Management Organization and Human Nature: An introduction[1]

Lívia Markóczy
Cranfield School of Management
Cranfield Universty
Cranfield, Bedfordshire
MK43 OSS, UK
+44 (0)1234 751 846
L.Markoczy@Cranfield.ac.uk

Jeff Goldberg
Cranfield University Computer Centre
J.Goldberg@Cranfield.ac.uk

MDELAM

[1]A copy-edited version of this paper appeared in *Managerial and Decision Economics* **19**, 7/8, 1998.

Understanding humans is hard; so is understanding groups of humans, such as organizations. But just because something is hard, and just because anything resembling complete success is unattainable for a long way off doesn't mean that it isn't worth trying. It is after all what anthropologists, psychologists, economists and organization scholars and others work on every day. We do think that it is worth trying.

The fields of psychology, anthropology, economics, and cognitive science are coming to recognize explicitly that an understanding of how humans behave, think, feel and react as individuals and in groups requires an understanding of our evolved human nature. These fields are among the ones that management scholars draw on in developing theories of management and organization. The evolutionary approach to the study of human sciences is by no means a dominant or uncontroversial approach in those fields. Misapprehensions based on misunderstandings (which we discuss below) have made discussion of evolution and human nature taboo in many places. But discussion does appear to be growing. But there is as yet little work in the area of management and organization which has attached itself to that approach. One of the many purposes of this volume is to make management scholars aware of some of what there is.

Almost all parts of all living things were designed. Those parts were designed by natural selection to do something.[1] The central premise of what has now come be be called evolutionary psychology (EP) is that it is pointless to try to figure out how the human mind works without looking at what it was designed to do and what sorts of mechanisms were available to the designer. Just as "nothing in biology makes sense except in the light of evolution" (Dobzhansky, 1997), the human mind and human behavior can only make sense in the light of evolution. This volume on Management, Organization and Human Nature is designed to explore how advances in the understanding of our evolved human nature can help us understand management and organization. To a lesser extent it explores how our understanding of management and organization can help us understand our evolved human nature.

This volume came about in an unusual way, which we will not bore you with. We point this out because to the extent something resembles its origins, we can account for why this is an unusual special issue. One peculiarity is that while there is a single editor for this volume there are two authors of this editorial introduction. If this is unprecedented – we are not aware of a

[1] "Design" is the right word to use, but it should not be taken to imply a conscious or mindful designer. Richard Dawkins refers to natural selection as the "blind watchmaker" in the title of his book (Dawkins, 1986) to get this notion across.

precedent, but we haven't investigated – so be it.[2]

There are other things which the editor has tried to achieve in the special issue, which, if not unprecedented, are unusual. Among other things, she took what might be an unusual approach to an interdisciplinary collection around a management issue. More of this will be discussed below.

The driving force behind the special issue is the belief that what has come to be called "Evolutionary Psychology" (EP) over the past decade can help us understand many of the problems addressed by those who study organizations. The editor asked each contributor to refrain from producing their own introduction to EP in their papers with the promise that it would be provided for in the editorial introduction. But it is not just enough to provide an overview of what EP is (as we do in section 1), it is necessary to explain what it isn't (as we do in sections 2–5).

1 What is Evolutionary Psychology?

Evolutionary Psychology (EP) is not a particularly radical hypothesis. It is merely seen as such. The human brain is an organ, adapted in the evolutionary process to perform some functions in its environment just as the human eye is such an organ. That is hardly a radical claim.

What becomes more radical is that it forces us to take a more careful look at how the human mind is designed. If you think about the simple views of the human mind that were explicit in behaviorism and implicit in what the anthropologist John Tooby and the psychologist Leda Cosmides have called the "Standard Social Sciences Model (SSSM)" (Tooby and Cosmides, 1992), the human mind is a general learning machine for picking up what is in its environment. The SSSM takes the view of the mind as a blank slate containing nothing but some motor functions, a few drives, and a general learning mechanism. The SSSM flies in the face of some obvious facts: We don't behave like chimpanzees or dolphins and they don't behave like each other. Our brains are not merely larger versions of the brains of other large brained mammals. Our brains and minds have been shaped by evolution as human brains and minds to help us solve the problems that our ancestors were presented with. The same is true for chimps and dolphins.

Humans do learn enormous amounts of things and there are different human cultures, but it takes specific built in brain mechanisms to learn so much. The flexibility of our learning is evidence for built in structures in the mind, not evidence against it. Language learning helps illustrate this point.

[2]This does lead, however, to having to refer to the editor in the third person in this essay – a problem we hadn't considered until right now.

Among the many things that a human infant and child has to do is sort out from the sounds that it hears what is part of human language and what isn't. This is a task of enormous complexity, and is simply not solvable without some prior notions of what kinds of things happen in human language and what kinds of things don't happen in human languages. This problem is solved by virtually every human child, and it could not be solved without there being a learning mechanism which provides a recipe of what to look out for in the acoustical signal. That same mechanism not only enables language learning, but it also restricts the class of possible human languages. A language with a sound system that would not be identified by a child as having human language sounds would not be learned. Our ability to learn something as enormously complicated as human language, and to do much of it automatically, is evidence for complicated innate mental structure.[3]

It is our innate nature to have a very substantial degree of flexibility and conformity to our local culture. But that flexibility is not unconstrained. As we wrote earlier in this journal (Markóczy and Goldberg, 1997):

> [W]e must not forget that variation is not the enemy of universals. A snowflake [...] can have a large (practically infinite) number of shapes and still be "snowflake shaped". Even if every snowflake is unique, and there are an (almost) infinite number of possible shapes they can take, the shape of a snowflake is still highly constrained by the nature of how snowflakes are made and the laws of physics involved. Just as there is a snowflake nature and a human nature, there may well be a culture nature and an organization nature. Universals and diversity coexist perfectly when we come to understand that universals are often best stated as constraints on systems rather then claims that some superficial entity must appear in every system. We don't demand that a theory of snowflake nature should be able to predict the exact shape of any snowflake; we only demand that it define and explain the (infinite) class of possible shapes and tell us what can't be a possible snowflake. We should demand no more and no less from a full theory of organizations.

[3]Our example is not uncontroversial, although it should be. Most contemporary linguists are willing to acknowledge that there is a great deal of innate structure for learning and using language, although they disagree about what degree this should play a role in developing linguistic theory. The controversy is that the champion of the innate structure view, Noam Chomsky, rejects the notion that language capacity is an adaptation. Dennett (1995, §13.2) provides an outstanding analysis of Chomsky's position. Pinker (1994) provides an excellent and accessible overview of what is known about what he calls "the language instinct" and definitely champions the view that it is an adaptation.

There may be a vast, even infinite, number of ways that cultures can be set up, but that doesn't mean that we can't still work to define the class of possible cultures. The class of prime numbers (whole numbers greater than 1 that can only be evenly divided by 1 and themselves; for example 7 but not 9) is infinite, but is still only a very small portion of the whole numbers.[4] Flexibility, responsiveness and variety are not facts about human nature which challenge the evolutionary approach, they are facts about human nature which the evolutionary approach must seek to explain.

Evolutionary psychology makes great use of the notion of "Environment of Evolutionary Adaptation" (EEA). Because of the time the evolution takes, requiring stable selective pressure over many hundreds or thousands of generations for anything but the simplest traits to evolve, EPers look at the millions of years between now and the time that the common ancestors of ourselves and the chimpanzees lived. It is those millions of years of evolution and the selective pressure then that made us who we are genetically, and not the past few thousands of years. So, EPers look at the supposed selective pressures on the members of hunter-gatherer bands living in the African savannah for clues as to why our minds are the way they are. Many facts about human nature are obvious, such as our level of visual acuity (less than a hawk's, greater than a mole's) or some aspects of our sense of taste (we like sweet things).

But it is not those obvious things which are of interest to the EPer. It is our social nature which draws attention. We must never forget that when we talk about the environment of our distant ancestors they – like us – lived or died, mated or were childless, raised viable children or failed to raise viable children mostly by successfully or unsuccessfully dealing with other people. Like hell, our environment is and was other people. EP is mostly, but not entirely, about social and sexual psychology.

We are very strange animals. For any well studied species there are a number of unique or unusual properties, but it might be useful to mention just a few possibilities.

1. We are one of the few mammals with large paternal investment in care of off-spring

2. We are the only species with a large combinatorial communication system (human language).

[4]For those who want to know how small a portion, the number of prime numbers less then n is approximately $n/(\ln n)$ (Schneier, 1996, p. 258). Basically the density of prime numbers slowly decreases as you look at higher and higher numbers, so in the very high ranges they are rare, but there are still an infinite number of them.

3. We are the only species which engages in large scale trade.
4. We are the only species with brain lateralization (left brain, right brain)
5. We are the only species that engage in rational planning.
6. We are the only species to use arbitrary symbols to identify group affiliation.

1.1 What sorts of thing have EPers learned?

Work in EP over the past decade has produced many results from otherwise inexplicable patterns of grief for the dead (e.g., Crawford et al. 1989) to testable hypotheses about the nature and role of gossip (e.g, Barkow 1992) and an understanding of the heartache associated with love (e.g., Tennov 1979); from sex differences in delusions of persecution (e.g., Walston et al. 1998) to perceptions of violations of group norms (e.g., Wenegrat et al. 1996); from the patterns of cooperation and redistribution among the sago producers of Papau New Guinea (e.g., Dwyer and Minnegal 1997) to studies on willingness to take risks (e.g., Rubin and Paul 1979; Wang 1995).

There are countless articles advancing the understanding of sexual behavior, including mate choice and different perceptions of sexual behavior. There is a whole stream of research on social exchange, reciprocity, altruism, cooperation, cheater detection and the emotional system that support these behaviors. If one were to do a count of work published in the last ten years using EP, it is very likely that the two areas, sexual behavior and cooperation, make up the bulk of the work. Third place would probably be investigations of our moral sense.[5] Over the past few years there have appeared both a number of popularizations of EP and scholarly books that can be read by people in other fields. The origins of our moral sense (and to a lesser extent our emotions) has been one major area leading to such books as *The Moral Sense* (Wilson, 1993), *The Origins of Virtue* (Ridley, 1996)[6], *The Moral Animal* (Wright, 1994), *Passions within Reason* (Frank, 1988), most recently *Unto Others* (Sober and Wilson, 1998), which is reviewed in this issue, and very exciting recent contribution in this area is *Just Playing* (Binmore, 1998).[7] There have been more general books that address cognitive science and how the mind works from an evolutionary perspective, most

[5]We have not done that count, so our point here is speculative, but we would be willing to put money on the result.

