DARWIN MEETS SOCRATES:

EVOLUTIONARY PSYCHOLOGY AND THE INNATE IDEAS DEBATE

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Abstract

The underlying premise of this thesis is that evolutionary psychology and philosophy can exert a productive mutual influence on one another. To illustrate this, I focus on the innate ideas debate in philosophy. This debate concerns the origin and justification of our concepts and beliefs, and is intimately linked with the empiricist-rationalist debate of the seventeenth and eighteenth centuries. The empiricists claimed that all ideas derive ultimately from experience, whereas the rationalists claimed that some ideas are innate. An evolutionary psychological perspective updates this issue in various ways. For instance, it provides a naturalistic explanation for the origin of any innate contributions to our mental representations of the world, and has implications for the subject matter and accuracy of these contributions. Not only does an evolutionary perspective have implications for philosophy, the philosophical literature contributes to an evolutionary psychological perspective on the innate design of the human mind. In particular, various suggestions for innate content can be drawn from the philosophical literature. Among these are the belief in other minds, belief in an objective and mind-independent external world, causal cognition, moral cognition, and elements of our understanding of space and time. Finally, an evolutionary perspective raises an important question: If certain aspects of our worldview are innate, does this provide any reason to think that these aspects accurately depict the world? The simple version of the argument for this conclusion is that if an aspect of mind is innate, it must be useful, and the best explanation for its usefulness is that it accurately depicts the world. Although there are important criticisms of this position, I argue that, in certain circumstances, it is reasonable to assume the approximate accuracy of some innate mental content.

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Introduction

The list of philosophical problems that thinkers, without evident success, have long struggled with – the problems of induction, of other minds, of the existence of the external world, of justifying rationality – all mark assumptions that evolution has built into us.

-Robert Nozick, The Nature of Rationality, *1993, p. 121.*

The scientists, not the philosophers, now address most effectively the great questions of existence, the mind, and the meaning of the human condition.

-Edward O. Wilson, The Philosophers' Magazine, *Autumn 1999.*

The title of this thesis, *Darwin Meets Socrates*, might be somewhat misleading. It hints at a mixture of biology and philosophy, but in fact it is *psychology* and philosophy that is the focus of the work. The reference to Charles Darwin relates to the fact that it is a particular approach to psychology that will be considered, namely, evolutionary psychology. This approach involves the application of Neo-Darwinian principles to the study of the human mind (Barkow, Cosmides, & Tooby, 1992; Barrett, Dunbar, & Lycett, 2002; Buss, 1999; Crawford & Krebs, 1998; Evans & Zarate, 1999). The underlying premise of this work is that evolutionary psychology and philosophy can exert a productive mutual influence on one another. More specifically, I focus on the mutual influence of these two disciplines in regard to the innate ideas debate.

The innate ideas debate, which was at the heart of the empiricist-rationalist controversy of the seventeenth and eighteenth centuries, concerns the origin and justification of our concepts, beliefs, and cognitive abilities. The rationalists claimed that some ideas are innate, whereas the empiricists claimed that all ideas derive ultimately from experience. As Block (1981) noted, "this issue, like many others discussed under the heading of 'philosophy of psychology' is not easily pigeonholed either as science or as philosophy" (p. 280). Consequently, it offers a suitable case study for the thesis that psychology and philosophy can exert a healthy mutual influence on one another. Furthermore, with the recent groundswell of interest in the application of evolutionary theory to human psychology, the topic of innate ideas is once again timely.

There are various ways that evolutionary psychology and philosophy can inform one another. To begin with, an evolutionary perspective on psychology has a number of important implications for philosophy. The innate ideas debate has its origin in pre-Darwinian philosophy. Evolutionary psychology updates this debate, and has implications for classical empiricism, rationalism, and Kantian philosophy. One of the most important implications of an evolutionary perspective is that it provides a naturalistic explanation for the origin of any innate mental content.[1] As Peter Carruthers (1992) put it, "the only suggestion that is consistent with current scientific knowledge is that innate beliefs might be determined through evolutionary selection" (p. 111). In addition, an evolutionary perspective has important implications in regard to the function and subject matter of innate ideas. Another set of implications of evolutionary psychology for philosophy relates to the justification of knowledge. If evolutionary psychology reveals that certain aspects of our representation of the world have an innate origin, this raises an important question: Does

[1] The phrase 'mental content' will refer to all explicit aspects of phenomenology, including perceptions, concepts, beliefs, memories, and imagery.

the innateness of these aspects of mind give any reason to think that they are accurate? Later I argue that, in certain circumstances, it may.

