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Prospects for an evolutionary economic psychology: Buying and consumption as a test case

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Abstract

Until a few generations ago, humans made their living by foraging, like other animals. We have therefore inherited genes that allowed our ancestors to thrive as hunters and gatherers. Thriving in a modern economy requires very different behaviours but we cope because the human brain evolved to be flexible with the ability to form cooperative networks with other humans and to maintain the shared body of information, expertise and values which we call "culture". We argue that human economic behaviour is influenced by both the genes and the culture that we "inherit" and that both are a result of a Darwinian evolutionary process. An evolutionary approach is therefore likely to be of value in developing theories of economic behaviour. We then use this approach to analyse in broad terms how people that are born with the brains of foragers living in a small-scale society become consumers in a modern society and where this behaviour is likely to lead our species.

Introduction

The present paper has two goals. First, we assess what an evolutionary approach to economic psychology might be like. Secondly, we test our approach by trying to apply it to one of the most prominent kinds of economic behaviour, buying and consumption. Economic psychology is not a branch of psychology, but an interdisciplinary activity that seeks to bring together insights from both psychology and economics. On first analysis, therefore, an evolutionary economic psychology should seek to combine "evolutionary psychology" with "evolutionary economics". Unfortunately, both these phrases have come to have precise, distinctive meanings within their disciplines, and they have little if anything in common. In order to reach our goals, therefore, we have to go back to first principles and ask what evolutionary explanations are like, in the specific context of human economic behaviour.

This is one of a series of papers in which we have sought to construct an evolutionary economic psychology. In a paper first presented sixteen years ago, Lea (1994) posed the question, 'How did human economic behaviour evolve?' In a more recent paper, Lea and Webley (2006) asked the more specific question, 'How did human interest in money evolve?' Our aim in this present paper is more general. Some of the same subordinate questions will be raised but this time we are standing a little further back and looking at the forces that operate in the evolution of human behaviour. It has become commonplace to think of human behaviour as being strongly influenced by economic forces. But how can we relate this to the idea that humans are animals who negotiate their habitat just like any other animal? We are still feeling our way and the present paper is partly speculative, but these sorts of speculations are the only way forward – particularly if they lead to the development of testable hypotheses.

Economics, psychology and all the social sciences, rely on the implicit assumption that human beings are a single species with characteristic preferences and abilities. If human beings are a product of their genes and these genes are a product of evolution by natural selection, it follows that an evolutionary approach will bring important insights to the social sciences. Evolutionary analysis has helped biologists to better understand the abilities and preferences of other species. Similar analysis of human behaviour may provide a foundation on which we can build a broad cross-disciplinary understanding. The study of economic behaviour is already an interdisciplinary endeavour so these foundations should be particularly useful in our field.

But can an understanding of the process that created the human genome really be useful in explaining human economic behaviour (or any human behaviour)? After all, humans clearly do not have "characteristic preferences and abilities". Humans are cultural animals along with the genetic endowment we born with, we all have a cultural inheritance that we begin to acquire when we are born. Human behaviour can be seen as the product of a dual inheritance, both genetic and cultural. It is therefore impossible to gain a useful understanding of the economic behaviour of 21st century humans by looking only at the effect of genes. The contemporary economy is a cultural institution and the behaviours that allow individuals to thrive (or not) in this economy are largely culturally learned. Our genes provide us with a brain that enables us learn these behaviours, even though both genes and brain are virtually

identical to the genes and brain that enabled our ancestors to learn the very different behaviours that were necessary to thrive in the environments that existed in the past.

We will argue that evolutionary analysis can indeed shed light on human economic behaviour, but only if we use a form of evolutionary analysis that takes into account the influence of both genes and culture. The importance of culture was recognised in both of the earlier papers referred to above (Lea, 1994; Lea & Webley, 2006), but in the present paper we make this more explicit.

Why our species is particularly special

In trying to set out the general shape that an evolutionary economic psychology might take, it is necessary to take into account two unique features of human evolution.

First, as noted above, modern humans are the product not just of biological evolution, but of a co-evolutionary process in which genetic and cultural evolution interact (Boyd & Richerson, 1985; Cavalli-Sforza & Feldman, 1981; Durham, 1991; Lumsden & Wilson, 1981; Richerson & Boyd, 2005). The modern adult human mind is the produce of a brain shaped by living for many generations in social groups which shared cultural information and which modified and accumulated this information over the generations. An evolutionary understanding of the human mind or human culture can only be gained if we consider how humans evolved the capacity for culture and how having culture affected the evolution of the human mind.

By some definitions, culture is not unique to humans. If animals learn as a result of living near to one another, they can be said to share information and behaviours. Many species of vertebrate have been demonstrated to have "culture" in this broad sense (Laland *et al.*, 2000). Animals closely related to humans show patterns of socially learning which more closely recall human cultural inheritance: for example chimpanzees show evidence of cultural inheritance of behaviours such as tool use, which are popularly considered among the hallmarks of human culture (McGrew, 2004). Some of the behavioural components that allow us to be cultural, therefore, seem to have been present in our ancestors before the splitting of the chimpanzee and human lineages. But at some time after that, the culture of humans grew radically in complexity and became essential for survival. The "culture" learned by animals does not seem to be much more complex than that which could easily be learned or invented during an individual's lifetime. Detailed research is often necessary to determine whether a behaviour has been socially or individually learned. In humans there is never any doubt: no-one is born able to construct a computer, or be a citizen in a democracy (Boyd & Richerson, 1996). Only humans maintain a culture that accumulates information over time. Valuable new knowledge that individual humans gain during their lifetime does not die with them and each new generation can benefit from the experience and ideas of their ancestors.

The second unique feature of human evolution is that it somehow produced a species in which unrelated individuals cooperate to an extent not seen in any other species. The high level of cooperation seen in some social insects occurs between individuals

who are close genetic relatives and this can be explained in evolutionary terms (Hamilton, 1964). But humans cooperate with complete strangers whom they are never likely to see again. How did such behaviour evolve through a system in which is often described as "competition for survival"? The answer is undoubtedly linked to the evolution of culture. Members of culture jointly "own" the information, skills, rules, values and beliefs that are characteristic of the culture. This is extraordinarily cooperative but it has also proved to be very successful.

Human cooperation is particularly relevant to our understanding of economic behaviour. Even though "the market" is commonly thought of as "competitive", cooperation is essential for trade. A trading partnership only works if agreed rules are obeyed and people who participate in a market demonstrate a willingness, not only to agree and follow rules, but also to participate in the often costly chore of punishing those who do not obey the rules. There is evidence that exposure to a modern market economy can actually enhance co-operation: an economic game study that compared behaviour of people in small-scale societies with those in societies that participate in the global economy found similar economic behaviour in all cultures, but there were some differences. Members of societies that participate in the global economy were among the most cooperative (Henrich *et al.*, 2004).

The characteristics of evolved systems

In developing an evolutionary explanation for economic behaviour, it is helpful consider how else such behaviour might have come about. Evolved systems can be compared on the one hand with systems that have come about by random processes, and on the other hand with systems that have been designed. Compared with systems of random origin, systems that have developed through Darwinian evolution can be expected to be *adaptive*, that is to say fit for the function they fulfil. They share this property with designed systems; but unlike designed systems they are also *adapted*: they have reached their current state through a series of small changes, rather than by a single comprehensive effort.