[6]Some of the material for this introduction is taken from a review we wrote of that (Markóczy and Goldberg, 1997).

[7]The editor regrets her failure to successfully arrange a review of that book for the special issue. Among many insights and clarifications that it provides, it makes an extremely

notably *How the Mind Works* (Pinker, 1997) but also *The Prehistory of the Mind* (Mithen, 1996) and *Evolution in Mind* (Plotkin, 1997) among many others. More anthropologically oriented books (but still accessible to the non-anthropologist) include *Human Universals* (Brown, 1991), and *Human Nature: A critical reader* (Betzig, 1997) and others. In social psychology a recent collection, *Evolutionary Social Psychology* (Simpson and Kenrick, 1997), shows why in the words of the editors "social psychology and evolutionary theory need each other" (Kenrick and Simpson, 1997).

While it might be an exaggeration to claim that there has been even a mini-boom in this area, evolutionary psychology is catching the interest of ever more people and so is something to pay some attention to just for that reason.[8] But that is hardly the only reason to pay attention to EP. In a sense, this special issue is about why those studying management and organization should pay attention.

1.2 EP, sociobiology and ethology

Many readers may very well be asking whether Evolutionary Psychology is just sociobiology by another name. A much smaller portion of readers will be wondering whether sociobiology is just human ethology by another name. There are subtle and important differences between those three movements in the study of behavior, but there is a tremendous overlap. However the popular misunderstanding of sociobiology (often equating it with Social Darwinism) has made it impossible to begin a conversation saying that one is taking a sociobiological approach. According to Binmore (1998, p. 180–181):

important contribution by taking the task of model building seriously. That is an attitude that helps clarify and avoid certain types of errors.

[8]Bandwagon type arguments or means of persuasion – although fallacious – have, at least in the case of mate selection, an outstanding evolutionary pedigree. Those who have more popular children (or children who have a larger or better choice of mate) will have more or "better" grandchildren. If traits that lead to popularity are heritable then even if you don't find a particular potential mate attractive, the fact that others of your sex do should increase his or her attractiveness to you. You will have more grandchildren if your children inherit whatever it is that makes one popular, so you are better off mating with someone popular. There are many things that need to be clarified about this argument, and if you find it fishy please read section 2 and then come back to this. Most notably, the behavior of seeking the popular mate does not have to lead to more grandchildren in our current environment, but only had lead to more grandchildren on average during a substantial portion of the millions of years of human evolution (section 2.9). Also note that for this argument to work, we are not claiming that people actually think like that or make the calculations, nor do our genes make that calculation. It just happens to be the case that if a gene leads us to be more attracted to popular potential mates, then all things being equal, that gene will leave more copies of itself in subsequent generations.

> One must also be aware of [those] who wilfully misrepresent evolutionary theories in order to denounce them as simplistic... So successful has this campaign been that one must now refer to much of what used to be called sociobiology as evolutionary psychology or behavioral ecology if one hopes to evade knee-jerk abuse.

But now that we have admitted that much of sociobiology is carried over into the approach of evolutionary psychology, we ask the reader one thing: Before you dismiss EP (or sociobiology or human ethology) with "oh, I know what that is, or at least I have overheard people who pretend to know what that is, and it's bad" please do us the courtesy of reading the sections of this essay which discusses popular misunderstandings of evolutionary theory (sections 2–5). If you are of the opinion that Edward O. Wilson's book, *Sociobiology* (Wilson, 1975), is a book about biological determinants of human societies or people's behavior within them then you have been grossly misinformed, and you should be extremely cautious about passing judgment on a book that is almost entirely about entomology. As Dawkins (1989, p. 329) says about *Sociobiology*, "I wish people would read it more and read about it less."

1.3 EP and reductionism

The approach we are taking is unabashedly reductionistic. We have provided a slightly more detailed reply to anti-reductionists elsewhere (Goldberg and Markóczy, 1998) and here we only point out that reductionism when understood as trying to explain something in terms of simpler things and in terms of things already explained should be uncontroversial (Dennett, 1995, p. 80–83). We think that Dawkins (1986, p. 13) described the situation well:

> If you read trendy intellectual magazines, you may have noticed that "reductionism" is one of those things, like sin, that is only mentioned by people who are against it. To call oneself a reductionist will sound, in some circles, a bit like admitting to eating babies. But, just as nobody actually eats babies, so nobody is really a reductionist in any sense worth being against. The nonexistent reductionist – the sort that everybody is against, but who exists only in their imaginations – tries to explain complicated things *directly* in terms of the *smallest* parts, even, in some extreme versions of the myth, as the *sum* of the parts! [emphasis in the original]

Binmore (1998, p. 514) asserts his reductionism even more strongly:

> But if we want to know why our subjects apply one particular fairness norm rather than another, we need to begin by looking at an optimizing model that studies the evolution of fairness norms in the environment that actually shaped them. The disastrous research strategy to which advocates of *homo ethicus* are prone reverses this reductionist approach. Instead of moving *down* a level when they find their current optimizing model fails to work well, they move *up* a level. But it is a fatal error to attempt to explain low-level phenomena in terms of high-level phenomena. Biologists have demonized Wynne-Edwards for falling pray to this mistake. Economists and philosophers who try to explain individual behavior in terms of various notions of "group rationality" have so far escaped similar treatment, but I would be very happy to place them in at least the outer circle of hell among the noble pagans.

If you are among the far too many people who thinks that reductionism is some evil to be avoided by all right minded compassionate people, please think again. Reductionism is about providing explanations in a way that doesn't beg the question. It is not about explaining high level phenomena directly in terms of the lowest possible levels. If you are among the people looking for a way to quickly dismiss the approach we are taking here, you will no doubt find this admission of reductionism a welcome opportunity. We ask you only to be fair when reporting us as reductionists that you clarify what *we* mean by the term.

1.4 EP in organizations

Almost all of the fields that the field of organizations studies draws from are being affected by evolutionary psychology: Anthropology, cognitive psychology, economics, and social psychology. While EP is very hard to date (and could easily be attributed to Darwin), we will say that the contemporary academic movement started with the publication of *The Adapted Mind* (Barkow et al., 1992) because it is that work which brought together so many people from so many disciplines. What has been missing from this perspective is the study of organizations and the behavior of people within them. Management scholars have, for the most part, not been participating in this conversation including so many of the sorts of people management scholars normally draw ideas from.

Actually that is not entirely true. There has been some work by management scholars using and contributing to evolutionary psychology (e.g., Nicholson 1997; Pierce and White forthcoming; Salter 1995; Bernhard and Glantz 1992). But to date those management scholars have not been working with each other, or have even been aware of each others existence, although the organization of this special issue has helped to repair that. This has not been due to any lack of cooperativeness, but merely an artifact of how these management scholars became interested in EP in the first place.

To show why the route that people take to EP may explain their recent (and hopefully short) isolation it may be instructive to describe how we came to our interest in EP. As it is also fashionable to wear ones' motivations on the ones' sleeves, this digression may be seen by some as an essential part of this introduction. We came to EP through three routes. (1) Our interest in cognitive psychology had us follow developments in that area, where EP is definitely discussed and debated. This is particularly the case for the study of the psychology of cooperation, which is a particular interest (e.g., Goldberg and Markóczy 1997). (2) The editor experienced a great deal of cultural prejudice when any time there was some discrepancy in her behavior or thinking or ideas it was attributed to her being Hungarian instead of British. Our reaction to this was to take a closer look at both attributions of differences based on nationality and also at human universals (e.g., Markóczy 1998; Markóczy and Goldberg 1998). (3) Recognizing that the mind and the human perceptual systems must be designed to work most of the time in the environment that the species evolved in provides one of several fronts on which some forms of relativism can be attacked. The incessant (and usually ill-informed) discussions of epistemology that is thought necessary by some in the field of management lead us to pay far more attention to epistemology than we otherwise would have. We are pleased that at least some benefit has come from it.

Now returning to the point of why those working in the areas of management and organization from an evolutionary or human nature perspective have not been working together so far, it is because our connections to EP have been through different routes. One is working on cognition, another decision making, another social psychology, another on economics, another on organizational behavior, etc. It is exactly because EP has an impact across so many fields on so wide a range of interests that matter for the understanding or organizations and people within them that our paths have only just started to cross. Also we are delighted by the fact that articles by management scholars explicitly using EP are beginning to appear in mainstream management journals in addition to this special issue (e.g., Nicholson 1997; Pierce and White forthcoming).

We will return very briefly to more specifics about how EP can shed light on the study of organizations when we discuss some of the individual papers, but first a much longer digression is needed.

2 Misunderstandings of Darwinism

Darwinism and human evolution are things that almost everybody thinks they understand, but few really do. Some of that misunderstanding may be relatively harmless in isolation. Some of the popular misunderstandings are real howlers. "If monkeys turned into people millions of years ago, how come we don't see them do it today?" (as the grandmother of the editor once queried.) But it is not just creationists who misunderstand. On far too many occasions we have heard the claim that humans evolved from chimpanzees or other such factoids from academics in making various arguments about human nature. But what we want to address here are more subtle fallacies and misunderstandings of Darwinism. Three of those fallacies (the "naturalistic fallacy", the "perfection fallacy" and the "nature–nurture fallacy") are so pervasive and pernicious that they deserve extended discussion, and so are discussed in sections on their own. In this section we list some of the more minor fallacies, and give some brief comments.

"The problem with Darwinism is that everybody thinks they understand it, but few people actually do." That slogan is repeated often by those who, like us, wish to have Darwinism discussed by people who are not themselves evolutionary biologists.[9] That necessitates this longest section, attempting to debunk (or at least deny) some of the many fallacies and misunderstandings that are so current in the public (and even professional) discussion of evolution and how it relates to human behavior. Many writers have put a great deal of effort into doing what we are attempting to do here. While there may be a few novel points made in what follows, it should generally be understood as being based on either books for the general public on evolution and human behavior (e.g., Pinker 1997; Dennett 1995; Ridley 1996; Wright 1994; Dawkins 1986; Cronin 1991; Gould 1977, 1985a) and several volumes such as this have also included discussions of misunderstandings of Evolution and human behavior (e.g., Symons 1992; Kenrick and Simpson 1997). So, if so many people who are both more knowledgeable and more eloquent then we are have said all this before, why are we saying this here? There are several reasons. (1) If we said "stop reading this right now and come back

[9]We have not be able to trace the origin of the slogan. Dawkins (1989, p. 19) attributes a similar, but not identical, sentiment to a statement made by the evolutionary biologist Jaques Monod.

to it after you have read, say, *Darwin's Dangerous Idea* (Dennett, 1995), you either wouldn't do it or we would never see you again. (2) No one source lists the sorts of objections and misunderstandings that we have encountered among organization scholars. (3) We actually do feel that we have a few new things to say on some of these topics.