Just as evolutionary psychology can inform philosophy, the philosophical literature can inform evolutionary accounts of the mind. Primarily, this literature is a fertile source of hypotheses concerning innate concepts and beliefs. In some cases, the aspects of mind suggested by the philosophical literature are aspects people might otherwise have overlooked. Some components of our mental representations of the world may be so deep-seated that we do not notice them. Furthermore, even if we do notice them, they may seem so trivially obvious and natural to us that we do not think they need to be explained. An example is the idea that the future but not the past can be influenced by voluntary behaviour. Such aspects of our understanding may seem obvious and unimportant to us, simply because they are so deep-seated. As a result, we may overlook some of the most important and fundamental aspects of our minds. Philosophers, with their habit of relentlessly questioning even the most fundamental aspects of our belief systems (for instance, asking questions about the nature of time), may help to unmask these important but overlooked aspects of the mind, and bring to light facts about our nature that we were unaware of, or had not thought needed explanation.

Many of the innate aspects of cognition I propose in later chapters relate to topics in philosophy. This includes the belief in other minds, belief in an objective, mind-independent external world, causal cognition, moral cognition, and elements of our understanding of space and time. According to Stace (1945), these are *unreasoned beliefs*: beliefs that are not derived from experience but also cannot be justified by reason. *Natural selection provides a plausible explanation for the origin of these most basic of beliefs*. I will attempt to show that many of our intuitions regarding philosophical questions such as these have surprisingly clear connections to fitness considerations.

My analysis is based on the assumption that any innate aspects of the mind must have implications for voluntary behaviour. More specifically, I will argue that conscious aspects of mental life that have an evolutionary origin contribute to the behavioural flexibility that is so characteristic of our species. Conscious aspects of brain activity appear to be associated with the performance of novel or unpractised tasks; in contrast, automatized tasks tend to occupy little or none of our conscious awareness.[2] As such, it seems reasonable to suppose that the evolutionary function of any consciously accessible mental content that is a product of natural selection will be related to the performance of novel or unpractised tasks, and hence to our behavioural flexibility. Based on this principle, I argue, for example, that our understanding of the self/not-self distinction and our understanding of the fact that the world continues to exist when not perceived underpin our capacity to generate novel behaviours aimed at achieving our goals. An organism with a low level of behavioural flexibility would not require such a generalized and abstract understanding. However, in order for greater behavioural flexibility to evolve in a lineage, such an understanding is necessary.

There is another way that the philosophical literature can contribute to research in evolutionary psychology: Certain philosophical arguments may shed light on the origins of our pre-philosophical intuitions. Philosophers have raised a number of very difficult questions concerning the justification of beliefs. How can the evidence of the senses justify belief in objects that persist when out of the range of our senses? How can this evidence

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[2] The term 'conscious' will be used to designate mental states that we are aware of and that we could report. The terms 'consciousness' and 'awareness' will be taken as synonymous.

justify our belief in other minds or causal laws? It is difficult to see how such beliefs can be justified in terms of sensory experience. However, if we set aside the epistemological issues, the same questions can be turned to another purpose: They can be used as Chomskyan-style poverty-of-the-stimulus arguments for the innate origin of certain aspects of the human worldview (see Chapter 2). Take, for example, Bishop Berkeley's (1710/1982) argument that the senses provide no ultimate evidence that objects continue to exist when beyond the reach of the senses. This argument can be co-opted and used to argue for an innate contribution to our understanding that objects do indeed continue to exist when unperceived. Similarly, David Hume's (1739/1978) epistemological observation that our belief in causes is ultimately unjustified can be used to argue that the concept of *cause* could not be derived solely from personal experience, and G. E. Moore's (1903) argument that the good cannot be defined in terms of any other property can be used to argue for an innate contribution to the concept of *moral good*.

The analysis I present in this thesis is based almost exclusively at the psychological level, although the assumption is that all aspects of psychological experience are associated with events in the brain (or, more precisely, *are* events in the brain; see Stewart-Williams, in press). Scientists do not yet have any clear understanding of how the genome contributes to the structure of the brain, or how the brain's activity might result in the structure of the mind. But this is no reason to reject the innateness hypothesis in regard to specific mental content (Jackendoff, 1987). It may be possible to demonstrate that certain aspects of mental content are innate, even before we can specify how this could be.

The focus of the present thesis is humans. However, unless otherwise stated, I make no claim that the aspects of mind considered are necessarily unique to humans, and in some cases I will draw on the animal cognition literature to bolster the case for innateness. *I do* *not pretend to provide conclusive arguments that any of the aspects of mind I consider are innate.* However, I do hope to establish that the notion that these aspects are innate is at least a reasonable proposition, and that it is consistent with the existing evidence. A final comment: Critics of evolutionary psychology sometimes accuse advocates of this approach of pan-adaptationism (see, for example, Gould, 2000). Pan-adaptationism involves overextending adaptationist explanations, and viewing traits as adaptations when they are not. It is certainly possible that I do exactly this. Nonetheless, I defend my stance. I do not deny that there is a danger of over-extending adaptationist explanations; however, there is also a danger of under-extending them. Labelling an aspect of mind or behaviour an adaptation when it is not is clearly a potential mistake, but it is not the only possible way to be mistaken. It is also possible to overlook the fact that a given aspect of mind or behaviour is an adaptation. Avoiding evolutionary explanations is no guarantee of gaining accurate beliefs. It is perfectly reasonable to entertain the hypothesis that a given aspect of mind or behaviour is an adaptation, as long as one is willing to jettison this hypothesis if the evidence seems to require it.