A product of design can be a single unique thing. But each product of Darwinian evolution is produced by the replication of a previous similar thing. The copying process must be reasonably faithful, but it must not produce perfect copies, or there could never be any change over time. Selection between the variants, which causes some to reproduce more than others, drives the direction of change over time. All organisms that are alive today are the descendants of other organisms that thrived and reproduced in past environments. They were able to solve the problems posed by the environment in which they lived, but when the environment changed, different characteristics were selected.

Both the products of a designer and the products of Darwinian evolution are fit for purpose. They are copies of things that managed to solve problems posed by their environment in order to reproduce, which implies that they are reasonably well suited for that purpose. But neither evolved nor designed products are likely to be ideally suited for their job or jobs. Both designers and selection have to work within

constraints. They seldom even manage to achieve the best possible compromise between purpose and constraint but they do tend to be highly serviceable.

Compared with a design process, selection works under an additional constraint. It does not invent new variants for the purpose of solving new problems, but works with variants that happen to be available, because they were successful (or at least harmless) in earlier environments when conditions might have been quite different. Anything that has evolved betrays traces of its evolutionary history. Novel environmental problems are solved by modifications of structures previously selected to solve other problems. For example, the reptilian ancestry of birds is betrayed by their feathers, which are modified scales. Feathers have better insulating properties than scales but there are structural similarities. A modified section of gut that serves as a buoyancy aide in some species of fish performs as a simple lung in other fish species, allowing them to survive short periods of water scarcity. In terrestrial vertebrates, the same basic structure is a highly efficient organ for absorbing oxygen from the atmosphere.

As soon as one considers the nature of human artefacts in this light, one becomes aware that even though designers have been involved in them, they are the products of an evolutionary process, though not of genetic evolution. It is impossible to think of anything that exists today that can be considered the invention of a single designer. Even a unique work of art is created using techniques developed by previous artists and the each artist is influenced by those who came before. In the same way, today's technological devices, scientific theories, and social institutions are similar to those that existed in the recent past, which were, in turn, similar to their immediate antecedents. Designers do have novel ideas and incorporate them in the work, but they are largely tinkerers. They start with an existing design, elaborate or improve it, and pass it on to a new generation of designers, and so on through many steps. Every component of human culture, therefore, can be thought of as a product of evolution. The archaeological record clearly shows styles and technology being replaced. Whole cultures disappear or undergo drastic transformations. In historical time, we have seen old ideas being replaced by new ones.

Why cultural evolution is Darwinian

Even though there is no disagreement that culture is at least partly the product of an evolutionary process, there is less unanimity about the details of that process. For example, it is hotly debated among anthropologists and others whether cultural change is a random process, or subject to selection, or some mixture of the two. Similarly, it is equally hotly debated among political scientists and others how far the evolution of culture can be modified by design, either by individuals within the culture or by the imposition of alien trends from outside. Furthermore, there is lack of clarity about what "selection" might mean at the cultural level, and about what it might mean to "design" a culture.

Meanwhile, other groups of scholars, mostly from the natural sciences, recognized cultural evolution to be "descent with modification", to use the terms Darwin coined

to explain the evolution of species. As biologists' understanding of genes developed in the 20th century, the mechanisms by which species changed and diverged became better understood. But Darwin himself knew nothing of genes. He simply saw that when there was inherited variation between individuals, any variants that allowed individuals to have more surviving offspring would become more common over time. In the case of humans, the useful variants could be "inherited" culturally.

The "culture" of a human population can therefore be seen as analogous to the "gene pool" of population of living organisms. Ideas, knowledge, habits and other components of culture are transmitted from person to person. There is much variation between cultural components, just as there is much variation between biological characteristics. And just like biological characteristic, the components of culture are subject to selection. Some spread rapidly and faithfully throughout a population while others are not so readily acquired. When conditions change, many old ideas do not survive and are replaced by new ones.

The processes by which a culture changes are far more complicated than the processes by which the frequency of genes changes in a gene pool. For a start, each individual within a gene pool gets its genes from only two parents and its genetic endowment is fixed at conception. Culture, on the other hand, is acquired from many "parents" and individuals can change their cultural values and beliefs throughout their lives. Living things have no choice about the genes they inherit from their parents but individual humans have some of control over what they remember. We can even choose to modify cultural components to make them more fit for our purposes.

But just because culture is complicated does not mean it is unfathomable. The development of the mathematical and computational tools to model complex systems has made a broad-brush analysis of cultural change possible. Beginning with the pioneering work of Cavalli-Sforza and Feldman in the 1970s, a sophisticated body of population-genetics-style theoretical work has been developed to gain a quantitative understanding of cultural change (Boyd & Richerson, 1985; Cavalli-Sforza & Feldman, 1981; Lumsden & Wilson, 1981). Laland and Brown (2002) provide an introduction.

Evolutionary analysis has been of immense help in explaining the similarities and differences between species. For example, mammals that make their living by burrowing underground for food all look very similar. They look like moles. But differences between them betray their ancestry. True moles are related to shrews but in southern Africa the burrowing creatures that produce what look like "mole hills" may be mole *rats*, related to mice, squirrels and other rodents. Australia has similar creatures that are marsupial, more closely related to kangaroos than the moles which they resemble so closely.

Cultural differences between populations can also partly be understood by their cultural ancestry. This assumption has been most systematically applied to understanding differences and similarities in the most ubiquitous cultural artefact: language (an approach that is older than the Darwinian approach to the origin of species, and one that indeed influenced Darwin's thinking). The similarities between French, Spanish and Italian suggest that they diverged from a common ancestor language sometime in the recent past. Estimates of the speed of language change can

be made by comparing texts written at different times and this makes it is possible to calculate when this divergence took place. The accuracy of the estimates can be improved by comparing it with historical evidence. The Romance languages began to diverge when there was no longer regular communication between people living in what had been the Roman Empire. At that point the languages began to evolve separately.

In analysing and comparing evolved systems, we sometimes only have their current forms available for inspection. But very often we also have evidence of ancestral systems from which we can infer elements of the process as it unfolds. Biologists analysing gene evolution have fossil evidence and evidence of the physical environment of the past. As the example of language differentiation illustrates, those who analyse cultural evolution can have similar resources. Present variations can be observed and records and artefacts from the past can be studied.

Cultural change occurs as individuals interact, exchange information and ideas and pick up habits. Our understanding of this process is far sketchier than our understanding of how genes combine to create new individuals or how we pick up viruses from one another. But there are similarities on which we can build. For example, we cannot know for certain whether or not a girl will adopt the faith practiced by her mother. But neither can we know if she will inherit her mother's nose or catch her mother's cold. In all three of these cases, however, experiments and observation can give us probabilities that can inform mathematical models.