If the approach we are advocating is going to be opposed and objected to, we want it to be opposed and objected to for the right reasons. Likewise, if it is going to be supported, we don't want it supported for the wrong reasons. We also want to prevent someone doing like Arthur Koestler, who, in the words of Steven Jay Gould was "conducting a campaign against his own misunderstanding of Darwinism" (Gould, 1980, p. 34).

2.1 The momentum fallacy

If hominids have lost body hair over the past 2 million years, then, we might suppose, that we should be totally hairless in another million years. That is an instance of the momentum fallacy. Extrapolating changes in the past to the future implies a belief that there is a certain momentum to those changes. That there is a force driving them which is ever present and will force the changes through to some sort of completion.

We must remember that the principle driver of evolution is selection pressure in the present (and in a broader sense, the past). Hominids may have always had a near optimal amount of body hair at each point in their history, and we may have a near optimal amount now. Change will only occur if there is sustained selective pressure for that change over a large number of generations.[10] If the environment and selective pressure doesn't change, then there is no reason to expect a change in the species.

2.2 The teleological fallacy

A very closely related fallacy to the momentum fallacy is the belief that evolution has goals or is working toward something. We are the product of evolution, but nothing set out to produce us. There are no future oriented goals, no targets.

[10]The word "only" in that sentence is a bit controversial. There may other sorts of changes, due to drift for example, which are neither adaptive nor a response to selection pressure. We had the pleasure to take a half day before the 1998 Behavioral Decision-making Research in Management conference in Miami to visit some of the isolated islands in the Florida Keys where we saw some of the land snails (one the the *Cerion* sub-species that have been used so well as examples of genetic drift (e.g, Gould 1985b). Nonetheless, in the context of this discussion we can ignore drift, which, if truly drift, cannot have any momentum either.

The evolutionary process is fundamentally retrospective. It will put together a collection of genes which have succeeded at building bodies that produced more copies of those genes *in the past*. The only reason that evolution works is because the future has always been enough like the past for the solutions that worked in the past to generally work in the future. When the future is suddenly not like the past, there are mass extinctions.

The symbiosis that led to eukaryotic cells and enabled the development of multicellular life forms (Margulis, 1981) did not happen because it would some day lead to multicellular life; it happened because it was good for the participants at the time. Certainly we would not be here to consider it had it not happened, but it didn't happen for us.

2.3 The "more evolved" fallacy

Humans are not more evolved then amoebas. Humans are more complex. But both species have had exactly the same amount of time since they separated to evolve into their contemporary forms. Human genetics may have changed more over that time, but the amoeba is as evolved as we are.

This seems obvious when pointed out, but it is a fairly widespread fallacy, as Dawkins (1986, p. 261) points out:

> The myth that mammals, for instance, form a ladder or 'scale', with 'lower' once being closer to fish than 'higher' ones, is a piece of snobbery that owes nothing to evolution. It is an ancient, pre-evolutionary notion, sometimes called the 'great chain of being', which should have been destroyed by evolution but which was, mysteriously, absorbed into the way many people thought about evolution.[11]

The fallacy probably underlies the statements that humans evolved from chimpanzees. You no more evolved from chimpanzees then you are a descendent of your cousin.[12] Whether the common ancestor of humans and chimpanzees were very similar to modern chimpanzees is another question altogether.

Looking at evolution and the tree of life in human terms – how did humans happen? – can lead us to mistakenly see ourselves as a goal of evolution. It

[11] We suspect that this is one point that creationists correctly understand about evolution, and much of their resistance to it is exactly because they firmly insist on a separation between ourselves and other living things.

[12] This is not a perfect analogy because there are places where people really are descendents of their cousins. The Ptolemaic dynasty would probably be a place to look for examples. Still it is a safe bet that no human is a descendent of any chimpanzee.

also leads us to measure everything in terms of ourselves. And it is that arrogance that underlies some of these misunderstandings.

2.4 The driver-seat fallacy

It is all too common for people to imagine that evolutionary psychologists and others are claiming that our thoughts and emotions are driven by our genes. One critic of EP has written "[a]ccording to those so-called evolutionary psychologists, our thoughts and actions follow the dictates of our selfish genes" (Rose, 1998). This fallacy misunderstands the way that genes work. Genes build bodies. More precisely genes contain information used in the process of building bodies, like a recipe.[13] Once the body is built, the genes have no control or influence on what those bodies do. Of course they build bodies which will tend to leave viable copies of those genes around for the future since there aren't many descendents of genes without that property. But the genes have no way of controlling the bodies that they build.

It makes no more sense to say that genes drive our thoughts and emotions than it does to say that genes pump our blood. Our heart pumps our blood and our brain drives our thoughts and emotions. Both organs are built using instructions coded in our DNA, but once those organs are built, our DNA has no opportunity to dictate anything to them.

Our genes are not in the driver's seat, we are. Our genes are *not* components of our psychology, but instead they are an important part of *building* the components of our psychology.

2.5 The selfish fallacy

Anyone who thinks that Dawkins in his now classic book, *The Selfish Gene*, wrote that people (and other forms of life) are ultimately selfish, should actually read the book instead. Genes are selfish but that doesn't mean that the bodies that they build are selfish any more than blueprints build blue houses. Dawkins is very clear about this in his writing, yet many people have been mislead by the title combined with some variant of the driver seat fallacy.

Once one learns to avoid the driver seat fallacy, it becomes easy to see that selfish genes can build selfless individuals. Yes, the genes build individuals that way for selfish reasons (from the gene's point of view), but that does not make the individual any less selfless.

[13] As argued very well by Dawkins (1982, p. 174–7), the recipe metaphor is much less misleading than the blueprint metaphor. Blueprints specify design and structure; recipes specify how to make something. Genes are better thought of as specifying a recipe.

A parent making huge sacrifices for its child is behaving very selflessly. Its self-sacrifice is entirely genuine. That its behavior benefits the genes that build the structures that drive the behavior does not diminish the pure selflessness of the behavior and the structure behind it. The gene, which built those structures, is selfish; not the structures. not the individual.

It should be noted that taking the gene's eye view toward understanding life and evolution frees us from focusing on the individual. In the vast majority of cases what is good for the gene is good for the individual, and this has lead to the tradition of focusing on the individual. Ironically it is the selfish gene view which allows us to liberate the study of evolution from being locked into viewing everything in terms of the individual. This runs counter to one of the many absurdities claimed by Lewontin (1993) who first claims that the reductionism implicit in the selfish gene view underlies an individualistic view of society, and that...

> This individualistic view of the biological world is simply a reflection of the ideologies of the bourgeois revolutions of the eighteenth century that simply placed the individual at the center of everything. (Lewontin, 1993, p. 107)

Yet it is exactly the selfish gene view which allows biologists to understand, for example, the societies of ants, bees and termites, which could never be made sense of by studying the interests of the individual insects.

2.6 The levels fallacy

Genes can build structures (including psychological ones) which behave on levels far removed from the gene. Genes can build bodies that behave in a way which make them behave altruistically toward members of their group, or their kin. They can build cells in bodies which behave nicely to their neighboring cells. Just as we pointed out that selfish genes can build selfless individuals, they can also build selfless parts of individuals or selfless collections of individuals. Evidence of group oriented behavior is not evidence against selfish genes. The selfish gene view is nearly tautological: There will be more copies of genes which produce things that help ensure that there will be more copies of those genes. But the structures created might involve great deals of unselfishness and cooperation. The levels fallacy is to forget that the interests of the individual, group, or part of an individual is not identical to the interests of its genes. These can and do differ without tension or contradiction.

What this means is that evidence of unselfish behavior of individuals or other units is not evidence against the notion of the selfish gene. If fact, it is

exactly these sorts of self-sacrificing behaviors that are used to illustrate the concept of the selfish gene.

2.7 For the good of the species

One occasionally hears mention of things evolving "for the good of the species". That sort of argument entails a form of the group selection that not even its most vocal advocates would accept. Living things don't do things for the good of their species. They do things because they are built that way by their genes, and their genes have built them in ways that have tended to leave more copies of those genes over past generations. In many cases, what is good for the individual is good for the species. Something that helps antelopes out run cheetahs helps both the individual antelope and the species. But sometimes the interest of the individual and the interest of the species don't coincide. Something that helps a redwood tree grow higher than its neighboring redwood trees helps that individual tree, but the species of redwood trees would be better off if they didn't compete with each other for sunlight in that way.

An extreme version of this fallacy appears in some forms of the *Gaia* notion of considering life on Earth as a single holistic entity with a purpose and mega-macro level survival mechanisms, in the activity of some species or individual can be seen as being for maintaining a global balance. See Williams (1997) for a critique of *Gaia*.[14]

2.8 The gene as a level fallacy

This subsection may not be of much interest to most readers, but does address a fallacy that confuses some of the discussion around the evolution of altruism and Group Selection controversy.

It is all too easy to talk about the "individual level" and the "group level" and the "gene level" and "species level" with respect to evolution and selection (e.g., Wilson and Sober 1994). What must be understood, however, is that talking this way is a short-hand way of speaking which works well most of the time, but can occasionally lead to misunderstanding. In a hierarchy of levels for selection or "vehicles" of selection, the gene doesn't really belong. A gene is a bit of information that is embodied in molecules over large spans of space and time. A molecule, cell, individual, group of individual, larger

[14]It is not our place here to review the various *Gaia* notions which range from the mystical to the trivial, but we have little sympathy for Lynn Margulis, one of the founders of the notion, when she complains that it has been misunderstood by New Age mystics (Margulis, 1998), since the work invites that misunderstanding.

group of individual and so on are far more transient then genes. If one wants a hierarchy of vehicles for selection, then bits of DNA (or RNA in the case of viruses, or even bits of protein for prions) are what should be in the hierarchy. Genes should not appear in that hierarchy. By definition, genes are what are selected for and are the builders of what selection acts upon, but other things are the vehicles for selection. Those vehicles of selection can be organized into a hierarchy that includes groups, individuals, and segments of DNA molecules.

It is often convenient to place genes in the hierarchy, but that leads people to the mistaken view that the "selfish gene" notion doesn't apply when talking about individual or group level selection. In fact, the selfish gene notion always applies, irrespective of the level in a hierarchy of vehicles of selection. While we have other disagreements with Elliott Sober and David Sloan Wilson about group selection, we agree with their statement:

> In short, the concept of genes as replicators, widely regarded as a decisive argument against group selection, is in fact *totally irrelevant* to the subject. (Sober and Wilson, 1998, p. 88).

