside economics, and each of these areas of evolutionary research has developed traditions of its own. Cultural anthropology also has seen the growth of a significant body of evolutionary theorizing, which has little overlap with evolutionary economics.

A salient feature of the research traditions I just mentioned is that by and large the development of an evolutionary perspective has been almost inductive. Researchers studying the phenomena empirically have been drawn to an evolutionary characterization of the dynamics involved. Of course there is recognition of similarities of the theories being put forward to biological evolution, and an interest among many of the authors in the similarities and differences between the evolutionary processes they see as driving change in their area of research, and evolution in biology. But the primary motivation for such theorizing seldom seems to have been to explore whether biological evolutionary analogies might hold in their arena of research. For the purposes of this essay, I will call these bodies of empirically oriented research that have adopted an evolutionary perspective, evolutionary social science.

The last quarter century also has seen a parallel development, coming largely from scholars based in biology or philosophy, which has been expressly concerned with exploring the extent to which the evolution of human culture can be understood in terms of processes closely akin to those involved in evolution in biology. The volumes edited by Aunger (2000) and by Wheeler et al. (2002) provide excellent broad reviews of this movement. The term "culture" here needs to be understood very liberally, as encompassing all of the domains of evolutionary social science I mentioned above, and more, including for example customs, broad belief systems, and religion. In what follows I will be using the term in this broadly encompassing sense. Dawkins (1983) has employed the term "Universal Darwinism" to denote the broad inquiry. Some of the participants in this movement would put their interests somewhat differently, as trying to identify a conception of evolutionary process broad enough to encompass both the evolution of biological species, and of human cultures.

While these two characterizations of the agenda at first blush sound much the same, in fact there is a major difference between these ways of thinking about Universal Darwinism. The former, which I would associate particularly with Dawkins (1976, 1983) and Dennett (1995) is basically oriented theoretically by modern evolutionary theory in biology, or a version of that theory, and is postulating that the evolution of human culture can be understood in terms of a process where the key variables and mechanisms are neatly analogous to those in biological evolution. The latter perspective, which I would associate with Hull (1988, 2001), and a number of the anthropologists (for example Richerson and Boyd 2005) who are involved in the discussions, involves a broad view of evolutionary theory, and is very open to important differences between the way aspects of human culture evolve, and the evolution of species.

The basic argument of this essay is that evolutionary social scientists can participate actively and enthusiastically in Universal Darwinism, if the view of the endeavor is the latter. On the other hand, the narrower view of Universal Darwinism poses a problem. The details of the processes involved in the evolution of human culture differ significantly from those involved in biological evolution. And to try to cram their analysis into the mold patterned closely after biology would seriously handicap the development of a serious empirically oriented social science.

The issue I am raising here has nothing to do with biological reductionism. My target is not sociobiology, or evolutionary psychology. Although I believe that some proponents of these fields have claimed far too much of the character of human behavior and cognition as explainable as the result of biological evolutionary selection, that has molded the nature of Homo Sapiens, the Universal Darwinists whom I am considering here in general are not of that camp. Using the term put forth by E. O Wilson, the brand of Universal Darwinism I am focusing on here presumes a long "leash", and treats the evolution of human culture as proceeding largely on its own terms.

Rather, the problem with the narrow version of Universal Darwinism is that it assumes that many of the features of evolution in biology carry over with very close analogies in cultural evolution. My concern here is with arguments that aim to push on evolutionary social science concepts like "memes", or "replicators", or "interactors", and more generally with a point of view that is relatively blind to particular features of the evolution of economic, social, political and cultural phenomena, which are very different than the features of biological evolution.

My argument is basically about the kind of evolutionary theory that social scientists need to work with in order to square with important empirical details of how change occurs in their area of inquiry. The issue here transcends issues regarding evolutionary economics, involving evolutionary social science more generally, and is concerned with analyses that are oriented towards relatively fine grained understanding, rather than broad theoretical analyses. For this reason the evolutionary social science that will be the center of attention in what follows will be the interdisciplinary bodies of research concerned with the processes of change of science, of technology, and of business organization and practice, where, as I have noted, there has been extensive empirical research oriented by an evolutionary theory. One point that will become clear is that, if one pays attention to the details, there are significant differences in the dynamic processes at work in these different areas. A general evolutionary theory broad enough to be relevant to these different areas of human culture had better be quite roomy. On the other hand, there are several common elements across the evolutionary processes at work in these areas that differentiate all of them from the way biological evolution proceeds.

Before I proceed, it may be useful if I provided a preliminary sketch of my attitudes towards the proposal for a Universal Darwinism. First of all, as I have stated above, such a Universal Darwinism better be broad, and not tied too closely to mechanisms of biological evolution. On the other hand, a broad evolutionary theory that posits that change occurs through a process that involves variation, selective retention, sources of new variation...is a very powerful source of understanding regarding human cultural change, as well as change in the composition and nature of

biological species. And this broad theory, after all, was Darwin's great insight and contribution. A Universal Darwinism that is as open to the nature of the detailed mechanisms involved, as Darwin was when he wrote, would be a very useful theory, that facilitates and stimulates interesting discussion across a wide range of disciplines.