Social psychologists are developing an understanding of the processes that lead to the creation and modification of social norms at the individual and small group level. With mathematical models this process can be scaled up to the population level. The processes that create and modify culture are too complex to be modeled with great precision. But so are the processes that create and modify our climate and weather. In both cases, precise predictions are not possible but forecasts are still useful to help us plan for the future.

Experiment and observation has revealed the "biases" that influence the transmission of cultural information. For example, the extent to which people are persuaded by a message is influenced by its content but a number of other factors are also influential, such as the source of the message and the conditions under which it is delivered (Hovland & Weiss, 1951) (Perloff, 2004). Members of one generation make deliberate decisions about what to teach the next but this is no guarantee of what the next generation will learn. For example, it is our experience that many adults try to avoid swearing in front of children. Yet children seem to pick up swear words somehow, even though they may avoid using them in front of adults. Adults also unconsciously vary the information they transmit to younger people, depending on their relationship. For example, mothers are more inclined to influence their daughters to have children at appropriate times but not other young women (Newson *et al.*, 2007).

Just as it is impossible to consider human genetic evolution without taking into account the cultural context, most biologists would regard it as a mistake to consider human cultural evolution divorced from its biological context. But there are so many interesting questions which need investigating. How have the genetic and cultural

evolutionary process interacted with each other throughout human evolutionary history? Is the capacity to be influenced by culture selected for at a genetic level, or does it emerge as a by-product of other advantageous cognitive traits (cf. Byrne, Barnard, Davidson, Janik, McGrew, Miklosi & Wiessner, 2004)? And if there is a selective process on cultural traits as a result of their varying tendency to propagate themselves within the community, how does that affect the survival and tendency to reproduce biologically of the individuals who constitute that community? These issues are explored by gene-culture interaction theorists such as Boyd and Richerson (1985), who conclude that a mere dual-inheritance theory cannot provide a full evolutionary explanation for human behaviour. The alternative is some kind of co-evolutionary theory.

Economic behaviour is clearly heavily dependent on culture, so an evolutionary economic psychology seems bound to involve a large element of cultural evolutionary theory. To say more about what it might be like, however, involves an examination of how evolutionary ideas have been used in its two parent disciplines.

Evolutionary psychology

Buller (2005) refers to Evolutionary psychology as having a "broad sense" and a "narrow sense", and we shall use his terminology here. In the broad sense, it could have the general meaning of any psychology set into the context of Darwinian theory, or of a search for evolutionary explanations of any type within psychology; and it was in that sense that Ghiselin (1973) first used the term. More recently, however, it has acquired a specific meaning, denoting two particular kinds of evolutionary explanation.

The first of these narrower senses of evolutionary psychology dates from the emergence of sociobiology as a concept with the books of Wilson (1975) and Dawkins (1976). It was rapidly assimilated into psychology as a "grand theory of everything" – the sort of theory that had virtually disappeared from psychology in the latter half of the twentieth century. Sociobiological theory was rapidly applied to explain persistent (or supposedly persistent) tendencies within human motivation, such as the stronger motivation of mothers than fathers towards providing parental care, the persistence of sibling rivalry, patterns in parental preferences among their children, the stronger tendency for polygyny than for polyandry (cf. Wilson, 1978) and gender differences. As these examples illustrate, the explanations were frequently controversial, and the facts they purported to explain were somewhat stylised. Their obvious merit was that they addressed large questions about human behaviour that had been left largely untouched by psychologists since the focus of interest in psychological research shifted from motivation to cognition in the 1960s. It is perhaps not surprising that this kind of evolutionary psychology remains popular with some (e.g. Buss, 2003) and unpopular with others (Eagly & Wood, 1999).

However, evolutionary psychology soon shifted its focus away from motivation to the cognitive arena, and it is in this context that the phrase has most clearly become a technical description of a type of explanation. Beginning with Barkow, Cosmides and

Tooby (1992), psychologists seeking to apply evolutionary ideas to cognition took especial note of the fact that exposure to the modern environment has been of too short duration for significant genetic adaptation to take place. Instead, they argue, the human mind must be thought of as being adapted to the conditions of the Environment, or more correctly the Environments, of Evolutionary Adaptedness (EEA), the long period during which our ancestors foraged for their food. There has not been enough time for genetic evolution to reshape our brains since we ceased to live as small bands of nomadic hunter-gatherers. Furthermore the evidence suggests that very little genetic change has occurred since this time. People whose immediate ancestors are hunter-gatherers are more likely to be lactose intolerant than those from a dairying background. But other than this, there is no evidence that humans who are recently descended from the nearest modern analogue of Stone Age humans are any less able to thrive in modern conditions. If a person is born into modern conditions or or adopted into them early in life, he or she as able to thrive a person with many generations of pastoralists, agriculturalists and city dwellers in their ancestry.

Evolutionary psychologists in this narrow sense have focused on the idea that the human brain contains discrete functional mechanisms, called Evolved Psychological Mechanisms (EPMs) that carry out particular cognitive tasks that were advantageous for the reproductive chances of the individual organism in the EEA. The selective process is seen as acting on these EPMs, making universal in the species, or at least in particular age or sex classes within it. The object of the evolutionary psychologist is to "reverse engineer" the cognitive system, to discover from its input-output characteristics both the way it works and its evolutionary origins. It is this approach that is most commonly understood by the phrase "evolutionary psychology", taken in its narrow sense.

The development of this idea that is most directly relevant to economic psychology is that of Gigerenzer and his colleagues, who have argued for a particular implementation of Simon's (1955) idea of bounded rationality in decision-making. They suggest that algorithms or heuristics operate as modules in the sense in which that concept is used in evolutionary psychology: "mechanisms that a mind can actually carry out under limited time and knowledge and that could have possibly arisen through evolution" (Gigerenzer and Goldstein, 1996, p. 652). The theme of adaptiveness, of the effectiveness of these mechanisms, has been present in Gigerenzer's work from the start, and the theme of adaptedness has become much more explicit in his more recent work, e.g. Goldstein and Gigerenzer (2002).

Evolutionary economics

Evolutionary economics is even less well defined than evolutionary psychology and there is no wide agreement about what it denotes. There is an obvious analogy between the market and the evolutionary process (for recent reflections on this see Markose, 2005). This analogy perhaps explains the historic liking of right-wing thinkers for evolutionary explanations, going back to Social Darwinism (see Hofstadter, 1944): both markets and evolution are capable of producing well organised, orderly results without any central planning or design. Approaches like

Hirshleifer's (1977) evolutionary analysis of competition between firms exploit this kind of analogy. But for the most part evolutionary approaches to economics lie outside the mainstream of theoretical thinking, not least because they involve a recognition that economic development is a historical process, whose current state depends on its past as well as on the present balance of resources and demands. Figures like Marx (1867/1978), Veblen (1898), Schumpeter (1934/1949) and Keynes (1936) are therefore seen as representing this approach. Hamilton's (1953/1970) survey of the field makes evolutionary economics more or less synonymous with institutional economics. More recently, Boulding (1981) has offered a general treatment of the subject, which tries to use analogies from biological evolution in a systematic way to generate new insights into (mainly) macroeconomic processes.