This is because genes, for their own selfish reasons, can build selfless individuals, selfless strands of DNA, or selfless beings at other levels of selection if it increases the chances of that gene increasing its extent in the population.

2.9 The time-scale fallacy

We must remember that it is only a few hundred generations between us and Plato. Evolution requires a sustained evolutionary pressure over thousands of generations to have an effect.[15]

It is this which explains the apparent paradox of things like contraceptive mechanisms. As Donald Symons puts it:

> The brain/mind mechanisms that constitute human nature were shaped by selection over vast periods of time in environments different in many respects from our own, and it is to these ancient environments that human nature is adapted. Because modern contraceptive technology has existed for an evolutionarily insignificant amount of time, we have no adaptations specifically designed to deal with it. (Symons, 1992, p. 138)

[15]The number of generations to have a noticeable effect on a population depends on the strength of the pressure, what one means by "noticeable effect" and many other things. But without some exceptionally strong selective pressure, we should really be talking about many thousands of generations at a minimum.

Steven Pinker (1997, p. 42) puts it more simply: "Had the Pleistocene savannah contained trees bearing birth-control pills, we might have evolved to find them as terrifying as a venomous spider."

Often people are asked to give evolutionary explanations for things like adoption, contraception and the like. With a little imagination one can come up with an initially not-implausible story about almost anything. Sometimes that might be a useful exercise, other times it may not be.

> Adoptions and contraception, like reading, mathematics, and stress-induced illness, are products of an animal that is living in an environment radically different from the one in which its genes were naturally selected. The question, about the adaptive significance of behavior in an artificial world, should never have been put; and although a silly question may deserve a silly answer, it is wiser to give no answer at all and to explain why. (Dawkins, 1982, p 36)

Of course it may very well be useful to ask about the evolution of such behavior, but it is silly in many cases to expect that the answer should somehow show that the behavior is adaptive in our current environment, by which we mean not just our environment at the dawn of the twenty-first century, but our environment since the dawn of civilization.

When we combine our understanding of the differences between our very new environment and our understanding that our goals are not always our genes' goals, then we can stop puzzling over every bit of behavior which runs counter to propagating our genes. And when we understand the time scales involved, we can dismiss the arguments of those who paint "dysgenical" nightmares or eugenical utopias based on 20th century demographics.[16]

Richard Dawkins (1986, p. 162) argues that one reason that we fall into this fallacy is that "we are equipped to make mental calculations of risk and odds, with the range of improbabilities that would be useful in human life." So our minds are designed to deal with time spans of a few generations at most.

> Evolution has equipped our brains with a subjective consciousness of risk and improbability suitable for creatures with a lifetime of less than one century... If on some planet there are beings with a lifetime of a million centuries... [t]hey will expect to be dealt a perfect bridge hand from time to time. (Dawkins, 1986, p.162)

[16]There are many other reasons to dismiss the dysgenical nightmares, but that is not what this essay is about.

We can easily imagine the difference between one hour and 42 days (one thousand hours), but our minds boggle at conceptualizing the difference between 1 million years and 1 billion years (one thousand million years). Yet for human evolution we do need to think in terms of millions of years, an expanse of time our minds don't naturally cope with.

2.10 The happiness fallacy

Once we recognize that there are substantial differences between our current environment and the environment we are adapted for, the immediate reaction of many is to suggest that much of our unhappiness is because of this difference. But we must be careful jumping to that conclusion. While Thomas Hobbes may have been wrong about "solitary" he was probably pretty close to the mark in other respects with the view that the life of man in the state of nature was "solitary, poor, nasty, brutish and short." We are evolved to be made happy by certain things and miserable by others. It's the misery of hunger that drove our ancestors to collect and hunt food in the face of danger, as well as the satisfaction of a good meal.

We suspect that some of the attraction of the happiness fallacy is a result of some form of the naturalistic fallacy which will be discussed below. It is part of our romanticizing nature and natural states. That is, many people choose the replace Hobbs' imagine with John Locke's view of the Nobel Savage.

2.11 The explicit knowledge fallacy

Some of the mechanisms proposed by evolution for explaining our behavior are extremely sophisticated and may involve very complicated calculations. Every now and then someone responds with "Yes, but we can't make those calculations." The comment is true, but beside the point.

While it is true that we can't explicitly make the calculations, it is also true that plants can photo-synthesize without a PhD in chemistry; sunflowers can maximize their faces exposure to the sun without being able to pass a high school geometry class; a viceroy butterfly can imitate the less palatable monarch butterfly, without being able to write books about bird psychology and visual perception; and the literally bird-brained predator of the viceroy can fly very well without ever having heard of Bernoulli forces and the fluid dynamics needed for the understanding of winged flight.

When brainless forms of life have evolved structures that do very clever things, we don't demand that those creatures (or plants) have an understanding in their minds of how or why they do it. But when creatures with

substantial brains have evolved structures which lead them to do very clever things, some people do like to point that their brains just aren't up to the task. This is a peculiar double standard.

What makes the double standard behind this fallacy even more peculiar is that it tends to come from same people who criticize the "rationality assumptions" of economics. Yet it is the people who are falling into this fallacy who are attaching too much importance to human rational reasoning capacity.

Once we understand that evolution can build structures that do remarkable things without the need to build minds that consciously understand those things we no longer have any paradox recognizing that our bodies and brains are smarter than we are.

2.12 All "Just So Stories"

Those who seek evolutionary explanations are often accused of making up "Just-So stories" (named after the series of stories by Rudyard Kipling on such matters of "How the Elephant got its Trunk" (Answer: stretched in a tug-of-war with an alligator.)). This debate has been gone over and discussed in so many places that we find we have nothing to contribute, and are frankly tired of it. See Dennett (1995, pp. 242–251) for a fuller discussion of this. We only wish to point out that the goal of the enterprise is to use what we know about human evolution to develop testable hypotheses which we then test. That is a multi-stage process. It involves discovering what we can about human evolution from the sources available to us; it involves generating hypotheses; and it involves testing and refining those hypotheses. Some of the earlier stages in this process will be more speculative than the later stages. We believe that speculation has its place if it is clearly labelled as such. Indeed some of the articles in this volume are more speculative than others. The contributions by Spitz, Waldron and Watson are at the more speculative end of the spectrum, but are included because they introduce what the editor sees as very fruitful directions for further work. While the contribution by Browne, for example, gathers an overwhelming case based on a wide variety of solidly established evidence. Several of the other contributions (e.g., Evans, Markóczy and Goldberg) report on experiments that were devised to test hypotheses derived from evolutionary thinking.

Speculation is also held in check by developing formal models. They may still be speculative, but at least it is clear what follows from those models with their very explicit assumptions. The contributions by Hirshleifer and Rubin and Somanathan do that.

Finally, a last word about speculation. We need to be careful about

double standards. The charge of speculation or Just So Story is often levelled at those working from an evolutionary perspective, and often with some justice; but we suspect that what appears in scholarly journals in the social sciences – including management – is certainly no less speculative then what appears in the EP, sociobiology and human ethology journals. Yet because the charge is particularly levelled at those taking an EP approach, we must be more careful in recognizing our speculations and labelling them as such. We hope that the critics will do the same for their own approaches.

2.13 The deterministic fallacy

Are we any less the masters of our destinies if our minds are built by our genes? Are we preprogrammed to be who we are in a way that denies our flexibility as individuals and as parts of societies? First of all, the question of free will and genetics is a red herring. Whether our minds are shaped entirely by our genes or entirely by the society in which we grow up, the consequences for free will are identical. Whether "my genetic make up made me do it" or "my upbringing made me do it" or "the Devil made me do it" one should be no more or less responsible for their actions, either morally or legally. As long as the thoughts and feelings are caused by something, whether by biological structures or social structures, the puzzle of free will remains.[17]

Some have tried to argue that an evolutionary approach to human behavior can't be right because human behavior is variable and flexible, while a genetic approach implies that our behaviors are programmed. But once the driver-seat fallacy (section 2.4) is cleared away, such an argument just doesn't follow. And as mentioned earlier, it is the extra "innate" structure of a computer that gives it far more flexibility than, say, a toaster, which has far less wired into it.

It is interesting that those who fall into this fallacy appear to give a special status or privilege to genetic causes of which they are not giving to other causes of behavior.

[17]For the record, our view on free will is that ultimately in the strictest sense it doesn't exist, since physical events have physical causes. However, for all practical and ethical purposes we can act as if it does exist in the same sense that we can consider a bowling ball to be a single solid object without having to consider the fluidity of all of the quantum mechanical entities that make it up. Free will is real at the macroscopic level. In this, we are basically following the view of Dennett (1984). But whatever one's view on the question, the issue of biological versus social causes for behavior should make no difference.

3 The Naturalistic Fallacy

The biologist John Maynard Smith, when commenting on a politically motivated attempt by someone named Don Smith to modify evolutionary theory so that homosexuality would not be seen as maladaptive, said:

> I think [Don Smith] would have been better to say:
>
> > If people have despised gays because gayness does not contribute to biological fitness, they have been wrong to do so. It would be as sensible to persecute mathematicians because the ability to solve differential equations does not contribute to fitness. A scientific theory – Darwinian or any other – has nothing to say about the value of a human being. (Maynard Smith, 1988, p. 40–41)

Don Smith's political motives may have been laudable, but as Maynard Smith points out, he had no need to revise the theory. All he needed to do was recognize that biology does not teach morals. Something isn't "right" merely because it is natural, and something isn't "wrong" merely because it is unnatural. Maynard Smith goes on to propose at least a partial answer to why the naturalistic fallacy is so strong and so pervasive even though it is so obviously a fallacy.

> In all societies men have constructed myths about the origins of the universe and of man. The function of these myths is to define man's place in nature, and thus to give him a sense of purpose and value. Darwinism is, among other things, an account of man's origins. Is it to be wondered at that it is expected to carry a moral message? (Maynard Smith, 1988, p. 41)

Almost everyone who writes about the issue finds it necessary to say that while the study of human evolution can't tell us what is right, it can help us understand how we come to have a feeling for what is right. What is important is that we make the distinction. We can look to human evolution for an account of our moral sense just as we can look to human evolution for an account of our color perception, but that is not the same thing as looking to human evolution for an account of the electromagnetic spectrum or for an account of what is right.