I shall proceed as follows. In the next section I will develop the argument, which was implicit in what I have said, that evolutionary social science has an intellectual standing and history in its own right, and that it is a mistake to view evolutionary social science as basically about efforts to apply theory developed for biology to analysis of human cultures. At the same time, evolutionary social science has, since Darwin, borrowed a lot from biology, and much of that borrowing has been fruitful. In particular, the broad Darwinian theory of change through a process involving variation, selective retention, new variation, has provided a clarity and rigor to analyses of cultural evolution that, before Darwin, was not there.

I then turn to the significant differences between processes of human cultural evolution, and biological evolution. This will lead me to argue that the narrow version of Universal Darwinism cannot cope with those differences, and makes for bad social science theory. In the concluding section I address, from the perspective of a social scientist, what is required of a Universal Darwinism, if that framework is to be broad enough adequately to encompass both the common and the varied aspects of human cultural evolution, as well as biology.

2 Evolutionary thinking in the social sciences, past and present

It is important to recognize that evolutionary propositions about cultural and social development were prominent in the writings of philosophers of the Scottish enlightenment, for example Mandeville (1724), Hume (1739), and Smith (1776), long before *The Origin of Species* was published. As Darwin later proposed regarding biological evolution, these early evolutionary social scientists argued that the cultural phenomena prominent around them were not the result of any well articulated plan (by human beings, or by God). The hallmark of the evolutionary perspective on cultural and social change then, as now, was emphasis that prevailing structures were the result of somewhat myopic processes that had been operating over long periods of time.

Thus Mandeville described the evolution of the "modern" man of war as the accumulation of incremental additions and modifications over many years, with no overall program guiding that evolution. Adam Smith's discussion of the progressive division of labor in pin making, with the associated development of mechanized production, and more generally his metaphor of an invisible hand behind economic coordination in a market economy, likewise was an argument that cultural and social order and systematic progress can occur without overall design. Long before Darwin, these authors established that complex and efficacious outcomes could be the result of an evolutionary process operating over long periods of time, without any overall designer, whether human or divine.

But while evolutionary theorizing in the social sciences, in the above sense, was there long before Darwin, Darwin clearly has had an enormous influence on such theorizing since his time.

Darwin's great theoretical accomplishment was to put forth a particular mechanism, variation and selective retention, through which evolution worked, at least regarding the evolution of species. That specification was pretty broad. Only much later did biologists come to understand what was behind variation, on the one hand, and selective retention, on the other, in biological evolution. But Darwin did lay out explicitly the broad dynamic process he proposed was at work, something the early evolutionary social scientists did not do in their analyses.

I think it plausible that the early evolutionary social scientists had something like a theory involving variation, and selection, in mind. However, even if so, Mandeville's account of the evolution of warship design does not lay out in what sense, and to whom, various design attributes proved advantageous, or the mechanisms through which these survived and accumulated over many generations of warships. Similar remarks apply to Smith. He articulated a broadly convincing account of the emergence and development over time of undesigned social orders, but did not discuss in any detail why and how some social orders survived and others did not. That is, while these authors hinted at the specific mechanisms involved in the evolution of the phenomena they were addressing, they did not specify those mechanisms.

Not surprisingly, in view of the fact that he had drawn some of his own inspiration from social science writings, Darwin himself proposed that his theory of evolution had application beyond biology, and might well fit changes over time in language, moral ideas, and the structure of human groups. And Darwin's theory clearly influenced strongly a number of subsequent writings on social and cultural phenomena. Thus Bagehot (1872), James (1897), Veblen (1898, 1899), and others, argued that Darwinian mechanisms of evolution apply not simply to biology, but also to mental, epistemological, moral, social, and political evolution, although none of these authors fleshed out the details explicitly.

As is well known, some of the late 19th century evolutionary social science writings had a strong nationalist and racist cast. Partly as a result, many early twentieth century social scientists shied away from adopting ideas from biology. The influential critique of social Darwinism by Hofstadter (1944) warned social scientists of the dangers of taking ideas from biology. For these and other reasons, for a considerable time evolutionary theorizing about cultural and social change proceeded under a dark cloud.

At the same time, both Schumpeter (1934) and Hayek (1973) were developing important evolutionary theories, Schumpeter's concerned with the dynamics of competition in modern capitalist economies, and Hayek's with the evolution of social orders. It is interesting and relevant that Schumpeter explicitly rejected the notion that his theory was connected to biological evolutionary theory, although in his Capitalism, Socialism, and Democracy he did use the term "evolutionary" to characterize the economic processes he was describing. Hayek began to explore the common evolutionary principles he believed applied both to culture and biology only towards the end of his career.

Over the last quarter-century there clearly has been a major renaissance of explicitly evolutionary theorizing in the social sciences, a portion of it strongly influenced by evolutionary theory in biology, but important parts of it not much. Evolutionary theory has become an important part of the research tradition in scholarship on a variety of different aspects of culture.

In anthropology, a number of writers have proposed that the culture and social structure of the societies they have been studying need to be understood as the result of a process of variation, selective retention based on the contribution of different traits to individual and group survival, and a new variation, along lines very similar to those Darwin put forth in his *Origin of Species* (see e.g. Boyd and Richerson 1985, Richerson and Boyd 2005, Cavalli-Sforza and Feldman 1981 and Durham 1991).There is a long tradition of evolutionary theorizing about how human languages change over time, and of the relationships between languages, and in recent years significant advances have been achieved in this broad area of research, which recently Croft (2000) has described.