In contrast to evolutionary psychology, evolutionary economics focuses on the modern period. Paradoxically, because most evolutionary economists have leanings towards institutional economics, they take the role of what we called above "design" in the emergence of economic systems and phenomena far more seriously than most more orthodox economic theories. "Design" here stands for the political process; to say that economic systems and economic change involve design is to assert that such systems and changes do not just happen, they are the result of a particular history involving political choices and political pressures. For Marx, of course, human beings are at least partly shaped by the economic systems they live in and the positions they occupy within them. This was in accord with Darwin's view that variation among humans could be introduced by culture.

Evolutionary economics is not just a tendency that can be detected in the writings of grand historical figures, however. Modern research in the field deals with specific instances of economic behaviour, making sophisticated use of concepts from cultural evolution theory as well as from microeconomic analysis. For example, Ruprecht (2005) discusses how the history of institutions has combined with the psychology of taste to determine the market for sweeteners, using Lancaster's (1966) "characteristics" approach to demand theory to model changes in apparent tastes.

More recently, the approach of Evolutionary Game Theory (EGT, see Weibull, 1995) has grown up. This is not a surprising development, considering that both modern economics and modern evolutionary theory have made such extensive use of game theory. The characteristic of EGT, in comparison with more conventional uses of game theory within economics, is that it does not assume fully rational players, but rather treats players as having strictly limited knowledge and foresight. However, it allows individuals to have characteristics that are subject to selection, and in consequence they may achieve similar results to those of rational agents (see Subramanian, 2005, for an example). To some extent EGT has developed independently of the older, more institutionally oriented, evolutionary economics; however Villena and Villena (2004) have recently argued persuasively that the two can and should cross-fertilise each other. It is interesting to note that while some applications of EGT allow for change only between generations, and so are placed firmly within a model of genetic evolution (e.g. Riechmann, 2001), others rely on learning processes such as imitation that can take place within generations, and so are appealing to cultural evolution (e.g. D'Artigues & Vignolo, 2005)

Evolutionary economic psychology

Given the general meaning of an evolutionary explanation, the specific nature of human evolution, and the ways evolutionary explanations have been used in psychology and economics, what can we expect of an evolutionary economic psychology?

As often in economic psychology, it seems to us that progress will depend on a fusion of ideas from the economic and the psychological spheres, in this case from evolutionary psychology and evolutionary economics. Evolutionary psychology directs our attention to genetic evolution and to the prehistory of the human species, whereas evolutionary economics directs it to cultural evolution and our more recent history – history so recent that it is better called politics. And as in the study of human evolution more generally, it will not be enough to set up a conflict between these two approaches, and try to establish a victor, nor will it do just to set them one alongside the other. Rather, we have to accept that they interact comprehensively. Human economic agents bring brains that evolved in pre-modern conditions to modern institutions, but our minds are products of the interactions of our brains with those institutions, as indeed of our social environment in general. Just as human minds have shaped those institutions, so too those institutions have shaped and continue to shape our minds.

This argument for an evolutionary economic psychology may or may not be convincing as a piece of general theory. However it will never become truly persuasive (or, alternatively, be dismissed from the intellectual agenda) until it is applied to particular questions in economic psychology, and deployed to make testable predictions about specific economic behaviours. The remainder of the present paper seeks to start that process. First, we list a number of simple propositions that seem to follow from an evolutionary approach to our interdisciplinary study. Then we develop an evolutionary account – one that takes account of the co-evolution of genes and culture – of one of the most important particular economic behaviours, buying.

First, therefore, some principles of an evolutionary economic psychology that follow directly from the arguments above.

1. Tastes can be explained and perhaps even predicted. According to neoclassical economic theory, everything in the economy is driven by the tastes of the consumer, but those tastes are themselves inscrutable. Stigler and Becker (1977) famously protested against this abdication, and much of pure and applied consumer psychology is devoted to trying to explain and predict tastes. An evolutionary approach affirms that this effort is not wasted. If we go back to the earliest period of evolutionary psychology, with Ghiselin (1973) and Wilson (1978), we find strong statements about the nature of the human instincts from which all consumer demand flows. If there is such a thing as human nature, it follows that tastes for modern artefacts can ultimately be explained in terms of a relatively small number of reliable motivations. The explanation may not be direct, and the motives may be social or artefactual rather than directly utilitarian, so that the mapping of motivations into tastes will not be consistent across times and cultures.

Nonetheless a biological explanation should be possible. Lea and Webley's (2006) attempt to probe the modern human taste for money is an example of this kind of analysis. Sometimes human motivations will be expressed in relatively consistent, reasonable tastes; sometimes they will be expressed in more compulsive, "visceral" desires (cf. Loewenstein, 1996). Lea (1994) was trying to understand the most fundamental economic taste of all: why we have a taste for economic life.

2. To predict tastes, we must take culture into account. Although tastes can be explained, we cannot expect to find a single fixed list of human tastes, at least not at the level where they would prompt the purchase of particular commodities. One of the strongest human motivations may be to acquire the tastes of members of the group with which we identify (Cialdini & Goldstein, 2004) and the people we admire (Henrich & Gil-White, 2001). It is not difficult to see why possessing the motivation to learn behaviours likely to be useful would have been advantageous for our ancestors (Boyd & Richerson, 1985). Learning from others is less time consuming and risky that learning for ourselves, and it reduces the risk of doing something that breaks an implicit rule of the group and attracts punishment or exclusion by other group members.

3. Abstract information has concrete value. The accumulation of culture that makes human evolution different from that of every other species required the reasonably faithful transmission of knowledge and skills from one generation to the next. The examples of other species with a modicum of culture shows that accidental transmission through imitation and other social learning processes (see Heyes, 1993, for a review) can sustain minor variations in behaviour, but not the explosion of cultural development that has characterized human culture for the last 50 thousand years or so (Boyd & Richerson, 1996). Humans seem to be predisposed to share information – to tell and teach, and to listen and learn. This has only the palest of parallels in the animal kingdom (see Caro & Hauser 1992). It follows that the "information economy" is not a startling new development: it is the logical consequence of the process that gives us any kind of economy at all.

4. Irrational behaviour is not an accident. Humans are evolved, not designed. We do not have perfect decision-making processes, we have those that evolution has given us, and we evolved under particular constraints. Careful thought through all the possibilities and their long-term consequences was not adaptive in the EEA. This line of reasoning applies not only to Gigerenzer's "simple heuristics that make us smart" (which in most situations produce only small deviations from optimal behaviour), but also to the massive and pervasive irrationalities of human choice such as our general myopia (cf. Ainslie, 1992): the very long term was irrelevant for most of human evolution. Our behaviours and capacities evolved in a variety of environments and this has made us flexible but those environments were very different from those that exist today. There may be limits to our flexibility.

5. History really does matter. Evolutionary processes (both genetic and cultural) create what exists in the present by modifying what existed in the past. If we

want to understand economic behaviour we will have to try to understand economic institutions and the political processes that modified them. The kinds of social influence they permit or encourage will have a profound influence on the way people experience and express their instinctive tastes. Cultural evolution is much faster than genetic evolution and can therefore track changing circumstances much more rapidly than genetic evolution. But the past is still one of the strongest influences on the present. And because cultural evolution is much faster than genetic evolution, cultural change is constrained to some extent by the preferences, capacities and limitations of a genotype that was advantageous in the cultural conditions that existed in the past. Our biology makes our behaviour flexible enough to fit reasonably well into many cultural environments.