Overview

The thesis is divided into two parts. The first part sets the scene, and consists of the first two chapters. Chapter 1 presents an overview of the modern theory of biological evolution, focussing on the areas most germane to evolutionary psychology. Basic concepts such as natural selection and sexual selection are outlined, along with a discussion of the New Synthesis and common misunderstandings of evolutionary theory. Particular attention is paid to inclusive fitness theory and the genes'-eye view of evolution (Dawkins, 1982, 1989; Hamilton, 1964; G. C. Williams, 1966). This is the approach that most evolutionary psychologists have adopted (Buss, 1999). However, because there are important criticisms of this perspective, it is necessary to outline it in reasonable detail, and make a case for its legitimacy. Following this, Chapter 2 provides a summary of evolutionary psychology, which involves the application of Neo-Darwinian principles to the mind and behaviour. This chapter outlines the key concepts, theories, and findings in this area, including the theory of parental investment and sexual selection, kin selection theory, and the theory of reciprocal altruism. Special attention is given to material relevant to the innate ideas debate.

The second section of the thesis derives implications for the innate ideas debate from evolutionary psychology, and derives implications for evolutionary psychology from the philosophical literature. Chapter 3 begins by defining innateness, and then outlines the pre-Darwinian debate over the innate ideas issue. It then provides an overview of the implications of an evolutionary psychological perspective for the innate ideas debate. In the course of the chapter, three hypotheses are outlined that can be applied to any proposed innate idea. These are: (1) it is genuinely innate and a product of natural selection; (2) it is not innate but is implicit in innate aspects of thought and behaviour; and (3) it is not innate, but is intuitively plausible as an indirect result of the innate design of the mind. Thus, a three-part framework is presented for classifying the rationalists' suggestions for innate ideas.

Chapters 4 to 8 investigate various candidates for innate components of the human mind. In many cases, the innateness hypothesis seems plausible, and is supported with developmental, comparative, and other evidence. Chapter 4 looks at the possibility that certain aspects of our conceptual frameworks have an evolutionary origin. This includes various conceptual distinctions, such as that between self and non-self, animal and non-animal, human and non-human, male and female, and kin and non-kin. It also includes the concepts of *object* and *mind*. Evidence is presented for the innate origin and evolutionary significance of these concepts, which I propose constitute the basic categorical framework of human experience.

Chapters 5 to 8 deal with innate content related to philosophical issues. The first three of these chapters each cover with one innate aspect of mind in depth. Chapter 5 links the belief in an objective and mind-independent external world to evolved components of the mind, namely, the capacity to distinguish mental states that have objective referents from those that do not (e.g., perceptual states versus imagery), and the capacity to mentally represent the continued existence of aspects of the world that are beyond the reach of the senses. Chapter 6 examines the possible evolutionary origin of causal cognition. I argue that the innate contributions to this faculty include the concept of *cause*, with its implication that one event necessitates another, and the capacity to distinguish between event sequences that are causally connected and those that are not. Chapter 7 examines the possible evolutionary origin of moral cognition, and of certain important aspects of human moral behaviour, including our altruistic tendencies and general abhorrence of incest. Chapter 8 discusses in less detail miscellaneous other candidates for innate aspects of mind related to topics in philosophy. These are: the Kantian categories of space and time, the belief in freewill, the capacity for mathematics and logical reasoning, the capacity for inductive reasoning, and the understanding of the persisting identity of objects, people, and minds. In some cases, it is concluded that there may be an innate contribution; in other cases (such as belief in freewill), the innateness hypothesis is rejected.

The thesis culminates in Chapter 9, which looks at the possible implications for epistemology of the innateness of the various aspects of mind considered in the Chapters 4 to 8. The focus of this chapter is the question of whether innate ideas constitute a naturalistic source of metaphysical knowledge. The simple version of the argument for this conclusion is that if an aspect of mind is a product of evolutionary selection, it must have been useful, and the most parsimonious explanation for its usefulness is that it accurately depicts the world. There are a number of criticisms of this argument. These include the idea that evolutionary justifications are circular, that evolved mental content is not necessarily accurate, and that, if the argument is taken seriously, it has some highly suspect consequences. These criticisms necessitate important qualifications to the initial argument; nonetheless, I argue that in some cases limited conclusions can be drawn about the world from an analysis of evolved contributions to our view of the world. Evolutionary theory cannot provide an ultimate justification for any belief, but in certain circumstances it bolsters our conviction that a given belief is a reasonable first approximation.