The readers of this journal of course are familiar with the renaissance of evolutionary economics in the period since the mid-1970s. The renewal had several sources, all basically empirical. One was a debate about the neoclassical theory of the firm that was engendered by empirical studies showing clearly that the practices of firms regarding matters like setting prices did not involve anything like maximization calculations. Machlup (1946) and Friedman (1953) responded in defense of neoclassical theory by arguing that that theory said nothing about the decision procedures actually used by firms, only that the results of firm action taking were profit maximizing, and that competition assured that surviving firms and procedures in fact were so. This argument in turn led to the observation that, if the theory of the firm really rested on arguments about how competitive selection molded observed behavior, then the theory ought to be explicitly evolutionary, and the proposed result of competition ought to be something that was proved in the context of a theoretical evolutionary model, and not simply asserted (see Koopmans 1957 and Winter 1964).

A second source was the appreciation of many industrial organization economists that in many industries Schumpeter's characterization of the kind of competition going on, keyed to product and process innovation, was much more apt than competition as depicted in standard neoclassical theory. While some economists tried to model that kind of competition by extending neoclassical theory, others took to heart Schumpeter's argument that theoretical treatment of innovation and creative destruction required recognition of Knightian uncertainty and disequilibrium, a recognition that pointed towards evolutionary modeling.

The growing recognition among economists that technological advance was the principal source of economic growth also provided an inducement to some economists interested in that subject to try to develop an evolutionary theory. Partly that development came as a result of reflections on empirical studies of innovation, partly as a result of a reading of Schumpeter. In any case, some of the first formal evolutionary models were concerned with economic growth driven by technological advance (see for example Nelson and Winter 1974).

As I said earlier, my focus in this paper is not on the general theoretical modeling that has been an important part of the development of evolutionary economics, but on traditions of evolutionary social science that have been strongly empirically oriented with an attention to the fine grain. And here, as I noted, research communities involving economists, but also scholars from other disciplines, have grown up in several broad areas of inquiry.

Thus there is an extensive body of evolutionary theorizing regarding scientific knowledge. Here many of the key writers have their backgrounds in Philosophy, or the field of Evolutionary Epistemology as developed by Popper and Campbell (see in particular Popper 1959; Campbell 1974; Hull 1988, 2001; Kitcher 1993; Nelson 2004; Plotkin 1982). Both historians and economists have put forth evolutionary theories of technological advance (Basalla (1988), Dosi (1982), Metcalfe (1998), Mokyr (1990, 2002), Nelson and Winter (1982), Petroski (1992), Saviotti (1991), Vincenti (1990), Ziman (2000)). The literature on the evolution of business organization and practice is less extensive, but growing rapidly (Gavetti and Levinthal (2000), Nelson and Winter (1982), Romanelli (1991), Winter and Szulanski (2000), Zollo and Winter (2002)).

An important characteristic of all of these fields is that the human activity they involve is sharply goal oriented, with relatively broad agreement on the goals, at least at a high level of abstraction. And in each of these arenas one often can see conscious efforts at improvement, along with relatively steady selection criteria and processes whose workings in effect determine whether a new departure is accepted as an advance or not. Thus evolution in these areas of culture would appear to differ from the processes of change involved in religion, many sub-fields of the arts, fashion, and in a way that would seem to make the proposition that the substance in these arenas is evolving more than simply a metaphor. At least that is the belief of evolutionary economists like myself.

In the remainder of this essay I shall draw my arguments mainly from these fields. For the most part the research communities exploring these different arenas have had little contact with each other. It is interesting and relevant therefore that the separate groups of scholars have developed a number of similar conceptions of the broad evolutionary processes at work. But along side the similarities, there also are some interesting and important differences.

3 What is particular about cultural evolution?

To be able to encompass phenomena as diverse as the changing nature and composition of biological species, the development and particular responses of the immune system, behavioral learning in non-human animals and humans through differential reinforcement, and changes over time in the nature of human culture and society, all topics claimed to fit under a theory of change through variation and selection, a Universal Darwinism has to be very open regarding the particular details of the mechanisms involved.

Concerning the details, Darwin himself was open. He had to be. Virtually nothing was known then about the biological mechanisms at work. Thus Darwin had no

good reason not to admit the Lamarckian possibility of the inheritance of acquired characteristics in the evolution of biological species. At the time Darwin wrote, Weismann had not yet put forth his argument that acquired characteristics could not be passed on biologically across generations. The understanding of genes, and their roles in biological inheritance, was far in the future. Much of the history of evolutionary biology since Darwin can be understood as getting the details and mechanisms right. The broad theory of biological evolution, driven by variation and selection, put forth by Darwin has largely stood intact. But the particular mechanisms involved in the evolution of species now are much better understood than they were in Darwin's time.