6. Understanding cultural change as an evolutionary process that is subject to Darwinian analysis promises to provide new insight into how human economic behaviour has developed, and also into how it will continue to change as the process of economic modernization and change continues worldwide.

As a more extended example of the application of evolutionary economic psychology, we shall take the linked behaviours of buying and consumption. We are not concerned here to offer an explanation of the details of consumer behaviour, though this can be attempted: an evolutionary analysis of this sort has recently been proposed by Saad (2007). In our view, it is the fact that modern humans are consumers at all that requires an evolutionary explanation.

Humans appear to enjoy acquiring things. It is a striking fact of modern economic history that once people have adopted modern culture and more resources are available to them, they use these resources to buy more things rather than investing in producing more children. They have a small number of children and buy more things for the children they do have. Modern children and their parents have more things than they need and they often have more things than they can afford. We offer here a broad, general, evolutionary account of these rather odd facts. But while it is of course a strength of evolutionary theories that they can be applied very widely, we accept that a further stage of developing and testing hypotheses about particular buying behaviours will still remain necessary at the end of the current analysis.

Consuming in the Environment of Evolutionary Adaptedness: Antelopes and Berries

As mentioned above, evolutionary argument about human behaviour must take into account the environments in which our ancestors lived. The Pleistocene climate was extremely changeable and humans made their living in a wide variety of habitats. This suggests that humans are able to adapt to many different *physical* environments. The *social* environment for our ancestors was far more consistent, however. For most of the human species' evolutionary history, and that of the species from which we sprang, individuals lived as part of small nomadic kin-based groups. They hunted and

gathering their food, with little in the way of tools, possessions or permanent structures (Foley, 1996). We cannot be exactly sure of either conditions or human behaviour in the Pleistocene Era, but it is a reasonable working hypothesis that for a hundred thousand years at least, the human lifestyle was similar to that of the few hunter-gatherer cultures that remained isolated from modern culture long enough for anthropologists to document their lifestyle (e.g. Chagnon, 1968; Lee, 1979).

By definition, there were no shops in any of the environments in which our Pleistocene ancestors lived. So what might they have needed to do that would have created the behaviours, motivations and mental capacities that allow modern humans to successfully negotiate crowded aisles of products, find and select certain articles from among many and return home often having enjoyed the experience? What might have been the Stone Age precursor of shopping? We argue that it is foraging – seeking food by the two means that define the hunter-gatherer way of life, hunting and gathering. Buying is a good topic for an initial analysis within evolutionary economic psychology, because foraging is one of the best-understood areas of behaviour within the behavioural ecology of both humans and non-human animals. Foraging theory is reasonably secure and makes straightforward predictions, and the relation between evolutionary thinking and psychological analysis has been well worked out in that context (cf. Lea, 2006).

When the foraging practices of human are studying using the same methodologies and categories we use for analysing the behaviour of other primates (Bailey and Aunger, 1990), hunter-gatherer humans spend about the same proportion of time foraging as non-human primates. Also, there is consistent social differentiation within hunter-gatherer foraging. Even in the modern era there are many different hunter-gatherer groups, living in different habitats and with distinctive foraging behaviours and cultures. But across this variation runs one commonality. In almost all the habitats in which humans lived or have lived (the high Arctic is an obvious exception), foraging involved the acquisition of two major classes of commodities, which we can typify as Antelopes and Berries. The distribution of economic roles between the genders varies greatly between cultures, even hunter-gatherer cultures, but it is not random (e.g. Burton, Brudner & White, 1977; Douglas & Isherwood, 1980). Hunting and its associated roles are more likely to be undertaken by men; gathering and its associated roles are more likely to be undertaken by women and children.

Analysis of hunter-gatherer foraging with the conventional tools of optimal foraging theory has been productive (Winterhalder & Smith 1981). But it does not necessarily follow that the need for near-optimal foraging behaviour in the EEA will have produced behaviour that is near-optimal in a modern environment, or even a brain that is capable of developing near-optimal behaviour in the modern environment. Modern consumption involves a double alienation, which can be described as unnatural because of its differences from consumption of the hunter-gatherer economy of the Pleistocene EEA.

In the first place, within the consumer culture of a modern economy, few needs or desires are fulfilled by direct action on the physical or biological environment. Rather, we fulfil them through the mediation of the economy – by the purchase of goods or services. Secondly, little of the time and effort that is required to gain access to a particular commodity is spent in actually going out and getting it, or in actively

consuming it. We spend substantial amounts of time working, more than in typical hunter-gatherer societies (Sahlins, 1974). But, in modern society, most people's work does not directly produce objects or services for their own gratification. Instead we work to obtain money, which in itself offers no gratification, or only a parasitic, functionless gratification (Lea & Webley, 2006). The act of buying, even in the minority of cases when it involves careful planning, takes up a tiny proportion of the true time cost of acquiring something like a car, or extracting the consumption services which it is supposed to deliver (Illich, 1974, p.18). We will explore some possible implications of this alienation below.

The purpose of Stone Age consumption: Children

It is a cliché of the behavioural ecology of sexually reproducing species that females can be understood as devices for turning food into offspring, while males can be understood as parasites on that process. In many species, however, males are co-opted so that they make a contribution to the productive female effort. In species like humans, with complex social behaviour and large cooperative networks, producing offspring is a much more significantly cooperative endeavour, with fathers, other kin and even non-relatives within the social group supporting mothers and their children (Hrdy, 1999; Mace, 2000). But in the EEA, the twin roles of hunting (stereotypically male) and gathering (stereotypically female) can still be evaluated in terms of the fitness currency standard theory prescribes. How successful (in terms of fitness) is a particular man's hunting or a particular woman's gathering? That is to be measured in terms of how many children and other close relatives thrive well enough to produce children themselves. Gross returns in terms of the mass or calorific value of food gathered are only a proxy for these more fundamental measures.

The over-production of offspring is routine among living things. It is this excess on which natural selection works. But producing children that cannot thrive is a waste of time and resources. Often effort is better spent supporting one's children that are already born or the children of close relatives (Cronk, 1991; Voland, 1998). A degree of optimism about the future availability of resources is favoured by natural selection. Optimists will suffer more hardship and loss when resources turn out to be lower than average but they are in a position to take advantage when resources are higher than average. Individuals that can monitor availability of resources and adjust their reproduction accordingly are most favoured by natural selection. Even in non-human species, it is a classic finding that reducing the number of offspring produced may increase the number that survive to adulthood (Lack, 1947, 1954) – though subsequent research suggests that there must be additional processes limiting fecundity (e.g. Vander Werf, 1992, Brown & Brown, 1999).