Finally, I summarize the contributions this thesis makes, the testable predictions that emerge from it, and its limitations. My overall conclusion is that evolutionary psychology and philosophy can inform one another, and that the mutual interplay of these two disciplines does much to advance the innate ideas debate.

Part I:

Evolution and Evolutionary Psychology

Chapter I: Evolutionary Theory

Nothing in biology makes sense except in the light of evolution.

-Theodosius Dobzhansky.

Let me lay my cards on the table. If I were to give an award for the single best idea anyone has ever had, I'd give it to Darwin, ahead of Newton and Einstein and everyone else.

-Daniel Dennett, Darwin's Dangerous Idea, *1995, p. 21.*

The purpose of this first chapter is to provide an outline of the theory of evolution, focussing on aspects of the theory that will be relevant to the later discussion of evolutionary psychology and its possible links with the innate ideas debate in philosophy. Some of the biggest questions faced by human minds are questions of origin. All cultures are thought to have myths and theories concerning the origin of the universe, humans, and life in general (Ayala, 1997). One of the more influential creation stories is the traditional Biblical account, according to which God created the universe and all life around 6,000 years ago. On this view, each species is a separate and unchanging creation. Given the short span of human life and human history, it is probably natural for people to have assumed that species were unchanging, just as our limited perspective makes it natural to view the earth as flat and motionless. However, just as scientific investigation overturned the geocentric view of the universe, so too it has overturned the view that species are immutable. Instead, they have come about through a process of evolution. This chapter provides an outline of the Neo-Darwinian theory of evolution.

Darwin's Theory of Evolution by Natural Selection

The idea that species have evolved is most commonly associated in people's minds with Charles Robert Darwin (1809-1882). However, Darwin was not the first person to make this suggestion. The earliest known suggestion of the possibility has been attributed to the Ancient Greek philosopher, Anaximander (Ayala, 1997). By Darwin's time, the idea was well known and the accumulating geological and fossil evidence had made it increasingly plausible (Richards, 2000). The French naturalist Jean-Baptiste Lamarck (1744-1829) had put forward the first real theory of evolution. According to Lamarck, individuals strive to improve themselves and then pass on acquired characteristics to their offspring. This inheritance of acquired characteristics drives evolutionary change.

Although Darwin was not the first to propose that species had evolved, prior to Darwin the idea had lacked widespread acceptance. The turning point came in 1859, when he published *On the Origin of the Species by Means of Natural Selection.* This book had two main aims (Dennett, 1995). The first was to argue that evolution had occurred. Darwin made a strong case for the fact of evolution, providing evidence and arguments that all modern species had evolved from earlier ones (many of which were now extinct), and that the members of any two species had a common ancestor if you went back far enough (the more similar the two species, the more recently they shared a common ancestor). Darwin's real achievement, however, relates to the second aim of his book. One of the main reasons that evolution still lacked widespread acceptance was that no one had suggested a plausible mechanism for it (Richards, 2000). Darwin's great accomplishment was to outline such a mechanism: natural selection. (Natural selection was also independently discovered by Alfred Russel Wallace.)

The theory of evolution by natural selection was distilled from a variety of sources. One important influence was the famous 1798 essay by Thomas Robert Malthus (1766-1834), *Essay on the Principle of Population.* This introduced Darwin to the idea that all organisms produce more offspring than can survive to reproduce, an idea that became the first step in his explanation for evolutionary change:

> As many more individuals are produced than can possibly survive, there must in every case be a struggle for existence, either one individual with another of the same species, or with the individuals of a distinct species, or with the physical conditions of life.... Can it, then, be thought improbable, seeing that variations useful to man have undoubtedly occurred, that other variations useful in some way to each being in the great and complex battle of life, should sometimes occur in the course of thousands of generations? If such do occur, can we doubt (remembering that many more individuals are born than can possibly survive) that individuals having any advantage, however slight, over others, would have the best chance of surviving and of procreating their kind? On the other hand, we may feel sure that any variation in the least degree injurious would be rigidly destroyed. This preservation of favourable variations and the rejection of injurious variations, I call Natural Selection. (Darwin, 1859)

In short, individuals within a population differ and some variants have an increased likelihood of surviving and reproducing. To the extent that these variants are inheritable, they are more likely to be passed to the next generation than are other variants. They will thus increase in frequency. And that, in a nutshell, is it. The real power of the idea comes when it is recognised how much it can explain. Differential reproductive success does not just explain change in the frequency of different traits in a population. According to Darwin (1859), the gradual accumulation of small but favourable changes over incomprehensibly large stretches of time accounts both for the origin of functional adaptations (such as eyes and wings), and for the origin of new species. As I will argue later, the theory can also account for the existence and basic nature of mind.