Steven Jay Gould, who generally is not considered a supporter of evolutionary psychology, is one of the many people who made exactly this point

> . . . nature (no matter how cruel in human terms) provides no basis for moral values. (Evolution might, at most, help to explain why we have moral feelings, but nature can never decide for us whether any particular action is right or wrong.) (Gould, 1991, p. 327)

All of those who have worked to understand exactly how evolution can help to explain why we have moral feelings (e.g., Wilson 1993; Wright 1994; Ridley 1996; Binmore 1998) and others say basically the same thing in this regard. Almost all writers about evolution for non-biologists such as Richard Dawkins and Steven Jay Gould have found it necessary to repeat this point many times and in many places. It seems obvious once it is pointed out the we can't immediately jump from what is natural to what is right. This means that either all of these writers (and so many more) as well as ourselves are belaboring an obvious point or there is some special need for the repetition.

We believe that there is a special need for the repetition. The naturalistic fallacy is not so often used in its most obvious forms, but is often used more subtly, even by those who reject it when presented with it in the straightforward sense.

3.1 The case of redistribution

To illustrate how the naturalistic fallacy crops up subtly in very surprising cases we will create two caricatures, Sally and Ann, who are arguing about the merits of welfare. Neither Sally nor Ann exist and their names are arbitrary. Ann says:

> I believe that given the welfare and the growing equality of opportunity that exists in our society, most differences in outcome are due to people's internal motivation, innate skills, learning and personality differences. Therefore, except where we have clear cases of inequality of opportunity we should eliminate most other welfare payments. The poor are poor because they don't have what it takes succeed, and there is no point in throwing money at them.

Sally is appalled by Ann's position as says:

> People are created equal, and we all know from reading things like the *Mismeasure of Man* (Gould, 1981) – or at least talking to people have read something about the book – that there are no innate differences between people. And even if there are differences, they balance out. Someone who is good at some particular thing,

> will be bad at something else and someone who is bad at some particular thing will be good at something else. So all differences in outcome are either due to luck or inequality of opportunity.

Please note that for this discussion we are talking about differences between individual humans, not sexes or "races". The point we are making is that both Sally and Ann are committing the naturalistic fallacy. For both Sally and Ann the responsibility that we as a society have to help the poor within the society depends on whether their poverty is due to their genetic make up. Ann wants to assert that it is, so that it is somehow "right" that they are poor, while Sally wants to deny that there is a genetic difference in their nature, and wishes to maintain that each person can potentially make equal in value contributions to society given the right opportunities. For both Sally and Ann, the policy we adopt depends crucially on whether their poverty is a consequence of their genetic make up. What we would like to ask both Ann and Sally is why should it make a difference whether the source of the inequality of outcome be genetic or otherwise.[18] Of course Sally and Ann are caricatures designed by us for our purposes, and the real arguments involve many more issues. But we do feel that the naturalistic fallacy underlying both Sally's and Ann's position is implicit in the larger public debate on redistribution.

We suspect that many of those who object to the study of human psychology and society from an evolutionary point of view are reacting negatively, because, like Sally, they are implicitly invoking the naturalistic fallacy and imagining that evolution would undermine their pro-redistribution beliefs. If, however, the naturalistic fallacy is clearly identified as a fallacy, then the question of how much redistribution is desirable for different societies is put on a different footing, and argued with more clarity, honesty and genuine progress by both those who favor less redistribution and those that favor more.

3.2 Genetic engineering

Quite possibly the best (and worst) illustration of the naturalistic fallacy is the near hysteria surrounding genetic engineering. While any type of engineering must be examined and its effects and risks evaluated and judged,

[18] There is one respect in which there is a meaningful difference. If Sally is right, the need for welfare or redistribution should disappear entirely as societies provide more equal opportunities; so spending on poverty relief should only be temporary, and therefore cheaper, under Sally's view. But we have never sensed that that is the core of the arguments.

there is a concern with genetic engineering which is disproportionate. Doubtless new technologies for synthesizing new chemicals and drugs and pesticides and the like are developed every year. But only one class of these particular new technologies has grabbed the public's and politicians' attention: genetic engineering. Why?

Our answer, which we won't discuss in detail, is that this stems from a form of the naturalistic fallacy. The underlying belief seems to be that our genes make us who we are in a privileged way. And the genes of wheat make wheat what it is in a privileged way. Other things, such as the food we've had, education, upbringing also make us who we are; and planting time, soil conditions, use of pesticides, etc also make wheat what it is. But the underlying fallacy appears to be given genes a special status. We feel few qualms about trying to improve ourselves or wheat by manipulating the non-genetic components, but when it comes to genes the reaction is often extraordinary.

Why do genes have this privilege? Why is actively changing something by changing its genetic make up playing God, while changing the same thing by changing the environment of its development a good thing? We don't know.[19] But whatever the reason the fact remains that many people give a special privilege to the way genes affect what things are, a privilege that only a deity should play with.

This is not the place to have a lengthy discussion of the merits and dangers of genetic engineering, nor a detailed discussion of popular understanding of the issues. We use the case to illustrate the power and the subtly of the naturalistic fallacy.

The case of genetic engineering also illustrates one of the central paradoxes of the discussion of the role of genes and values. It is our impression that it is often exactly the people who oppose discussion of a biological or genetic basis of human nature who also seem to be over-rating the importance of genetics by falling into the naturalistic fallacy. This is not as paradoxical as it first seems. If people by way of the naturalistic fallacy give far too much

[19]We can, however, speculate. Humans may naturally view fate as a force or as some personified entity, Fate. If so, it may be very closely linked to the (genetic) variability of children. Parents may be designed to accept of love what Fate dealt them. Accepting of Fate is then a virtue, and challenging Fate is a sin which Fate will punish, just as Oedipus was punished for trying the cheat Fate. That is all pure speculation without a shred of evidence and with a number of holes in the story. Maybe, someday, we or others will make it precise enough to find ways of testing it. Until then, such speculations should be relegated to footnotes. Another, possibly alternative, story is that our minds are designed to distinguish between accidental and essential properties of things, and particularly of "natural kinds". The genes make up the essence, and our minds rebel against such tamperings.

moral weight to our biological nature, they will naturally be frightened of the consequences. Once the naturalistic fallacy is clearly seen and banished, so also vanishes the evil consequences of a genetical basis for human nature.

3.3 Is the naturalistic fallacy really a fallacy?

There are those who seek to "naturalize" ethics (e.g., Arnhart 1998), and they are occasionally accused of making the naturalistic fallacy. Such a debate could easily lead an observer to suspect that the status of the naturalistic fallacy as a fallacy is far from broadly accepted. This section is intended to show that those seeking to naturalize ethics – whether correct or not – are not challenging the status of the naturalistic fallacy, but instead are challenging something else, Hume's thesis. This discussion is based heavily on (Sober, 1994b).

Let us consider four debating points

1. *Naturalistic Fallacy*: What is natural is good
2. *Natural psychology of ethics*: What we see as good is what we naturally see as good.
3. *Natural basis for desires*: What we desire is ultimately grounded in our nature.
4. *Hume's Thesis*: From exclusively *is*-statements one cannot validly deduce *ought*-statements.

Belief in the naturalistic fallacy is clearly a denial of Hume's thesis, since concluding that something is good based entirely on the claim that it is natural is going from an exclusively *is*-statement to an *ought*-statement. But there are candidate violations of Hume's thesis which are consistent with accepting the naturalistic fallacy as a fallacy. For example to claim that "what is desirable is good" is clearly a violation of Hume's thesis, but it does not claim that what is natural is good. There may, after all, be many things which are natural, but not desirable. Combining some version of that claim with a naturalized view of desires may provide a basis for naturalizing ethics which does not involve committing the naturalistic fallacy.

We will not comment on the prospects for naturalizing ethics. All we will do is point out that the controversy over Hume's thesis should not be taken as a controversy over the naturalistic fallacy. We suspect that those who seek to naturalize ethics would agree that the naturalistic fallacy is a fallacy in at least the instances of our examples.

Additionally it must be noted that Hume's thesis does not claim that *is*-statements should have no role in deriving *ought*-statements, but merely that *is*-statements on their own are insufficient. That is, every one, no matter what position they hold about the for debating points above, would agree that when making an individual moral choice certain facts about the world will be relevant.

4 The Perfection Fallacy

Natural selection finds remarkable and truly astonishing solutions to difficult problems, and given its power to optimize, it is easy to slip into the view that almost everything it creates is perfectly optimized for its task. If this were true, it would be reasonable to assume that what natural selection produces is perfect, that all is for the best with the best of possible adaptations. Chapter 3 of Dawkins (1982) is dedicated to "limits on perfection" and lists many important limits and the reader is directed there. Additionally the volume Dupré (1987) contains some excellent discussions on these issues. The perfection fallacy is sometimes called the "Panglossian Fallacy", but that term has been used in so many different ways that we prefer to use our own term (Dennett, 1995, p. 239).

There is one limit to perfection that we particularly wish to focus on here. Adaptations do not need to be perfect, they just need to be good enough. Consider the old joke about two friends, Alice and Bob on a camping trip. One night their campsite is attacked by a bear. Alice quickly grabs her running shoes and puts them on. Bob turns to her and says "Surely, you don't think that you can out run the bear!" Alice answers, "I don't need to out-run the bear; I only need to out-run you."

This sort of adaptation is wonderfully illustrated by the example of the digger wasp *Sphex ichneumoneus* discussed by Dennett (1984, p. 10–13) among others citing Wooldridge (1963). Before it drags food (a cricket that it has paralyzed) into its burrow (which it must do by backing in), the wasp will first check out the burrow head first. After inspecting its burrow, it will emerge and then pull the cricket back in with it. This looks like intelligent, well optimized behavior. If, however the cricket is moved (say by the wind or a biologist) a few inches from the mouth of the burrow the wasp will drag it back to the mouth of the burrow and do a new inspection. If the cricket is displaced again the wasp will repeat the activity including the inspection. This has been tested with up to forty repetitions. Presumably the biologists got bored.

The wasp's behavior certainly seems stupid and maybe even maladap-

tive. But we should be aware that very few of the wasp's ancestors had to face biologists pulling nasty tricks on them. In general, the wasp's behavior and mental ability is good enough on average in the long run although it is obviously far from perfect.

The perfection fallacy is sometimes inseparable from the naturalistic fallacy. If, after all, nature cannot be improved upon and any attempt to do so destroys something perfect, than what is produced by nature is perfect. An illustration of the intermingling of the two fallacies comes from a popular child rearing book (Eisenberg et al., 1989, p. 54): "Bottle feeding, oddly enough, comes more naturally – or at least more easily – than breastfeeding." The attitude underlying the sentiment is that we should be surprised that anything could be easier or more natural than what is natural.