The general evolutionary process proposed by Darwin provides a very illuminating way of understanding the dynamics that have led to the current state of a wide variety of different phenomena. However, while proposing that change occurs through a process involving variation and selection carries the analysis a certain distance, such a theory certainly is incomplete without a specification of just how that process works. Solid understanding requires identification of the process details. Over the years we have learned a lot about the details of the mechanisms driving the evolution of species. These details involve entities like genes, which can be inherited, and phenotypes whose characteristics, including their chances of having offspring, are influenced by their genes. However, it is almost sure that details of the processes involved in the evolution of species, the immune system, operant conditioning learning, and the evolution of culture, are different. It would be a mistake to simply assume that the details we now know about the mechanisms behind evolution of species carry over to these other areas. Some may. Some may not.

I want to propose here that there are at least four intertwined "details" about the evolution of human culture that differentiate that process from biological evolution, or at least the standard model thereof, in important ways. They are, first, the often major role of human purpose, intelligence, and intellectual interaction, both in the generation of variety, and in the selection process. Second, selection criteria and mechanisms seldom involve directly issues of human survival or reproduction. The well being of certain kinds of organizations may be at stake, but often not. Third, the entity that that is evolving—aspect of human culture—is a phenomenon that cannot simply be characterized as the aggregation of the population of traits possessed by individuals, but has a collective property. These aspects of the evolution of human culture all are involved in a fourth important difference; the way human individuals and groups are involved with culture and its evolution is different in many ways from the manner in which genes and living entities are related in the evolution of species.

In the remainder of this section I will discuss each of these features in turn, focusing both on common elements across the areas of culture I am using as exemplars, and some of the differences.

3.1 The important role of human purpose, understanding, and intellectual interaction

First of all, there is the important role played by human purpose, sometimes very sophisticated understanding, and often intellectual interaction of several persons or groups, in the processes through which much of human culture evolves. A key point in cultural evolutionary theorizing is that the complex bodies of action and thought that mark the contemporary human scene should not be understood as having been created as a result of some coherent plan, but rather need to be understood as having "evolved". It also is clear that, in at least some areas of human culture, new variants come into existence almost randomly, and in some the selection process involves little in the way of conscious choice. However, it is important not to play down the intelligence, planning, learning, arguing, persuading, that often are involved in some areas of cultural evolution.

Of course a number of non-human animals display intelligence, and probably thought, in choosing the actions they take. But the issue here us not which species have been endowed with an intelligent capacity for choice by biological evolution, but rather about the shaping of evolution by intelligent behavior. Outside of humankind, there is no evidence of major continuing cross generational cumulative advance in culturally based learning.

It is obvious that this uniquely human capability is associated with the unique human capability both for analytic thinking and for language. These elements clearly are important in the evolutionary processes bearing on the principal arenas of culture I am focusing on here: technology, business organization and practice, and science. In each, the nature of new departures clearly is subject to an element of chance. However, while there are significant differences across these areas that I will discuss shortly, in each for the most part the new things that are tried in practice have been subject to a considerable amount of scrutiny before they actually are put into practice.

Recognition of the purpose and thought that often go into innovation would seem to call for a view of the relevant "variation" in cultural evolution that is broader than in biological evolution. Variation in Darwinian biological evolutionary theory is variation of genes, and traits and behaviors, in an extant population at any time. This is the "stuff" on which selection works. However, in cultural evolution a good portion of the relevant variation is in human minds, and explored through calculation, discussion, and argument, rather than in actual practice. Thus a team of engineers contemplates a wide range of plausible designs, and gradually homes in on one, before they actually build and release a new product or process for use. Managers of a business firms may contemplate a range of possible actions before actually choosing one and putting it to practice. Scientists often consider a variety of possible explanations for phenomena they are studying, before focusing their research on a prime candidate. The actual variation at any time is a small portion of the contemplated variation, and an important part of the selection process involves the winnowing of alternative ideas for action before final action is taken.

It might be argued that there is a definitional issue here. If the concept of variation in an evolutionary theory is considered to mean only actual extant variation in practice, which can be "tested" by the environment, then the variety of possibilities

held in mind before action is taken might be considered "pre-practice" variation, and not the variety that is driving evolution. However, pre-practice contemplated variety clearly is a vital part of cultural evolution. And it is a mistake to try to distinguish too sharply between pre-practice variation and variation in practice. In many cases, like in the process of designing a new aircraft, there are simulation tests, wind tunnel tests, and tests of a prototype along the way. The lines between contemplated variety and actual extant variety is not sharp. Also, as I will argue below, in many cases beliefs about efficacy play a major role in selecting on extant practices, as well as on contemplated alternative courses of action.

I noted above that there seem to be significant differences across the three areas on which I am concentrating in these respects. As an example, I want to highlight an apparent difference between the efforts to advance modern technologies, where pre-practice off line research and experimentation play a major role, and the attempts to improve other aspects of business practice, where it would appear that much less can be learned from "off-line" research and experimentation. As a result, while "learning by doing and using", along with R and D, is a vital aspect of the processes through which modern technologies evolve, these mechanisms seem to be virtually the only way that new forms of business organization and practice not tied to technology can be tested.

As a social scientist advocating an evolutionary theory of at least many aspects of cultural change, I want to highlight that my insistence that human purpose and intelligence often plays a major role in the evolution of culture does not mean that the process is not evolutionary. The clear fact that scientists, and technologists, carefully consider what they do does not mean that progress in science and technology can be understood as the result of a coherent plan. Scientists and technologists lay their bets in different ways, and the winners and losers are largely determined in ex post competitive evaluations. In that sense, particular new departures are partly blind, in the sense put forth by Campbell (1960, 1974). But it would be a serious analytic mistake to see new departures in these fields as the result of strictly random events and choices.