Darwin's theory continued the scientific revolution inaugurated by the Copernican/Newtonian revolution (Ayala, 1997; Richards, 2000). Before Darwin, scientists had made astounding progress in explaining the motion of the heavens without reference to supernatural agency, and in purely naturalistic terms. The Darwinian revolution extended this explanatory system to the domain of life on earth – human life included. Evolutionary theory explained the diversity and design in organisms as the product of a mindless process, a process with no intentions or goals. This point was partially obscured by Darwin's use of the term 'selection,' which lends itself to an anthropomorphic conception of the process (R. Wright, 1994). The term is, however, purely metaphorical. To say that traits are selected if they enhance reproductive success is only to say that traits that tend to enhance reproductive success tend to increase in frequency. Neither God nor any intelligence of nature is required to do the selecting.

Sexual Selection

An early challenge for evolutionary theory was explaining certain apparently non-functional structures in nature. The classic example is the peacock's tail. Rather than increasing the bird's chances of surviving, if anything this unwieldy structure is a distinct handicap. Darwin's explanation involved dividing adaptations into two classes: those whose function relates to survival and those whose function relates to reproductive success (Darwin, 1871). Selection related to reproductive success he named *sexual selection.* Sexual selection has two components. The first, known as *intrasexual selection*, relates to competition among members of one sex, often though not always males, for sexual access to the other. In many species, the males are larger, stronger, and more aggressive than the females (Maier, 1998). This is thought to be due to selection for traits that increase a male's chances of successfully competing with other males for sexual access to females. The second component of sexual selection involves the preferences of one sex for certain traits in the other. This form of selection, known as *intersexual selection*, provides an explanation for the peacock's tail. At some point, peahens evolved a preference for males with larger, more colourful tails. This created selection pressure for such tails. A process of runaway selection ensued, with peacocks' tails getting progressively larger over many generations. This continued for as long as the average costs in terms of survival were outweighed by the benefits in terms of reproductive success. Although this accounts for the tail, it raises another question: Why would this peahen preference have been selected in the first place? It is possible that the initial preference was random and arbitrary (R. A. Fisher, 1930). It is more likely, though, that it was selected because large and colourful plumage correlates with strength, good health, and freedom from parasites (Hamilton & Zuk, 1982; Zahavi, 1975). The offspring of peahens with an inherited preference for large, colourful tails would thus have been more likely to survive and reproduce, and consequently the preference would have increased in frequency.

The Modern Synthesis: Natural Selection and Genetics

A major deficiency in Darwin's initial theory was that it lacked a plausible mechanism of inheritance (Ayala, 1997). In Darwin's time, it was commonly believed that inheritance involved a blending of the contributions of each parent, such that the traits passed on to offspring were intermediate between those of the parents. However, this would lead to an averaging out of traits in the population and would prevent any directional selection. The key to solving this problem arrived shortly after the publication of *Origin of Species*. Unfortunately, no one noticed. In 1866, Gregor Mendel published a paper detailing his experiments with crossbreeding pea plants. His investigations suggested that the units of inheritance (now called genes) are indivisible particles that are passed on intact.[1] Although Mendel's work initially attracted little attention, eventually it spawned the science of genetics (Ayala, 1997). In the first half of the twentieth century, Mendelian genetics was combined with Darwinian natural selection (Dobzhansky, 1937; R. A. Fisher, 1930; Haldane, 1932; S. Wright, 1931). The result is known as the *modern synthesis*.

The modern synthesis was a great advance. It put Darwin's selection theory on a firm foundation and finally overthrew the competing Lamarckian idea that organisms pass on acquired characteristics genetically. Barring errors, the genes we pass on to offspring are those we receive at the moment of conception.[2] New variants do not arise from the striving of the parent organism or because there is a need for them. They arise through such factors as sexual recombination and random genetic mutation. Mutations typically occur when DNA is copied imperfectly during cellular replication (Ayala, 1997). Most mutations have no influence on the organism's reproductive success. Those that *do* have an impact usually have a detrimental effect and therefore quickly disappear from the gene pool of a species. Only in rare instances does a mutation enhance reproductive success. However, it is only in such instances that natural selection produces evolutionary change. Most of the time,

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[1] Actually, it has since been discovered that the hereditary units are not perfectly indivisible or particle-like (Dawkins, 1989). Nonetheless, this is a close enough approximation to be completely workable in practice. Note also that *phenotypic* characteristics may be intermediate between those of the parents; it is individual genes that do not blend but are inherited intact (approximately).