4.1 Gigerenzer and the attack on H&B

One area where the perfection fallacy seems to come out is with discussion of the human mind, and in particular with a line of research in cognitive psychology known of as the Heuristics and Biases program (HB) which looks at how humans assess probabilities as part of research on Judgment and Decision Making (JBM) which Goldstein and Hogarth (1997) provide a history and review of. In brief the program has been to help understand the mental mechanisms and representations used by humans by exploring systematic errors in judgment of probabilities. The attempt is to uncover the specific heuristics and biases humans use when making certain sorts of judgments.

Often this work is done by conducting experiments that show under what conditions people make such errors. The article by Markóczy and Goldberg and one by Evans in this volume are well within this general stream. What we have found is that some students and even some scholars are affronted by research that points out errors in judgment. They object to the use of the word "errors" or "biases" when describing the the results or behaviors. They object to the analysis and apparent disrespect HB researchers have towards human reasoning ability. We, and others working in this area, have learned to anticipate and address these objections when they come from students.

What took us by surprise is that this instance of the perfection fallacy should come not just from students being introduced to the concept, but be published (e.g., Gigerenzer et al. 1988) and picked up in leading journals in the cognitive sciences. What is worse is that the some of the leaders of EP (e.g., Cosmides and Tooby 1996) have also latched on to this criticism. This is particularly odd and disappointing because the HB program on the whole would be fully consistent with EP. By exploring under what conditions the particular heuristics and biases work correctly and where they don't work, we

can gain insight into what sorts of problems they were designed by evolution to solve. There was a great opportunity for cooperation between the HB program and EP that has been missed.

Gigerenzer et al. (1988) argued that one of the examples of erroneous reasoning (the "base-rate fallacy") that had been studied in the HB program was a consequence of the stating the probabilities as probabilities (or percentages) instead of as frequencies. They argued that stating these things as frequencies made the problems was much more natural. Cosmides and Tooby (1996) picked up on this and argued that humans are better intuitive statisticians than the HB people putatively credited them. Citing Gerd Gigerenzer the EP people attacked HB at every opportunity, while ignoring the very serious flaws in Gigerenzer's work (e.g, Kleither et al. 1997).

Steven Pinker in his otherwise excellent popularization of EP, follows the anti-HB line.

> Of course, people sometimes reason fallaciously, especially in today's data deluge. And, of course, everyone should learn probability and statistics. But a species that had no instinct for probability could not have learned the subject, let alone invent it. And when people are given information in a format that meshes with the way they naturally think about probability, they can be remarkably accurate. The claim that our species is blind to chance is, as they say, unlikely to be true. (Pinker, 1997, p. 351)

We agree that "the claim that our species is blind to chance" is unlikely to be true, but we also suspect that the claim is unlikely to ever have been made.

Additionally, Pinker's argument that the fact that we invented probability theory is evidence for an instinct for it is almost too silly to refute. We have invented complex numbers, space travel, FORTRAN77 and hydrogen bombs, yet that hardly argues that we have an instinct for any of those.

But returning to the point, HB researchers have never claimed that people are bad at making judgments about probability, but instead that the mechanisms they use can be fooled in the same way that optical illusions can fool a very sophisticated visual recognition system.

It is simply not a fair accusation. Neither is this:

> Tversky, Kahneman, Gould, Piattelli-Palmarini, and many social psychologists have concluded that the mind is not designed to grasp the laws of probability, even though the laws rule the universe. (Pinker, 1997, p. 344)

Since Pinker spent the preceding chapter of his book discussing how vision works, and almost all of the evidence used for his discussion was based on experiments that somehow fooled the visual perception system, it would be just as fair to say that

> Pinker, Marr, and many vision systems psychologists have concluded that the mind is not designed to grasp the visual world and the laws of optics, even though the laws rule the universe.

It would be absurd to make this claim. Pinker, Marr and other vision researchers constantly point out how the visual processing system can be fooled because that is the best way we have to understand how it does things when it does things right. There are many ways to get things right, and so the way to understand what algorithms and representations the mind uses is to see what sorts of errors it can be tricked into making.

David Kahneman and the late Amos Tversky have made an effort to be clear about this.

> [T]he study of systematic error can illuminate the psychological processes that underlie perception and judgment. Indeed, a common method to demonstrate that a particular variable affects judgment is to establish a correlation between that variable and the judgment, holding the objective criterion constant. For example, the effect of aerial perspective on apparent distance is confirmed by the observation that the same mountain appears closer on a clear then on a hazy day. (Kahneman and Tversky, 1996)

But this point was not only made in response to criticism from Gigerenzer and others, but in anticipation of such criticism. When Pinker (1997, p. 345) mentions Gilovich (1991) (or at least the title of his book), we suspect that he didn't read beyond the title, or at least not as far as page 2 of Gilovich (1991) who writes.

> Nor do people hold questionable beliefs simply because they are stupid or gullible. Quite the contrary. Evolution has given us powerful intellectual tools for processing vast amounts of information with accuracy and dispatch, and our questionable beliefs derive primarily from the misapplication of over-utilization of generally valid and effective strategies for knowing. Just as we are subject to perceptual illusions in spite of, and largely because of, our extraordinary perceptual capacities, so too are many of

> our cognitive shortcomings "closely related to, or even unavoidable costs of, [our] greatest strengths" (Nisbett and Ross, 1980). And just as the study of perceptual illusions has illuminated general principles of perception, and the study of psychopathology has enhanced our knowledge of personality, so too should the study of erroneous beliefs enlarge our understanding of human judgment and reasoning. By design, then, this book dwells on beliefs that are wrong, but in doing so we must not lose sight of how often we are right. (Gilovich, 1991, p. 2)

It may be possible that Pinker and even Cosmides and Tooby have learned about the HB program only from its critics. That is usually a mistake, and in this case a particularly large one. We agree with Kahneman and Tversky (1996) when they defend themselves against the criticism levelled by Gigerenzer.

> It is not uncommon in academic debates that a critic's description of the opponent's ideas and findings involves some loss of fidelity. This is a fact of life that targets of criticism should learn to expect, even if they do not enjoy it. In some exceptional cases, however, the fidelity of the presentation is so low that readers may be misled about the real issues under discussion. In our view, Gigerenzer's critique of the heuristics and biases program is one of these cases.

We raise this issue not only to illustrate an odd case of misunderstanding which might stem from the perfection fallacy. And we certainly don't raise this to ridicule Pinker, whose book is in general excellent and only ridiculous in a few select places. But also this section is a plea to the EP community: Cosmides and Tooby picked the wrong side in this debate. It is not necessary for the entire EP community to follow them blindly down that route.

4.2 Limits on limits on perfection

In this section we have been arguing that we should not always expect evolution to come to perfect solutions. But this can be taken too far. Some of the imperfections we might first see, may make more sense on closer examination. As usual, Dennett (1995) sums up the situation very well:

> There is simply no denying the breathtaking brilliance of the designs to be found in nature. Time and again, biologists baffled by some apparently futile or maladroit bit of bad design in nature

> have eventually come to see that they have underestimated the ingenuity, the sheer brilliance, the depth of insight to be discovered in one of Mother Nature's creations. Francis Crick has mischievously baptized this trend in the name of his colleague Leslie Orgel, speaking of what he calls "Orgel's Second Rule: Evolution is cleverer than you are." [p. 74]

5 The nature versus nurture fallacy

We believe that most discussion of nature versus nature is fundamentally confused. We also realize that many people agree with us, but often for different reasons. Many people will agree with us that discussion of nature versus nurture discussions are often confused, but will begin (and often end) their discussion with "it's a complex interaction of the two." Although it is obviously true, every time we hear that refrain we cringe. For some time, we couldn't quite put our finger on why that made us cringe, but in the opening chapter of his popularization of the evolutionary theory of the mind, Steven Pinker (1997, p. 33) articulates our reaction.

> And the "interactionist" position, with its phobia of ever specifying the innate part of the interaction, is not much better [than the "all or nothing" position]. Look at these claims.
>
> > The behavior of a computer comes from a complex interaction between the processor and the input.
> >
> > When trying to understand how a car works, one cannot neglect the engine or the gasoline or the driver. All are important factors.
> >
> > The sound coming out of a CD player represents the inextricably intertwined mixture of two crucial variables: the structure of the machine, and the disk you insert into it. Neither can be ignored.
>
> These statements are true but useless – so blankly uncomprehending, so defiantly incurious, that it is almost as bad to assert them as to deny them. For minds, just as for machines, metaphors of mixture of two ingredients, like a martini, or a battle between matched forces, like a tug-of-war, are wrongheaded ways of thinking about a complex device designed to process information. Yes, every part of human intelligence involves culture

> and learning. But learning is not a surrounding gas or force field, and it does not happen by magic. It is made possible by innate machinery designed to do the learning. The claim that there are several innate modules is a claim that there are several innate learning machines, each of which learns according to a particular logic.

So, if we think that nature–nurture discussions are generally confused, and if we don't wish to dismiss them with "it's a complex interaction of the two" what makes us consider nature–nurture discussions confused? Well, the answer is that behavior is a complex interaction of the two! Not only is it a complex interaction, but is an interesting interaction, and interaction that psychologists and others are coming to understand parts of.

Despite our ambition, we think that the nature–nurture question often makes little sense. Elliott Sober (1994a) discusses this by asking us to think about why one question makes sense and the other doesn't

1. Is this particle's acceleration due more to gravity or to electromagnetism?

2. Is Jane's height due more to her genes or to her environment?

These are two very different questions. The first one makes sense and the second one seems not to. At first it appears that the difference between the questions is that the first involves additive components. The acceleration of a particle is the sum of the acceleration on in due to certain non-interacting forces, when with genes and the environment there is no simple summing up of a contribution to height. Sober goes to some length to show that although that seems like the essential difference, it is not. There are ways (that we won't go into here) of formulating similar questions which don't differ in whether the forces are additive, but do differ in the essential way the two questions above differ.

If the differences is not that one involves additive forces and the other doesn't, what is the difference? Sober argues is that the first question makes sense in a fundamentally broader range of contexts then the second question. For the second sentence to make sense there must be a specified range of alternative environment and alternative genomes involved.

For example if Jane is a human and we ask the question while wondering what would her height would be if she had been born with the genes of a giraffe then our answer is more likely to be that the genes contribute more. On the other hand, if we expect that Jane could have some range of vaguely European human gene sets, but could have been raised in a low gravity

environment, we might be inclined to say that her environment matters more. The question about Jane's height can only be made coherent by specifying a range of gene-sets and a range of environments. Often researchers looking at influences of particular genes do exactly that. But because those ranges somehow never make it into to popular press reports, newspapers paint a picture of researchers asking and answering non-sensical questions.