3.2 Selection criteria and mechanisms

A second important difference between cultural evolution and the processes of biological evolution is that, while "natural selection" on the "fitness" of the organisms possessing particular traits or genes in principle provides a relatively straightforward theory of the processes of selection in biology, there does not seem to be any simple analogy to the connection in biology between traits and fitness regarding the evolution of many areas of culture.

This is not to say that, when one gets down to particular cases, or traits, fitness in biology is easy to understand. Consider the well-known example of the male peacock's tail. But the standard theory points the quest toward trying to find just how it is that male peacocks that have a magnificent tail on average have more surviving offspring with a similar trait than peacocks with puny tails. In this case the presently broadly accepted theory is sexual selection. Identification of the basic causal mechanisms of cultural evolution may be much less straight forward. Thus an

essential and often very difficult aspect of study of cultural evolution involves identification of the features, criteria, and mechanisms associated with an element being selected for or against.

There are three major (overlapping) reasons. First, for many areas of cultural evolution, the survival of the individuals and organizations involved simply is not at stake. Thus there often is no clear analogy in cultural evolution to the mechanisms involving fitness of phenotypes in biological evolution.

Second, the individuals, organizations, groups, that at any time hold particular beliefs or practices are not locked into them, as biological entities are to their genes, but can change them. Thus the relative importance of cultural traits can change, without any change in the population of the society to which that culture pertains.

Third, while not over playing the role of conscious decision-making, in a wide range of circumstances beliefs about the value, and efficacy, of a particular cultural trait strongly influence whether that trait is adopted, retained, or abandoned. And discussion, argument, persuasion, in some cases coercion, may be a central part of the selection process.

There certainly are important areas of culture where the practices of an individual or organization do affect how well they do in a way that matters for their survival or expansion, and in these cases selection criteria for cultural traits can be associated with growth or decline, or even death, of individuals, groups, or formal social units. In some cases biological survival is at stake. As noted, there is an extensive body of evolutionary writings on the cultures of peoples living close to the subsistence margin, and here the effect of elements of culture on the ability of individuals and groups literally to survive clearly is highly relevant. The culture of modern societies contains many food practices and taboos that have their origins, and in some cases their modern justification, in protecting health. In their choice of treatments, the contemporary medical profession at least gives lip service to the mandate of "do no harm", and modern societies have in place elaborate procedures for testing the safety of new pharmaceuticals before allowing them into commerce. The safety of an aircraft is viewed by the aeronautical engineering profession as a binding constraint on acceptable aircraft designs.

But consideration of what is necessary for human biological survival can carry explanation of the content of modern human cultures only a very limited distance. For the most part preferences for foods need to be explained on other grounds. Most of the medicines used by members of modern societies are not taken to deal with life threatening conditions. The constraints of basic safety leave an enormous amount of room for variation in the design of a new aircraft, or another kind of product, and a principal challenge for designers is to assess what customers most want.

A number of economists, and I include myself here, have proposed that, while biological survival may have limited power as an explanation for human culture, in many cases an analyst can identify a market or market like structure where the viability of an individual or organization providing a good or service is dependent on the extent to which what they are providing meets the demands of those who use it, often in a setting of considerable competition among suppliers. Thus business firms can fail if the products and services they supply, the technologies they are using, and

their other practices, do not meet the competition. In such a context, there is a clear analogy between business practice and genes and business firms and phenotypes (see Nelson and Winter 1982). I think it's fair to say that the best worked out models of cultural evolution are based on this analogy, with profitability for firms being the basic proximate selection criterion for the goods and services and practices involved in economic activity, and the determinant of whether or not new technologies and practices take hold.

However, even in a market context, there are limits to the analogy. In the first place, not all business firms doing poorly because of their use of inferior technologies or other business practices die as a result; among other things doing poorly relative to one's competitors is a powerful stimulus to changing one's practice, and many firms are able to do that effectively. Put another way, the selection mechanism in a market setting may involve business judgment and decision making, and the shifting of what firms do, as much as it involves the birth and death of firms.

Also, in many economic contexts competition is not particularly stringent, leaving room for firms to select their practice in terms of criteria other than profit. Of course relatively lenient selection environments would appear to be common in biological evolution, at least for significant periods of time. The important difference I want to highlight here is that in cultural evolution, there may be relatively strong selection criteria and mechanisms at work, as contrasted with drift, that do not have anything to do with organizational, much less biological, survival and growth.

This is true even in areas of culture which are strongly market oriented. Thus business firms not subject to strong competition may nonetheless systematically prefer certain practices to others, for example those that enhance the economic interests of groups within a firm who have the ability to influence decisions. But in addition, in many areas of culture the principal organizational actors are non-profit or public organizations. Primary and secondary education, and hospitals, are good cases in point. So is science.