Hunter-gatherer cultures that have been studied have low fecundity, compared with what is physiologically possible for humans. The number of times a mother surviving to age 45 gives birth ranges from an average of 4.7 (for the !Kung San: Howell, 1979) to 8 (for the Ache of Paraguay: Hill & Hurtado, 1995). Hammel (1996) argues that if children were born more often than this, they could not be carried around with the group. And while powerful men in many cultures may have many sexual partners,

the fecundity that can result seems to have been exaggerated in the popular literature on sociobiology (Einon, 1998). The more modest strategy of helping one or a small number of wives to raise a limited number of offspring is, to judge from its frequency, a more reliable pathway to fitness.

Mere production of offspring, therefore, is not a sensible goal. But, in the EEA and indeed in virtually all kinds of culture down to the present day, humans have behaved as if maximising the number of thriving offspring was an ultimate goal. Studies of a large number of traditional societies, both contemporary and historical, have shown that following the culturally prescribed behaviour results in members producing offspring at an approximately optimal rate, given the ecological conditions in which they live. Status, power and resource control were found to enhance lifetime reproductive success, especially for men (e.g. Borgerhoff Mulder, 1988; Chagnon, 1988; Cronk, 1989; Hill & Hurtado, 1995; Irons, 1979; Mace, 1996; Wang et al, 1995; and reviews by Cronk, 1991; Low, 1993; 1999; 2000; and Voland, 1998). Families have been as large as economic conditions would permit; in effect, virtually all available resources have been committed to producing children, with success being measured by their numbers.

Culture and foraging

In the EEA, human foraging and social behaviour can be understood in terms of the basic ecological principles about the acquisition of food and mates; everything is adapted to the production of the greatest possible number of children who will survive to produce grandchildren. However, even among foragers, the means of that adaptation are more complicated in humans than in other animals. This is because, as noted above, animals learn very little from each other, whereas almost everything humans learn is learned through contact with other humans. The behaviours we use in the course of foraging are far too complex, variable and flexible to be inherited via some genetically coded neurological architecture. And not only do human beings pick up complex skills and a vast amount of knowledge from the people we associate with, we also acquire most of our motivations from them. The sensation of hunger provides us with a motivation to eat, but we learn from our culture which potential foods we should think delectable and which to find disgusting. We also learn how food “must” be prepared and when it is appropriate to eat certain foods. At a more abstract level, we learn what is worth knowing and what skills are worth practicing.

Learning plays a crucial role in the foraging of non-human animals too. Key constructs and parameters such as the location of food patches and prey density have to be learned and information about them may have to be updated day-by-day or moment-by-moment. But this is quite unlike the human capacity to accumulate expertise within a population, a capacity that has enabled us to become foragers of unparalleled effectiveness. We can extract resources from almost every habitat on Earth. But culture is not merely a means of increasing efficiency. Humans have evolved to become dependent on it. Without our cultural inheritance we would not know what to do to satisfy our hunger. We are born with mouths that suck, and eventually chew, but we have no innate knowledge how to get edible stuff into the

vicinity of our mouths. To survive, we have to learn from our elders what people in our habitat eat and how to obtain it. In simpler societies, this foraging expertise can be picked up by observing and copying experienced individuals. In more complex societies, many of the skills necessary to make a living must be actively and abstractly taught.

The impact of cumulative social learning is not confined to the process of acquiring resources. It applies also to their use, including the ecologically central use, mating and raising young. In humans, reproductive expertise, like foraging expertise, is culturally transmitted. We may experience sexual urges without the assistance of culture, but it is debatable whether a group of naïve young men and women could work out for themselves the mechanics of sexual intercourse. The "facts of life" are culturally transmitted to each new generation and so is information about when and with whom it is appropriate to mate. Similarly, we may have some innate motivation to nurture – to behave in ways that protect our young from harm – but the details of what care a child needs and how much of their time and resources parents must allocate to each child is part of our cultural endowment. Society also has strong suggestions about who should provide help to mothers with the raising of their children. And, completing the circle back to foraging again, part of our duty toward our young is to equip them with knowledge and skills specific to the habitat in which they live which will enable them to find resources for themselves and their own children.

As we have noted, it is a fundamental principle of evolutionary psychology that there has not been enough time for genetic evolution to reshape our brains since we ceased to be hunter-gatherers. But cultural evolution has certainly reshaped our minds in the period since some humans first emerged from Stone Age conditions. An evolutionary economic psychology of buying, therefore, must specify what behaviours brains adapted to a complex pursuit of Antelopes, Berries for the purpose of producing Children might now deliver in a consumer culture. In using this common behaviour as a test case for an evolutionary economic psychology, therefore, we are posing the question: Does a knowledge of the evolutionary origins of our brains say anything useful about our consumption to-day? Or is a knowledge of the modern environment all we need in order to understand modern buying, with the human being at the centre of it a void, with no consistent nature, as some have suggested (e.g. Buller 2005), and many social scientists implicitly assume, a process that Gagnier and Dupré (1999) call "abolishing the body"?

Continuities

If we recognise buying as the modern analogue of foraging, we can see some evolutionary continuity, which extends beyond the Environments of Evolutionary Adaptedness of humans to our common vertebrate heritage. An early foray into economic psychology by one of us (Lea, 1978; see also Lea, 1981) attempted to extract simple own-demand curves, the most basic quantitative assessment of buying behaviour, from experiments with both animals and humans. The experimental conditions were very different, of course, both between animal and human

experiments and indeed within both groups, not least because most of the data were gathered for purposes other than plotting demand curves. But what was striking was not these differences but the general pattern of similarity. Demand curve analysis has found continuing use within animal psychology, particularly as a tool for the assessment of animal welfare (Dawkins, 1983; Pedersen et al., 2002). Moreover Hursh et al. (1988) have been able to show that many empirical demand curves, both animal and human, can be fitted to a simple functional form with few parameters; Hursh's latest research (so far unpublished) has refined this function to a particularly elegant exponential form.

Although own-price demand curves are a basic tool both in theoretical microeconomic analysis and in the construction of demand systems that model entire economies (Stone 1954; Deaton & Muellbauer, 1980), econometricians rarely report them except as parameters of a model. It is a rare economics textbook indeed that shows an actual empirical demand curve. The reason is simple; in a modern economy, consumption of any one commodity is embedded within the consumption of a vast web of other commodities. Understanding the cross-elasticises of demand is likely to be much more important for predicting actual demand for a commodity than knowing its own-price demand curve. Indeed, Lancaster (1966) argued that what distinguished a modern economy was its "sophisticated consumption technology", in which the range of goods on offer vastly outstrips the number of enduring human needs. By contrast, in the EEA and any pre-modern economy, there are fewer different goods available than there are distinct needs. People have to fulfil their needs through a series of compromises that may well involve over-consumption relative to one need if another is not to go unfulfilled.

Understanding buying in practice therefore comes down to understanding choice. Here too, however, continuities can be demonstrated. In the early phase of exploring the economic analysis of animal instrumental behaviour, a series of experiments (e.g. Lea & Roper, 1977; Battalio, et al., 1981) demonstrated that standard economic principles could make good predictions of the way animals' demand for goods is affected by the availability and price of other goods. More recently, the traffic has been the other way. Herrnstein (1961, 1970) proposed that pigeons' choices between schedules of reinforcement could be described in terms of a "matching law", and this has been shown to be a generalisation of wide applicability in animal and some simple human choices (Davison & McCarthy, 1988). In a series of theoretical and empirical studies, Foxall and his colleagues (e.g. Oliviera-Castro, Foxall & Schrezenmaier, 2006) have had considerable success in adapting the matching law to describe people's purchasing of consumer goods within a sophisticated economy, drawing on the large banks of data available from market research firms.