[2] A memorable counterexample to the idea that we inherit acquired traits concerns Jewish and Arabic males, who, despite having been circumcised for many centuries, are still born with foreskins (Pinker, 1997).

selection functions to *prevent* evolution by eliminating detrimental variants. Thus, evolution and natural selection are not synonymous terms (Badcock, 2000). According to current definitions, evolution is a change in the frequency of genes within a population.[3] Natural selection is one cause of this change. It is not the only cause; others include genetic drift (change due to chance factors; Gould & Lewontin, 1979; Tooby & Cosmides, 1992). However, selection alone can account for features of the organism that exhibit a high degree of complexity of design – features that it is wildly implausible to suppose came about purely through chance (Buss, Haselton, & Shackelford, 1998).

Inclusive Fitness

The next major advance in evolutionary theory provided an answer to a deceptively difficult question: What general function do adaptations have? Various answers have been put forward. One is that the function of adaptations is to enhance the survival and reproductive success of the individual organism. Another is that the function of adaptations is to secure the survival of the species or the group to which an individual belongs (see, for instance, Wynne-Edwards, 1962). Both answers appear to be incorrect. For a start, adaptations could not consistently favour the group at the expense of the individual. This is because organisms that benefited from such aid but did not also offer it would be advantaged over those who did, and thus this self-interested tendency would soon predominate in the population (Dawkins, 1989; G. C. Williams, 1966). But this leaves us with a mystery: If fitness were merely a matter of individual reproductive success, natural selection would be unable to account for 'biological altruism', such as that found in some

[3] Some theorists, such as Maynard-Smith (1976), count only those changes that have phenotypic effects as evolutionary changes. At any rate, it is important to note that evolution is something that happens to populations or gene pools; individual organisms do not evolve.

species of termites, ants, wasps, and other eusocial insect species, among which sterile castes of workers serve a fertile queen but never personally reproduce.[4]

The breakthrough came in the 1960s when a young graduate student, William Hamilton, elaborated on a point that had been touched on in the past but insufficiently appreciated (Hamilton, 1964/1996). Recall that evolution is defined as a change in the frequency of genes in a population. A gene will increase in frequency if, relative to other versions of the same gene (*alleles*), it increases the reproductive success of the organism of which it is a part, *or if it enhances the reproductive success of other organisms possessing the same gene.* The organisms most likely to possess a given gene are kin, and the more closely related the kin, the more likely this is. Current definitions of fitness incorporate not only the individual's reproductive success (direct fitness) but also the reproductive success of other kin, weighted for the degree of relatedness (indirect fitness; J. L. Brown, 1975). (Selection due to effects on kin's reproductive success is known as *kin selection.*) The sum of direct and indirect fitness is known as *inclusive fitness.* According to this theory, the function of adaptations is to enhance inclusive fitness. By thinking in terms of inclusive fitness, biologists were able to dissolve the nagging mystery of the biological altruism found among kin throughout the animal kingdom. In the case of eusocial insects, for instance, it turns out that the members of any given colony are all very closely related to one another. As a result, the labours of sterile insect castes contribute indirectly to their inclusive fitness.

[4] Biological altruism is defined as any behaviour that enhances another organism's reproductive success at the expense of that of the altruist.

The Genes'-Eye View of Evolution

But there is another way to construe this insight, and it is arguably more powerful. Rather than thinking in terms of individuals selected to enhance inclusive fitness, natural selection can be viewed in terms of genes selected to enhance *their own* fitness. This is the genes'-eye view of evolution, or selfish gene theory (Dawkins, 1982, 1989; Hamilton, 1972/1996; G. C. Williams, 1966). This perspective is often illustrated by imagining that genes are active agents that strive, via their phenotypic effects, to replicate themselves and outperform other versions of the same gene. This is, of course, purely metaphorical; genes are not conscious agents and do not strive to do anything (of course, nor do most organisms). The point is that, rather than viewing selection as the differential survival and reproduction of organisms, it is more accurate to view it as the differential survival of patterns of DNA. Organisms are, in a sense, by-products of the differential survival and replication of genes. As E. O. Wilson (1975) wrote, "Samuel Butler's famous aphorism, that the chicken is only an egg's way of making another egg, has been modernized: the organism is only DNA's way of making more DNA" (p. 3).

The genes'-eye perspective provides a parsimonious account of the biological altruism of sterile insect castes, an interpretation that avoids the cumbersome abstraction of inclusive fitness. No less than the individuals who actually reproduce, sterile workers behave in ways that result in the duplication of the genes shaping their behaviour. It makes no difference that they do not personally pass these genes to the next generation. Metaphorically speaking, eusociality is an evolved strategy used by genes to create more copies of themselves. On this interpretation, biological altruism is not a mystery at all. The appearance that there was a mystery was a result of asking the wrong question. Instead of asking how an adaptation benefits the organism, we should be asking how it benefits the gene patterns shaping the adaptation, where the benefit is defined in terms of the survival and replication of those genes.