In science, while competition for honor and grant financing can be fierce, the fact of such competition does not illuminate the nature of the criteria and processes used by scientists that determine whether a new scientific theory is or is not broadly accepted. A scientific group espousing a particular theory may gain or lose in reputation and financing in the short run depending on whether or not their case gains currency in the community. However, the consequences need not be long run. And of central importance to the argument I am making here, without downplaying how the reputation of a group putting forth a theory influences its reception in the short run, recognize that in the long run the causal arrow largely runs from how a proposed scientific theory ultimately is evaluated by the discipline, to the effect on the reputations of groups who had taken different positions on that theory, as contrasted with the other way.

It seems clear that in many areas of culture, what new elements are accepted and rejected depends largely on how well they meet the preferences and values that are operative in the selection process. This is true even of areas of culture that are strongly market oriented, in that the profitability of firms to a considerable extent

depends on their ability to meet the preferences of their customers. Thus in order to come to grips with why the products offered by various firms are profitable or not, one has to come to understand the nature of customer preferences in that field. And as I have noted, there are many areas of culture where literal market mechanisms are not operative, or operate very weakly. The heart of an evolutionary analysis of culture, therefore, involves identifying the preferences values and criteria operative in selection, and the mechanisms enforcing them.

I want to suggest tentatively that in many areas of culture it is important to distinguish between high level relatively abstract valuation criteria, that are widely accepted as appropriate in a field, and the proxy criteria that in fact often are operative, because it is impossible or difficult to directly assess elements of culture against the former, at least in the short run. While in a basic sense all cultural selection criteria are "socially constructed", in the three domains of culture that have been at the center of my interests, I interpret the arguments of sociologists (see e.g. Bijker et al. 1987; Latour 1986) that operative selection criteria are "socially constructed" as proposing that higher order selection criteria in fact have little explanatory power, that is that the operative criteria and mechanisms in fact have largely to do with who has the power to enforce their own particular interests or beliefs.

Thus it is widely agreed that scientists try to judge proposed scientific facts, mechanisms, and theories, on the basis of evidence of their validity, technology is evaluated according to its usefulness, business practice in terms of whether it contributes to profitability or not, and that these criteria are appropriate in their domains. But in many fields of science it is very difficult to exactly replicate reported experiments, and there often is dispute about just what an experiment in fact shows. In some areas of technology, it can be learned quickly and reliably whether or not a new device achieves a target level of performance. However, in some areas of practice, actual evidence of performance can take a long time to get, and may be quite unreliable; for example, the efficacy of mammography, as a general screening practice for all women, still is uncertain. It often is very difficult to get a clear reading regarding the actual efficacy of a business practice in terms of its contribution to firm profitability.

If the hard core social constructionists are right, analysis of the selection criteria and mechanisms that are operative in an area should largely be a search for whose and what interests have power and influence. But I think that is pushing the argument much too far. Studies of the evolution of accepted scientific doctrine generally show that important theories and proposed facts usually do get tested, directly or indirectly, and arguments that consistently fail to meet the test of validity tend to get dropped from the text books. In many areas of technology, improvements in performance, along lines generally agreed to be desirable, have been dramatic. In my view the record shows less evidence of consistent cumulative improvements in the way businesses are run, but in many aspects business operations are more efficient than they used to be. The social constructionists appropriately warn analysts of the evolution of culture to be wary that there often is a gap between the accepted high level values and criteria proposed to be working in a field, and the nitty gritty of actual selection processes. But in the areas where I have done my research, an

evolutionary theory tied to relatively high level selection criteria does seem to have a considerable amount of explanatory power.

3.3 Culture as a collective phenomena

A third area where cultural evolution differs from biological evolution, or at least the simple standard model thereof, resides in the nature of culture itself, as a body of practice, beliefs, values, and norms, that are broadly shared within a society. It is a mistake to view culture simply in individualistic terms, arguing in effect that only the attributes of individuals are real, including of course those that relate to other individuals, or to see the process through which culture evolves strictly in individualistic terms.

First of all, some areas of culture, complex production technologies are a good example, but so also are team games like football, are employed by collectivities, not by individuals, except in the sense that they are part of the operating group. Of course the same is true regarding some biologically built in behavior patterns, for example among the social insects. But the human organizations and other groupings that employ elements of culture are created by humans, and not something built into the system biologically. Similar considerations apply to the processes of change. In many cases the key actors in the process of change, both in the generation of new variety, and in the selection process, are organizations or other groupings of individuals, rather than individuals on their own as it were.

More important to my argument that the evolution of culture is different is the fact that culture is a collective phenomenon, affecting by its collective nature the way that individuals and groups within a society think and act. Elements of culture have substance, and can be studied, in their own right, independent of the particular individuals and groups who adhere to those elements. Put another way, elements of culture have a life that transcends the individuals that identify with those elements at any time. And there are a number of particular features of human society that only can be understood in terms of shared perception of a shared culture that profoundly affects the individuals who share it.

The importance of a shared culture, and the institutions that support that sharing, is an important element in all the areas I am focusing on here. Virtually all scholars of the modern scientific enterprise highlight its community nature, and the institutions supporting a core of common beliefs at any time, as scientific associations, and the academic disciplines that educate new entrants to the community. Similar structures are important in many fields of technology. A number of scholars of business organization and practice have written of the important role of precedent and general opinion in influencing managerial decisions regarding business practice.

The argument I have presented above has some things in common with arguments for the presence of group selection, or selection on species as a whole, in biology. But I propose that the features and mechanisms that link human cultures to the individuals who share that culture are particular in important respects.