The matching law is not always a good guide to human choice even in simple situations (Horne & Lowe, 1993). It appears that when people approach a choice situation with a problem-solving mind-set, quite different principles may operate, which have no parallels in other species. It is when we react, "mindlessly", to the prices and availabilities of goods that our behaviour is most consistent with the matching law. Since humans clearly make some economic choices thoughtfully and deliberately, a certain amount of animal-human discontinuity is inevitable. But it is unlikely that such discernment is a recent invention. Individuals within the hunter-gatherer societies of the EEA could well have shown similar thoughtfulness. It is

likely that they also perceived a difference between planned and habitual consumption, parallel to the distinction between planned and habitual purchasing which is one of the most obvious facts about the economic psychology of buying (e.g. Katona, 1975). Indeed, that distinction maps easily onto the distinction between hunting and gathering distinction. Hunting was a lower-frequency, longer-duration activity that is higher risk. It requires planning in a way that gathering does not (cf. Douglas & Isherwood, 1980).

Dysfunctionalities

As we noted above, if a behaviour is even partly the product of an evolutionary process, we would expect it to occasionally reveal its history, in pointless or actively dysfunctional ways. There are a number of ways in which modern consumption behaviour seems to be less than optimal and some may reflect features of modern retail arrangements that have no parallel in the EEA. For example, in typical modern shopping conditions, all kinds of needed and desired objects are displayed for the taking, a sharp contrast with the time and effort that must be committed to obtaining desired objects in more natural conditions: in hunting, each capture requires considerable planning. In gathering each individual object may be picked up quickly with little need of forethought but accumulating many will take an extended period and often the material that is gathered will require considerable processing before it is edible. As we noted above, modern conditions cause an alienation of the effort required to obtain something from the action of obtaining it.

A number of pathologies develop within the context of modern shopping. For example, if they are not directly limited by the amount of cash they have in hand, many young people find great difficulty of staying within a budget when they are faced with managing their own finances for the first time (see, for example, Lea, Webley & Bellamy, 2001). Secondly, large modern stores have major problems with shoplifting, and though some of this reflects deliberate criminal intent, significant amounts of it seems to involve impulsive behaviour by people who have no general pattern of illegal behaviour (see, for example, Sarasalo *et al.*, 1997). Most dramatic, perhaps, are the occasional cases of compulsive buying (see, for example, Dittmar 2005), in which buying behaviour seems to be totally disconnected from the desire to use or even possess the goods bought. A reasonable, if speculative, explanation of all these phenomena would be that the effortless availability of goods has no parallel in the EEA. Clearly many individuals possess the restraint required to act rationally in the presence of a cornucopia, but as always, in biology and culture, there is variation in the population.

Another well-known pathology of shopping is the difficulty many people have in saving a proportion of their income when it would clearly be in their long term interests to do so. In many situations, human choice comes reasonably close to the predictions of optimal choice theory, but intertemporal choices often involve massive irrationalities. Typically these involve people underweighting the future, and therefore spending more in the current period, and saving less, than would be optimal (Wärneryd, 1999); indeed, people generally save less than they plan (Katona, 1975).

Towards the end of life the tendency goes into reverse, with people often found to be saving more than can easily be understood (e.g. Borschsupan, 1992).

Clearly humans can learn to save, but there is no reason why individuals should have evolved an innate psychology that would allow them to make the best decisions in terms of their rational self-interest in the context of long-term saving. Animals such as grey squirrels have evolved the behaviour of storing nuts for the winter and their own individual survival depends on it. The survival of individual humans depends instead on them being part of a cooperative group. In small-scale societies, cultural norms enforce the sharing of scarce and valuable resources (Richerson *et al.*, 2003). A hunter who kills a large animal is expected to share the meat with his group and he and his family rely on similar generosity on the days when he is not so lucky. This is more efficient than each family trying to save a perishable resource for later or carry it to the next campsite. Perhaps this is why humans are so easily influenced by their social group and by advertisers in how they dispose of their resources. If a social group values wearing the latest fashions, for individuals who want to be part of that group, buying clothes becomes more important than having money in the bank. The motivation to save is a culturally acquired characteristic and until recently, human cultures enforced the norm of sharing with others rather than saving for one's own future.

Preferences, the demographic transition and the cultural evolution of consumer behaviour

Although there are continuities in the principles that underlie choice and demand in humans and other animals, no-one is saying that humans, whether in hunter-gatherer societies or a modern economy, make the same choices as pigeons, or that human demand curves are the same as those of pigs. Even if the form of demand curves and choice functions were the same, our relative demand for different commodities would be quite different. That indeed is one way of characterising what it is to be a human rather than a pig or a pigeon.

However human demand is not just specific, it is also plastic, and it is clearly moulded by culture. As we noted above, one of the functions of an evolutionary economic psychology is to "account for tastes", to borrow the title of Becker's (1996) book. But if we are to do so, we are clearly going to have to invoke cultural as well as genetic evolution. An obvious example is food preferences: people in different cultures learn, from an early age, to "like" different foodstuffs, including some that people with no experience of them invariably reject at first exposure – implying that we possess some innate caution (Rozin & Schiller, 1980; Rozin, 1996). But the alacrity with which populations abandon old recipes and embrace novel foods, from hamburgers to houmous, suggests that in some conditions at least, the cultural evolution of food preferences can occur very rapidly.

Changes in preferences generally occur in unsystematic and temporary ways with variations between populations. But, under the conditions of a modernizing economy, one striking and consistent cultural change occurs that transforms consumption

behaviour. It has now affected virtually every society in the world and there is no sign of it reversing. As societies modernize, they undergo what has become know as a "demographic transition": their members begin to limit the number of children they have (Thompson, 1929; Notestein, 1945; Chesnais, 1992). This transition was seen first in Western Europe in the late 19th century, and it occurs without exception: Currently almost all human populations have a low or rapidly declining birth rate.

In ecological terms, the demographic transition can be seen as a sharp decline in the efficiency of conversion of resources into offspring declines. Reproduction decreases as individuals acquire resources at an increasing rate. Something about modernization seems to turn humans from reproducers into consumers. Our contention is that this phenomenon occurs for understandable cultural reasons, and that it is the key to an evolutionary economic psychology of consumption.

In consumer terms, the demographic transition can be seen as a mass change in tastes. Modern humans have a greatly reduced taste for raising children. It is not that people are unable to produce as many children as they did before, nor is it that they want to but are prevented. They cease to want as many children. Modern contraceptive technology makes it easier for people to match their reproduction to their tastes, but it is not crucial. Most of the European population (including those that had emigrated to the Americas, Africa and Australasia) when through the demographic transition before even rubber contraceptives were widely available. In contrast, contraception was available in many less developed countries many years before the birth rate began to decline. The availability of contraception is neither necessary nor sufficient for the demographic transition to occur (Coale, 1973)(e.g. Szreter, Nye & van Poppel, 2003).