This point helps us understand something about what we mean by human nature. We are not talking about the genes that make Jane different from Susan, but we are talking about the genes that make Jane different from Bonzo the chimpanzee or Flipper the dolphin. Given that range of possible genotypes, it is very clear that much of Jane's characteristics are due to her genes.

6 Interdisciplinarity

The contributors to this volume include psychologists, economists, management scholars, and legal scholars. The range of reviewers was far broader including neurologists, anthropologists and others. Through evolutionary game theory economists and biologists are working ever closer together (e.g., Maynard Smith 1982; Sigmund 1993; Weibull 1995; Mailath 1998) some of that interaction is illustrated by the contribution by Jack Hirshleifer and by Paul Rubin and E. Somanathan in this volume. Likewise, there is growing collaboration between economists and psychologists, particularly in the areas of behavioral decision making (e.g., Rabin 1998; Rubinstein 1998) The articles by Martin Evans and by ourselves fall very roughly into that category. Economics and anthropology have enjoyed longer collaboration: Smith (1987) provides a review, and Kacelnik and Krebs (1997) provide a critique, as have anthropology and evolutionary biology. Likewise, there has been growing collaboration among the other fields, all centering around notions of evolution and optimality. It appears that Hirshleifer (1985) was right on target when he discussed "the expanding domain of economics".

Multidisciplinarity can be a difficult thing and is open for abuse.[20] It is too easy for a scholar in field X to claim that she is bringing in notions from field Y while in fact she is only bringing in her very distorted view of Y. To guard against that, the editor attempted to solicit a review from people in both X and Y when a paper by someone in field X imports notions from Y.

[20] At a workshop involving anthropologists, psychologists, economists, and a few management scholars a joke was going around: "Management really is multidisciplinary if we define multidisciplinary as involving n disciplines where $n \neq 1$. After all, zero is not one." One of the goals of the editor, a management scholar, is to help prove the critics wrong.

The hope is that this issue is multidisciplinary in the best sense.

7 The articles in this issue

The contributions in this special issue cover broad ranges in almost all dimensions. Some (Hirshleifer, Rubin and Somanathan) develop formal models and explore what sorts of behaviors we should expect to find. Others conduct specific experiments (Evans, Markóczy and Goldberg). While others discuss particular organizational consequences of our evolved human nature (Nicholson, Waldron, Browne). And some make specific use (or at least mention) of group selection (Hirshleifer, Spitz). With so many different dimensions and categorizations which could be used to discuss these nine papers and two book reviews, we plead opportunity overload, and must rely on a heuristic of sequence to accommodate our bounded rationality. That is, we will discuss them in the order presented.

Nigel Nicholson, who more than anyone has worked to promote the notions of EP within the study of management and organizations, discusses seven consequences for organizations of our evolved human nature. By covering such a wide range of aspects of human nature and the organizations, his paper presents a good introduction.

Nicholson's paper is followed immediately by the contribution of Kingsley Browne, a legal scholar, whose paper is in many ways the opposite. It focuses on one issue: An argument based on human nature that inequality in promotion between the sexes in organizations is not necessarily the consequence of discrimination. This paper provides an excellent example of an extremely thorough review of the literature on one specific area of the study of human nature and its implications for the rules governing organizations.

Paul Rubin and E. Somanathan use explicit models to explore how aspects of human behavior having to do with honesty and work ethics would evolve under those assumptions. They discuss a number of issues and provide one of the clearest examples of the "nature–nurture interaction" by showing a case where an evolved rule turns towards either on honest or dishonest disposition in response to the environment. Jack Hirshleifer also works with an explicit model, exploring the conditions under which the psychology behind coordinated competitive behavior (in particular, war) would evolve. Both Hirshleifer and Rubin have been proponents of the study of evolved human nature in developing our understanding economic behavior for decades. We are delighted that they have stuck with it during the years that anything sociobiological was taboo, and hope that this time around the efforts to fight the misunderstandings of Darwinism will allow their bodies of work to reach

a broader and more receptive audience.

Martin Evans continues to develop the ground breaking work of Cosmides and Tooby (1992) on our ability to detect cheating and looks at is specifically in terms of cheater detection involving individuals in relation to business organizations. His experiments are an important contribution to the stream of work in the cheater detection stream and the first that we know of which considers an organization context. Markóczy and Goldberg also conduct some experiments, but within a stream of research that – the base rate fallacy – which has a history outside of EP and whose integration into EP can take a number of directions. They argue that our minds are tuned to treat probabilities about people's behavior differently than we treat other probabilities.

The last three full papers in the volume are more speculative than the preceding ones, but each represents an important area where the study of organizations and the study of human nature should fit together extremely well. One extremely important – and often unmentioned – part of management research and activity is directed toward consulting. Is what the management consultant does affected by what we have learned of human nature? Andrew Watson discusses some of those issues. Deborah Waldron discusses the extremely important questions surrounding status within organizations and status seeking and maintaining behavior in humans. She provides a very good review of what may turn out to be the area in which EP has its most profound effect on the study of management as well as being the area in which management scholars are most likely to make a contribution to the study of human nature. Another extremely important issue is "groupishness" or "belonging to a club" or "being one of us" and general social and group identity. How much does social identity play a role in important decisions. Janet Spitz looks at exactly that question in schools of thought in certain legal decisions, and provides some discussion of the groupish inclination of US federal judges.

Over the past few years there has been a wealth of important books published which touch upon Management, Organization and Human Nature. Time, space, and frankly organization, allowed for only three of them to be reviewed. Barbara Pierce and Roderick White review two not so recent books together (Bernhard and Glantz, 1992; Salter, 1995), which in their very different ways are specifically about organizations and EP. Ken Binmore reviews a long awaited recent book Sober and Wilson (1998) by the people who are at the center of the controversy about the role of group selection in the study altruism in humans. These two reviews of three books only scratch the surface of discussing new directions in the study of people in organizations and our evolved human nature,

These twelve contributions (including this essay) to this special issue both individually and collectively will help us better integrate the study of management and organization with the study of human nature. We expect that this collaboration will be even more fruitful in the years to come.

7.1 What this special issue does not do

There are things that this special issue does not do. Some by design, others because of relative immaturity of EP and management, and others no doubt as a consequence of failures by the editor. One thing that was hoped for even more articles that demonstrated the applicability of EP to the study of management and organizations instead of papers that gave broad overviews of how it might be helpful in the long run. Greater participation of evolutionary biologists would also have improved this volume. By design this volume does not actually teach EP; there are better sources for that. Yet the first few articles (as well as the contribution by Waldron) do provide some overviews to some aspects and provide indications of sources in addition to what is provided here.

But even with these limitations, this volume does make a real and substantive contribution to the study of management, organization and human nature. It is a volume which the editor is very proud of, and the contributors should be proud of as well.

8 Acknowledgements

There are far too many people to thank for their help and contributions at the various stages of preparing this. We, and especially the editor would like to thank all of those who acted as reviewers: Ram N. Aditya, Ted Bergstrom, Kim Elsbach, Dennis Gioia, Jeff Goldberg, Courtney Hunt, Mark Jenkins, Barbara Pierce, Steven Regan, Dorothy Tennov, Mike Waller, Andrew Watson, and Rod White. The editor would also like to thank those who volunteered to act as reviewers, but were not ultimately called upon. The editor would also like to thank all of those who submitted papers or proposals for this special issue which for one reason or another where not included. The range of interest in this topic is staggering and we hope that those, often new to the area, will continue pursuing work in the area.

We would also like to thank the members of the Human Behavior and Evolution email discussion list, who helped with both specific queries and whose comments on excerpts from previous drafts of the essay have been extremely helpful. Discussion with them (even where we thought that they

illustrated the misunderstandings we discuss) has been extremely helpful.

Special thanks should go to Paul Rubin who saw the possibility of this special issue and entrusted us with it. His support, technical advice, and encouragement have made this possible.

Finally, and more than a bit self-indulgently, we will would like to thank our daughter, Tímea Markóczy Goldberg. Although her early arrival by one week (September 15, 1998) may have set back production of this volume by a month or more, she has contributed in a number of ways for which we are very grateful. First by letting us get some sleep at night; although thanks for this should also go to Richard Ferber, author of *Solve Your Child's Sleep Problems* (Ferber, 1985). Secondly, for bringing out in us such wonderful examples of kin selection and also demonstrating how much psychology and personality a person is born with. Finally, and most importantly, by being who she is.

References

Arnhart, Larry (1998). *Darwinian Natural Right: The biological ethics of human nature*. SUNY Series in Philosophy and Biology. New York: State University of New York Press.

Barkow, Jerome H. (1992). Beneath new culture is old psychology: Gossip and social stratification. In *The adapted mind* (eds. Jerome H. Barkow, Leda Cosmides, and John Tooby), pp. 627–637. Oxford: Oxford University Press.

Barkow, Jerome H., Leda Cosmides, and John Tooby (1992). *The adapted mind*. Oxford: Oxford University Press.

Bernhard, J. Gary and Kalman Glantz (eds.) (1992). *Staying human in the organization: Our biological heritage and the workplace*. Westport, CT: Praeger.

Betzig, Laura (ed.) (1997). *Human Nature: A critical reader*. Oxford: Oxford Unviversity Press.

Binmore, Ken (1998). *Game Theory and the Social Contract, Volume 2: Just Playing*. MIT Press series on Economic Learning and Social Evolution. Cambridge, Mass: MIT Press.

Brown, Donald E. (1991). *Human Universals*. New York: McGraw Hill.

Cosmides, Leda and John Tooby (1992). Cognitive adaptations for social exchange. In *The adapted mind* (eds. Jerome H. Barkow, Leda Cosmides, and John Tooby), chapter 3, pp. 163–228. Oxford: Oxford University Press.

Cosmides, Leda and John Tooby (1996). Are humans good intuitive statisticians after all? Rethinking some conclusions from the literature on judgment under uncertainty. *Cognition*, 58: 1–73.

Crawford, Charles B., B. E. Salter, and K. L. Lang (1989). Human grief: Is its intensity related to the reproductive value of the deceased? *Ethology and Sociobiology*, 10: 297–307.

Cronin, Helena (1991). *The Ant and the Peacock: Altruism and sexual selection from Darwin to today*. Cambridge: Cambridge University Press.

Dawkins, Richard (1982). *The extended phenotype*. San Francisco: Freeman.

Dawkins, Richard (1986). *The blind watchmaker.* New York: Norton.

Dawkins, Richard (1989). *The Selfish Gene.* Oxford: Oxford University Press, second edition. (First edition 1976, Oxford University Press).