In the last section, I suggested that the genes that will increase in frequency in a gene pool are not necessarily those whose phenotypic effects best secure the survival of the group or species, or even the survival and reproductive success of the organism in which they are found. From an organism-centred view, they are instead the genes that contribute most to the inclusive fitness of the organism. But from a gene-centred view, the gene that will increase in frequency is simply the one whose phenotypic effects increase the chances that *that gene* will increase in frequency, relative to other available alleles. As Hamilton (1963/1996) put it, for a gene, *G*, "the ultimate criterion which determines whether *G* will spread is not whether the behaviour is to the benefit of the behaver but whether it is to the benefit of the gene *G*" (p. 7). On reflection, this conclusion is difficult to avoid. After all, regardless of how beneficial the phenotypic effects of a gene may be to an individual (or a group or species), if these effects also make that gene less likely to be copied than alternative versions of the same gene, it will decrease in frequency and ultimately disappear from the gene pool. This is not to deny that the phenotypic effects of genes may benefit the individual, the group, the species, or even other species. The point is that they are not selected *because* they provide these benefits. This is not a trivial distinction; in some cases, selection will favour genes whose effects on the individual, group, or species are far from optimal (G. C. Williams, 1966).

So, ignoring chance factors, natural selection will favour those genes whose phenotypic effects result in them being copied at a greater rate than rival alleles. Many early commentators, holding an organism-centred view of natural selection, believed that an implication of evolutionary theory was that evolved organisms would be entirely selfish.

(This selfishness would have to be taken metaphorically in the case of non-sentient organisms, such as plants and probably many animals.) After all, the only organisms that would succeed in a competitive Darwinian world would be those that looked after their own interests. But on a gene-centred view of evolution, it is only genes that we would expect to be selected exclusively for 'selfishness'. As we have seen, selection may sometimes give rise to organisms that help other organisms to reproduce at the expense of their own reproductive ability. But selection will *not* favour genes that increase the chances that other genes will be replicated at the expense of their own chances of replication. Such genes would quickly disappear from the gene pool. Genes are only selected if they increase their own likelihood of being copied compared to rival alleles; hence, selection favours 'selfish' genes (Dawkins, 1989).

The selfish gene metaphor captures an important idea, but it may foster certain misunderstandings. One potential misunderstanding is that selfish genes necessarily give rise to selfish organisms. But as we have seen, selfish genes can sometimes give rise to non-selfish organisms. So, rather than ruling out biological altruism, the selfish gene approach *explains* it. Another potential misunderstanding is that *selfishness* implies *uncooperativeness.* But evolutionary selection among genes is not a war of all against all. Within the gene pool of a species, a gene is generally only in competition with other versions of the same gene. A gene will typically do best if it 'cooperates' with genes at other loci to build coherent organisms designed to enhance inclusive fitness (Dawkins, 1998).

The genes'-eye perspective turns traditional views of evolution on their heads. On the traditional view, organisms are the central players in the evolutionary story, and the hereditary material, DNA, is simply part of the mechanism through which individuals reproduce. But according to the genes'-eye perspective, this has matters back to front. Genes are not the organism's way of replicating itself; organisms are genes' way of replicating themselves (Dawkins, 1989). Indeed, individual organisms *do not* replicate themselves. With the exception of identical twins, each individual is built from scratch from a unique genetic recipe. And even in asexual species, in which parent and offspring are genetically identical, it does not make sense to say that the organism is replicated (Dawkins, 1982). After all, any injuries that an asexual organism sustains prior to producing offspring are not passed on to offspring. It is only the organism's genes that are replicated. Genes are the replicators in evolution; organisms are the temporary survival machines of genes, the means that they have 'invented' to copy and perpetuate themselves. The unique combination of genes in an organism is as short-lived as the organism, but the genes themselves can survive for thousands or even millions of years.

Earlier I suggested that the genes'-eye view of evolution is potentially more powerful than the inclusive fitness approach. From what has been said so far, it might appear that the two views are just different ways of construing the same data, one in terms of individuals enhancing inclusive fitness, the other in terms of genes enhancing their own fitness. Often they are indeed equivalent. Each gene in an organism has an equal chance of finding itself in offspring (50% in sexually reproducing species), and so the best way to maximise its own fitness is usually to cooperate with genes at other loci and contribute to the inclusive fitness of the whole organism.