We see the adoption of family limitation as the critical step in the evolution of modern consumer behaviour. It is not the result of a change in our genetic inheritance, nor is it a direct result of the way our evolved psychology responds to the modern environment. Consumerism is the result of a change in our cultural inheritance. The small number of offspring modern people have begin to inherit the values and behaviours of the consumer culture as soon as they are born. As part of their socialization, they are endowed with vastly more resources than they need for survival and they also inherit the perception that they want and need this or an even higher level of resources.

Why does the cultural evolution of consumerism inevitably accompany modernization? We believe that consumerism is a direct consequence of the decline in the motivation to produce children and that both stem from the change in the source of cultural information that occurs as societies modernize. We argued above that culture is the source of the information that humans use to balance between reproduction and the need to maintain their own health and ability to acquire resources. Judging by the reproductive choices made by people in traditional societies, for most of human history this information served our species well from an evolutionary point of view. There were periods when resources were scarce and mortality high but, by and large, our ancestors managed to efficiently convert resources into offspring. With modernization, however, it begins to fall apart.

Social influence and fecundity

We have proposed that the cultural change in the beliefs about children and family size that occurs as societies modernize is the result of the profound change in the pattern of social interaction that begins as societies modernize (Newson *et al.*, 2005; Newson *et al.*, 2007). The change in the structure of societies that occurs with modernization is well described and well documented (Davis, 1937; Durkeim, 1984/1893; Kohler, 2001; Zelinsky, 1971). In pre-modern societies, social networks are closed and deep. Travel is difficult and communication is largely face-to-face. Individual spatial and social mobility is low, especially for women. Most people spend their lives close to their place of birth. They associate with the same group of people for many years and a high proportion of the people they associate with are their genetic kin and/or conjugal kin. Modernization makes travel easier, provides economic opportunities outside the family and introduces new forms of communication. Social networks widen and a higher proportion of social interactions are shallow and short-term and the proportion of social interaction occurring between kin declines.

In a pre-modern community (and especially between kin) the production of the next generation is a shared goal; one woman's daughter is another woman's niece, or cousin or future daughter-in-law. A high proportion of the people a woman meets have a genetic interest in her successful reproduction and the successful reproduction of her children. In a modern community, people spend much of their time interacting with their friends and work mates. They hold a number of interests in common, but the production of healthy children is seldom an important shared goal. Indeed, the demands of parenthood can interfere with the interests of the group.

It seems that genetic interests do influence a person's opinion about reproductive decisions. Using role play studies to compare women's beliefs about reproduction in difference circumstances, we found that women primed by playing the role of a mother advising a daughter were more likely to choose behaviour consistent with achieving reproductive success than women who had played the role of a woman advising a younger friend (Newson et al., 2007).

If people rely on culture to provide them with the motivation to produce offspring, it is easy to see why this motive declines once cultural norms are no longer produced by interaction between people for whom the production of offspring is a shared interest. Our biology may equip us with sexual and nurturing urges but they are so inexact that culture can provide alternative ways of satisfying them that do not involve children. People who breed and raise cocker spaniels can be part of an international network who discuss, advise and encourage the nurture of this most obliging and rewarding animal. On the other hand, people raising their own children often feel alone, unsupported and completely mystified about how to be a "good parent" to these demanding and difficult parasites.

As we noted above, a weakened motivation to produce offspring could, in theory, have led to a reduction in the effort we put into extracting resources from the environment. Objectively, our biological need to acquire resources is reduced, so surely our motivation to acquire them should also decline? In fact, however, the opposite has occurred, and we demonstrate much greater acquisitiveness than our

ancestors. Why, when people in modern societies are free from many of the problems that people shared in traditional communities and we no longer have many hungry young mouths to fill? It may be, as Kaplan (1996) has argued, that our hunting and gathering motivations are mechanistically independent of our reproductive motivation, even though they are linked logically and ecologically.

On this analysis, we are stuck with a Stone Age need to acquire resources – a need to forage – even when we have no need for the resources themselves. We continue doing what is no longer necessary, just because it feels good to do it. This may be why acquisitiveness eventually comes to exemplify membership in a modern society. Perhaps too, however, we have another biological need – the need to consider ourselves to be an exemplar of whatever cultural norms we have adopted. If one has identified one's self as a cocker spaniel breeder, one perceives no reward in expending effort to be a bad or mediocre cocker spaniel breeder. We aspire to be (in the terms of the social group we identify with) among the best of cocker spaniel breeders.

It seems to us that both these effects are operative. Freed from the need to hunt and gather, modern people still need to expend effort on something. To live fulfilled lives, we need to adopt the motivation to expend effort on the things available to us, given the skills we possess. If we become motivated to attain things we cannot reasonably achieve, we are dissatisfied. If we lack the motivation to acquire anything at all, we are depressed. Modern culture provides us with many things which we might want to strive for. In our culturally diverse communities, we may not share experiences and values with the people we interact with, so we do not necessarily get cultural guidance from them about what to acquire. We have to decide for ourselves which acquisition pattern we identify with – the terms by which we will judge ourselves to have achieved something. We may become consumers of home entertainment systems, clothes and gourmet food, we may become consumers of knowledge, literature, and experience of other cultures, or we may become consumers of the gratitude and admiration of the people we help or teach.

Conclusion

Modern humans can congratulate themselves on the efficiency with which we garner resources, but must be ashamed of inefficiency with which we convert these resources into the next generation. If the biological purpose of living things is to work to ensure the transmission of our genes, modern humans are failing in two ways. Not only are we squandering resources and not turning them into future generations, our voracious exploitation of the world's resources is likely to change the environment in such a way that it will no longer support much human life. Freed by our consumer culture from the need to hunt and gather, and freed by the loss of family culture from the need to reproduce, our Stone Age brains still instruct us to expend effort on shopping and buying. In so doing, we drive the world economy, but the route we drive it on is not only barren in terms of human reproduction, it is also potentially destructive for the planetary ecology.

More generally however, we return to the question with which we started: is there any potential for evolutionary explanation within economic psychology? We believe that the example of the cultural evolution of low fertility demonstrates that there is, so long as the explanations take account of the unusual nature of the evolutionary process that has produced modern humans, and in particular the fact that it has involved an interaction between cultural and genetic evolution, a co-evolution in fact.

It follows that it should be possible to answer the question posed by Lea (1994) – what is the evolutionary origin of economic behaviour itself? Lea and Webley (2006) argue that humans may well possess a "trading instinct"; it is also clear that modern humans have developed within a trading culture. Both genetic and cultural evolution pre-dispose humans to trade – genetically, trade is the natural extension of reciprocal altruism; culturally, it provides a way of expanding the network of information exchange while allowing necessary biases in what is exchanged with whom. Expanding that network, however, may lead to radical departures from the behaviour that would maximise fitness in any genetic sense. The extraordinary levels of consumption that drive modern trade seem to be based on a surprising change of evolutionary direction.

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