3.4 Different kinds of connections between culture and units of society

All of the characteristics discussed above mean that the connections between elements of culture, and individuals and groups in society, are different than the connections between genes and the phenotypes that possess those genes in biological evolution. In my view, the proclivity within the group of scholars exploring the possible structure of a Universal Darwinism to start with biology, and then generalize, has resulted in inadequate recognition of this fact, or at least in proposed language that tends to obscure it.

The purpose of Darwin's theory of *The Origin of Species* was to explain the characteristics of existing living things, and how these characteristics came to be. With the development of the theory that it was "genes" that got passed down from generation to generation, that inherited genes were a major factor shaping the characteristics of phenotypes, and that the probability that particular genes would be passed on to the next generation depended on the fitness of the phenotypes that currently possessed them, the argument that evolution selected on genes as it selected on phenotypes became the central doctrine. Since under that doctrine it was genes that had the durability, and were what was inherited, it was a short step to Dawkins' proposition (1976) that the heart of biological evolution was selection on genes, the components in the process that could be replicated across generations, with phenotypes being "vehicles" through which the fitness of those genes, or rather the characteristics with which they were associated, got tested.

This point of view on biological evolutionary process has met resistance from a number of biologists, on a number of counts. Among other things, it has been argued that it glosses over significant differences between virus species, bacteria, fungi, plants, and animals. That is not my issue here. Rather, my issue is that in much of the writings on a Universal Darwinism, this perspective on biological evolution has been carried over as a model of how human cultural evolution works.

The most striking illustration of this proposition probably is Dawkins' (1983) widely cited proposal for the term "meme", which sounds like gene, for the units of cultural evolution. Dawkins also proposed treating of elements of the society involved in the cultural evolutionary process as "vehicles" for those memes, in the same sense that phenotypes are vehicles for genes. Dennett's (1995) influential book presents a similar point of view.

Perhaps reflecting concern that the Dawkins model does not even hold across all areas of biology, and perhaps uneasiness in any case of too hasty generalization of that model to the evolution of human culture, it is apparent that some prominent members of the community espousing a Universal Darwinism have been uncomfortable with Dawkins' linguistic proposals. The term "meme" presently is not widely used, although it has a number of advocates. On the other hand, the term "replicator" has become near common currency in these writings as a word that encompasses both genes and elements of culture. The term "vehicle" also no longer is commonly used. Hull (1988, 2001) suggested replacing it with the term "interactor" to denote a member or members of society associated with particular elements of culture in a manner that exposes those elements to a selection process, and by and large his terminology now is widely accepted.

Even in its more flexible version, it seems to me that a number of the proponents of Universal Darwinism are arguing not simply that cultural change proceeds through a process that involves variation and selection, which was Darwin's broad proposal regarding the evolution of biological species, but also that it is useful to see cultural evolution as involving gene-like things, and phenotype-like things, with their relationships similar to those in biology. It should be obvious that I am in full accord regarding the former proposition. However, the latter part strikes me as trying to see the details of cultural evolution as like the details of biological evolution. This may not be helpful to attempts to see what really is going on, or at least not helpful regarding all areas of culture. And for some areas of culture this perspective may be seriously distorting.

There is, first of all, the question of how useful it is to think of elements of culture as gene-like. There are a number of issues here. One is the extent to which an element of culture is sufficiently consistent, durable, and transferable, to warrant the analogy. My belief is that these issues depend on the area of culture.

The concept of "replicability" certainly captures a necessary condition for something to be gene-like, and replicability, narrowly construed, is of central importance in many areas of culture. The operation of the modern scientific enterprise depends on the ability of one group of scientists to replicate, at least broadly, the experiments and calculations of other scientists. It also is clear that many elements of "technology" are consistently the same when used by different parties, and over time, and are "transferable" with considerable fidelity from user to user. There certainly are lapses in these areas of culture from strict canons of "replicability", but I am not uncomfortable with use of the concept there. On the other hand, none of these characteristics seem to hold for many elements of business practice. And outside of the areas of culture on which I am concentrating, there are many in which interpretation or practice differs in significant ways across members of the society, and where the term "replication" tends to repress the hard efforts at teaching and learning, and the imperfect nature of the effected transfer, that are involved when a new member of the society picks up an element of the society's culture.

I note that a process can still be evolutionary even if the elements being selected on tend not to be particularly stable. If they are not, selection forces have a continuing job of cleaning out detrimental deviations from prior conditions, as well as winnowing on new departures. This makes for a less crisp process. But the dynamics still can be analyzed and interpreted within a theory that proposes that the process of change is driven by variation and systematic selection.

To shift orientation somewhat, I note that unless the contrary is stressed, the proposition that an element of culture is gene-like is likely to be interpreted as implying that a member of society "holds" an element of culture in the same way that a phenotype has genes. But this clearly is not right. In some areas of culture the connections certainly are very durable. It would seem that most persons go through life with the religion they grew up with, and many of the political beliefs. But even in these areas of culture, some people change. And in other areas of culture, change in belief or practice can be frequent and widespread. As I have stressed, a scientist

can change his or her mind. A technologist may come to master a new set of design concepts, and abandon use of an earlier design philosophy.