Dennett, Daniel C. (1984). *Elbow Room: The Varieties of Free Will Worth Wanting.* Cambridge, MA: MIT Press.

Dennett, Daniel C. (1995). *Darwin's dangerous idea: Evolution and the meaning of life.* London: Penguin.

Dobzhansky, Theodosius (1997). Nothing in biology makes sense except in the light of evolution. In *Evolution* (ed. Mark Ridley), pp. 378–398. Oxford: Oxford University Press. (Originally published in *American Biology Teacher, 35* (1973) pp. 125–129.).

Dupré, John (ed.) (1987). *The Latest on the Best: Essays on evolution and optimality.* Cambridge, Mass: MIT Press.

Dwyer, Peter D. and Monica Minnegal (1997). Sago games: Cooperation and change among sago producers of Papua New Guinea. *Evolution and Human Behavior*, 18(2): 89–108.

Eisenberg, Arlene, Heidi E. Murkoff, and Sandee E. Hathaway (1989). *What to Expect the First Year.* New York: Workman Publishing.

Ferber, Richard (1985). *Sovle Your Child's Sleep Problems.* New York: Simon and Schuster.

Frank, Robert H. (1988). *Passions within Reason.* New York: Norton.

Gigerenzer, Gerd, Wolfgang Hell, and Hartmut Blank (1988). Presentation and content: The use of base rates as a continuous variable. *Journal of Experimental Social Psychology*, 14(3): 513–525.

Gilovich, Thomas (1991). *How we know what isn't so.* New York: The Free Press.

Goldberg, Jeffrey and Lívia Markóczy (1997). Symmetry: Time travel, mind-control and other everyday phenomena required for cooperative behavior. Paper Presented at Academy of Management Conference, Boston.

Goldberg, Jeffrey and Lívia Markóczy (1998). Complex rhetoric and simple games. Academy of Management, San Diego.

Goldstein, William M. and Robin M. Hogarth (1997). Judgment and decision research: Some historical context. In *Research on Judgment and Decision Making: Currents, connections, and controversies* (eds. William M. Goldstein and Robin M. Hogarth), Cambridge Series on Judgment and Decision Making, chapter 1, pp. 3–65. Cambridge: Cambridge University Press.

Gould, Stephen Jay (1977). *Ever Since Darwin*. London: Penguin.

Gould, Stephen Jay (1980). Double trouble. In *The Panda's Thumb*, chapter 3, pp. 32–39. New York: Norton.

Gould, Stephen Jay (1981). *The Mismeasure of Man*. New York: Norton.

Gould, Stephen Jay (1985a). *The Flamingo's Smile*. New York: Norton.

Gould, Stephen Jay (1985b). Opus 100. In *The Flamingo's Smile*, chapter 11, pp. 167–184. New York: Norton.

Gould, Stephen Jay (1991). Kropotkin was no crackpot. In *Bully for Brontosaurus*, chapter 22, pp. 325–339. New York, London: Penguin.

Hirshleifer, Jack (1985). The expanding domain of economics. *American Economic Review*, 75(6): 53–70.

Kacelnik, Alex and John R. Krebs (1997). Yanomamö dreams and starling payloads: The logic of optimality. In *Human Nature: A critical reader* (ed. Laura Betzig), chapter 2, pp. 21–35. Oxford: Oxford Unviversity Press.

Kahneman, Daniel and Amos Tversky (1996). On the reality of cognitive illusions. *Psychological Review*, 103(3): 582–591.

Kenrick, Dougles T. and Jeffry A. Simpson (1997). Why social psychology and evolutionary psychology need one another. In *Evolutionary Social Psychology* (eds. Jeffry A. Simpson and Douglas T. Kenrick), chapter 1, pp. 1–20. Mahway, New Jersey: Lawrence Erlbaum Associates.

Kleither, Gernot D., Marianne Krebs, Micheal E. Doherty, Hugh Garavan, Randall Chadwick, and Gregory Brake (1997). Do subjects understand base rates. *Organizational Behavior and Human Decision Processes*, 72(1): 25–61.

Lewontin, R. C. (1993). *The Doctrine of DNA*. London: Penguin. (First published as *Biology as Ideology* (1991) Anansi Press.).

Mailath, George J. (1998). Do people play Nash equilibrium? Lessons from evolutionary game theory. *Journal of Economic Literature*, 36(3): 1347–1374.

Margulis, Lynn (1981). *Symbiosis in Cell Evolution*. San Francisco: Freeman.

Margulis, Lynn (1998). Life on Earth doesn't need us. *Independent*, pp. Part 2, page 5.

Markóczy, Lívia (1998). Us and them. *Across the Board*, 35(2): 44–48.

Markóczy, Lívia and Jeff Goldberg (1997). The virtue of cooperation: A review of Ridley's *Origins of Virtue*. *Managerial and Decision Economics*, 18: 399–411.

Markóczy, Lívia and Jeff Goldberg (1998). You can pick your friends, and you can pick your nodes but you can't pick your friends' nodes: Misattributions of others' priorities. *International Journal of Human Resource Management*, 40(5): 893–909.

Maynard Smith, John (1982). *Evolution and the Theory of Games*. Cambridge: Cambridge University Press.

Maynard Smith, John (1988). Science, ideology and myth. In *Did Darwin Get it Right?*, chapter 6, pp. 39–50. London: Penguin.

Mithen, Steven (1996). *The Prehistory of the Mind*. London: Thames and Hudson.

Nicholson, Nigel (1997). Evolutionary psychology: Towards a new view of human nature and orgnaizational theory. *Human Relations*, 50: 1053–1078.

Nisbett, Richard and Lee Ross (1980). *Human inference: Strategies and shortcomings of Social Judgment*. Englewood Cliffs, NJ: Prenctice-Hall.

Pierce, Barbara D. and Roderick White (forthcoming). From monkeys to managers: A socio-evolutionary link between resource context and social structure. *Academy of Management Review*.

Pinker, Steven (1994). *The Language Instinct*. London: Penguin Books.

Pinker, Steven (1997). *How the mind works*. New York: W. W. Norton.

Plotkin, Henry (1997). *Evolution in Mind: An introduction to evolutionary pscyhology*. London: Penguin.

Rabin, Matthew (1998). Psychology and economics. *Journal of Economic Literature*, 36(1): 11–46.

Ridley, Matt (1996). *The Origins of Virtue*. London: Viking, Penquin Books.

Rose, Steven (1998). Selfish genes and how to reject them. *Independent*, pp. Part 2, page 7.

Rubin, Paul H. and Chris Paul (1979). An evolutionary model of taste for risk. *Economic Inquiry*, 17(4): 585–596.

Rubinstein, Ariel (1998). *Modeling Bounded Rationality*. Cambridge, Mass: MIT Press.

Salter, Frank Kemp (ed.) (1995). *Emotions in command: A naturalistic study of institutional dominance*. Oxford: Oxford University Press.

Schneier, Bruce (1996). *Applied Cryptography*. New York: John Wiley, second edition.

Sigmund, Karl (1993). *Games of Life: Explorations in Ecology, Evolution and Behavior*. Oxford: Oxford University Press. (Cited page references are to the Penguin paperback edition, 1995).

Simpson, Jeffrey A. and Douglas T. Kenrick (eds.) (1997). *Evolutionary social psychology*. Mahwah, New Jersey: Lawrence Erlbaum.

Smith, Eric Alden (1987). Optimization theory in anthropology: Appications and critiques. In *The Latest on the Best: Essays on evolution and optimality* (ed. John Dupré), chapter 11, pp. 201–249. Cambridge, Mass: MIT Press.

Sober, Elliott (1994a). Apportioning causal responsibility. In *From a Biological Point of View: Essays in evolutionary philosphy*, chapter 10, pp. 184–200. Cambridge: Cambridge Unviversity Press. (Originally published as 'Evolution, population, thinking, and essentialism' in *Philosophy of Science, 47* 3 (1980), 350–383.).

Sober, Elliott (1994b). Prospects for an evolutionary ethics. In *From a Biological Point of View: Essays in evolutionary philosphy*, Cambridge Studies in Philosophy and Biology, chapter 5, pp. 93–113. Cambridge:

Cambridge Unviversity Press. (Originally published in L. Pojman (ed.) *Ethical Theory*, Wadsworth, 1994.).

Sober, Elliott and David Sloan Wilson (1998). *Unto Others: The Evolution and Psychology of Unselfish Behavior*. Cambridge, Mass.: Harvard University Press.

Symons, Donald (1992). On the use and misuse of Darwinsim in the study of human behavior. In *The adapted mind* (eds. Jerome H. Barkow, Leda Cosmides, and John Tooby), pp. 137–159. Oxford: Oxford University Press.

Tennov, Dorothy (1979). *Love and Limerence*. Briercliff Manor, NY: Stein & Day.

Tooby, John and Leda Cosmides (1992). The psychological foundations of culture. In *The adapted mind* (eds. Jerome H. Barkow, Leda Cosmides, and John Tooby), chapter 1, pp. 19–136. Oxford: Oxford University Press.

Walston, Florence, Anthony S. David, and Bruce G. Charlton (1998). Sex differences in the context of persecutory delusions: A reflection of hostile threats in the ancestral environment? *Evolution and Human Behavior*, 19(4): 257–260.

Wang, X. T. (1995). Evolutionary hypotheses of risk-sensitive choice: Age differences and perspective change. *Ethology and Sociobiology*, 17(1): 1–15.

Weibull, Jörgen W. (1995). *Evolutionary Game Theory*. Cambridge, Mass: MIT Press.

Wenegrat, Brant, Eleanor Castillo-Yee, and Lisa Abrams (1996). Social norm complience as a signaling system, II: Studies of finess-related attributions consequent on a group norm violation. *Ethology and Sociobiology*, 17(6): 417–429.

Williams, George C. (1997). Gaia, nature worship, and biocentric fallacies. In *Evolution* (ed. Mark Ridley), pp. 398–407. Oxford: Oxford University Press. (Originally appeared in *Quarterly Review of Biology, 67* (1992), pp. 479–485).

Wilson, David Sloan and Elliott Sober (1994). Reintroducing group selection to the human behavioral sciences. *Behavioral and Brain Sciences*, pp. 585–654. (Contains others' commentaries and response).

Wilson, Edward O. (1975). *Sociobiology: The new synthesis*. Cambridge, Mass: MIT Press.

Wilson, James Q. (1993). *The Moral Sense*. New York: The Free Press.

Wooldridge, D. (1963). *The Machinary of the Brain*. New York: McGraw Hill.

Wright, Robert (1994). *The Moral Animal. Why we are the way we are: The new science of evolutionary psychology*. New York: Vintage Books.