Also, at any time connections with an element of culture generally are a matter of degree, not kind, and connection itself may have several aspects. Members of a scientific community differ in their degree of knowledge about, even awareness of, a particular theory or technique. Among those in the know, beliefs about whether the theory is right or useful may differ in degree. Members of a craft community generally differ in their skills in using a particular technique, as well as in their degree of belief that it is the most appropriate technique for a particular purpose. More generally, unlike the question of whether a particular phenotype has a particular gene, which generally has a yes or no answer, the connection between an element of culture and a member of society generally cannot be so simply characterized.

An important consequence is that it may be narrowing, not broadly illuminating, to think of the mechanisms that provide continuity of an element of culture within a society as processes of "replication". For an element of culture to continue to be important within a society in the face of death and birth of members, it certainly is necessary that somehow new members of the society be able to acquire familiarity with that element and have the potential for embracing it. But the continuing adherence to that element of culture, a continuing belief in the efficacy of a mode of organizing business, for example, requires not only that new members of the management community be taught the efficacy of that practice in Business School, but also that members of the relevant community continue to adhere to it. A degree of replicability, in the sense that new members of a society gain access, is part of what is required for long run continuity, but is far from sufficient.

For all of these reasons, I am concerned that the presumption that elements of culture are gene-like, and the use of the term "replicator" to connote implicitly the central mechanism for continuity, may take attention away from aspects of culture that clearly are not gene-like. My concern here is diminished to the extent that scholars using the term recognize the differences clearly. But the term "replicator" to denote a general concept of what is required for continuity that includes both genes and elements of culture certainly would not have been my first choice (but for a well argued different point of view see Hodgson and Knudsen 2004).

I have similar concerns regarding the use of the term "vehicle", or now more commonly the term "interactor", to provide a generalization of the concept of phenotype, that encompasses the way that elements of culture get winnowed in the selection process. While the latter term avoids some of the connotation of the former, my reading of the literature suggests that many of its users still have in mind that the selection of an element of culture is determined by how well the "interactors"do in their encounter with the environment.

As I have argued, in some areas of culture selection surely needs to be understood in terms of how various beliefs and practices affect the well being of the social entities holding them. However, as I also have highlighted, in many areas of culture it is hard to find a strong tie between the judged suitability of an element of culture, and the well being of members of the relevant culture. Elements of culture are tested (explicitly or implicitly) against values and criteria that are held by that society to be

relevant in that area of culture. In my view, it is specification of the relevant values and criteria, and the mechanisms that are involved in the selection process, that is key to a useful theory of cultural evolution. In that specification of course it is essential to identify the actors, and what they do. However, in my view, to focus on the players tends to take attention away from the nature of the game.

Again, I have no problem with use of the term "interactor", so long as the focus of analysis is on the criteria and the process. But the term "interactor" to cover both the roles of phenotypes in the evolution of species, and the roles of members of society in the evolution of culture, would not have been my first choice for a way of getting into the processes of cultural selection.

4 A summing up

Let me pull strands together. The first point I have been making is that evolutionary theorizing about cultural, social, and economic phenomena has had a life of its own, going back well before Darwin, with much of it still motivated by an empirical appreciation for the dynamic forces at work in an area of study, rather than by any theoretical preconceptions regarding the relevance of Darwin's ideas. On the other hand, I believe that a broad Darwinian theory of evolution through variation and selective retention seems highly applicable to the study of the processes of change in various areas of culture, and its conscious application significantly enhances the power and rigor of theorizing there.

Second, the details of the processes of cultural evolution differ sharply from the details of biological evolution. This is not surprising, given the disparities of the subject matter. This is not to say there are no useful analogies, other than at the broad level that change in both arenas involves variation and selection. But in my view useful analogies ought to come mostly out of careful empirical investigation regarding what is going on in cultural evolution, and identification of some potentially interesting similarities to aspects of biological evolution, rather than from hunting for or constructing analogies on the presumption that they ought to be there. Thus while the details of biological evolution involve entities like genes, and phenotypes that contain packages of genes whose inclusive fitness feeds back to influence the incidence of different genes in the population, cultural evolution may or may not involve closely analogous mechanisms.

Third, the details of the processes of cultural evolution are not the same across areas of culture. The differences are interesting and important. Thus the processes for screening newly reported scientific findings and theories, for acceptance or rejection into the corpus of professionally accepted scientific knowledge, seems very much a collective community process, while the selection processes for new commercial technologies seems to involve prominently competition among firms. As another example, ideas for new technologies tend to be put through a variety of processes of analysis and off-line testing before they are brought to practice and tested on-line, while it is very difficult to test new managerial practices off line in any convincing way.

In short, I am fully convinced of the broad applicability of a general evolutionary theory, with the dynamics driven by variation, relatively systematic selection, new variation, in analysis of many aspects of the evolution of human culture. However, I believe that attempts to force the details of cultural evolution into a framework that works in biological evolution, in particular to assume that close analogues to entities like genes and processes like the dynamics of inclusive fitness, that are key in biology obviously ought to exist regarding culture, are generally misconceived and counterproductive. Indeed it seems to me that the differences are as interesting as the similarities, and I would like to urge a broad and flexible view of evolutionary theories of change.

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