However, there are also data that an organism-centred view cannot account for. Sometimes, for example, a gene will arise that outperforms rival alleles (and is therefore selected), but which has detrimental effects on the inclusive fitness of the organism (e.g., segregation distorter genes; Dawkins, 1998). This finding cannot be construed in terms of inclusive fitness. Having said this, though, I do not suggest that the inclusive fitness perspective should be abandoned. This perspective does have the advantage that it focuses on the individual organism, which is clearly an important unit in evolution (Hamilton, 1996). The two perspectives can usually be used interchangeably, depending on which is the most useful. The aim of this section has been to show what the inclusive fitness perspective amounts to, and to argue that the genes'-eye perspective goes beyond it, accounting for more data. (Some criticisms of the genes'-eye perspective on evolution, and especially the application of this framework to psychological science, will be considered in the next chapter.)

The Extended Phenotype

The genes'-eye perspective can be taken one step further. Usually we think of the phenotype in terms of the morphology, physiology, and behaviour of an individual organism. Dawkins (1982, 1989) suggested instead that the phenotypic effects of a gene should be defined as all the effects the gene has on the world that influence its replication rate. So, the phenotype of a spider genome consists not only of the spider's fangs and species-typical behaviour, but also the spider's web. The web is an extended phenotypic effect. Similarly, the beaver's dam and the bird's nest are phenotypic effects of genes, just as the bodies that build them are. No less than beavers and birds, dams and nests evolved through natural selection. Dennett (1991) suggested that clothes are part of the extended phenotype of *Homo sapiens*, and that anatomy books that picture us without clothes do not depict our species in its natural state. Finally, the phenotypic effects of a gene can even be located in other organisms. According to Dawkins' (1982) Central Theorem of the Extended Phenotype, "*An animal's behaviour tends to maximize the survival of the genes* *'for' that behaviour, whether or not those genes happen to be in the body of the particular animal performing it*" (p. 233).

Common Misunderstandings of Evolutionary Theory

Various misunderstandings have plagued a proper understanding of evolutionary theory. To begin with, the well-known phrase 'survival of the fittest' is a somewhat misleading characterisation of the theory (Badcock, 2000).[5] First, survival or longevity in itself is not a 'goal' of evolution. The driving force of evolution is the differential survival of genes, and the survival of an organism is simply a means to this end. Often there is a lot of overlap between the goals of individual survival and gene survival; after all, an organism must survive to be able to reproduce or contribute to the reproductive success of a relative. Sometimes, however, gene survival comes at the cost of reduced longevity for the gene vehicle. Another point is that fitness does not necessarily involve strength, ferocity, or speed. In fact, as I have suggested, fitness is not a characteristic of individual organisms at all; it is more properly considered a characteristic of genes. And the 'interests' of genes do not necessarily coincide with the interests of individual organisms.

The psychologist David Buss (1999) suggested that another common error is to suppose that adaptations must be perfect solutions, and thus that imperfections in the design of an organism argue against an evolutionary interpretation. They do not. The only rule guiding evolution is to go with the best solution available at the time. Because evolution often occurs across such enormous periods of time, the fitness advantage conferred by the best adaptation need only be very small for evolutionary change to occur. Furthermore, a gene need not confer this advantage on all or even most of the organisms possessing it; it

[5] The phrase was introduced not by Darwin but by the philosopher Herbert Spencer.

only needs to outperform other options *on average*. Another reason that adaptations are imperfect is that they are not designed from scratch (each *organism* is built from scratch, but its basic design is not). Instead natural selection tinkers with existing designs, and every step in the gradual evolution of an adaptation must be advantageous for the genes involved. Consequently, natural selection results in designs that no engineer would consider if starting from scratch (Gould, 1980). Finally, existing adaptations are those that met the criteria for selection in the past. They may or may not prove useful in the current environment or in the future. Natural selection does not have foresight. It cannot plan for the future but only provides a retrospective seal of approval (Dennett, 1995). Indeed, if natural selection *could* plan for the future, there would be no evolutionary change (Richards, 2000). For these reasons, it is no surprise that adaptations are far from optimal. In fact, imperfections in design *favour* the evolutionary explanation over the view that life is the creation of a perfect designer (Gould, 1980).

Another error is to think that evolutionary theory explains life as a product of pure chance (discussed in Dawkins, 1996). Although evolution has no goal and is not guided, neither is it a completely random process. Natural selection has a random element and a non-random element. The non-random element is the mindless retention of genes that enhance their own fitness relative to other available variants. The random element is the genetic mutations that produce much of the variation with which natural selection works. Note that 'random' in this context does not necessarily mean 'undetermined'. Mutations and other chance factors may only be random in relation to their effects on fitness, but not random in relation to their own causes. On the other hand, the course of evolution may involve some indeterminacy *if* the genuine randomness supposedly associated with the measurement of quantum states enters the equation.

Evidence for Evolution

Biologists still debate the finer points of the *theory* of evolution. However, the *fact* of evolution has been established beyond reasonable doubt (Futuyma, 1998). According to Dennett (1995), the hope that it will be discovered that species did not evolve after all is as realistic as the hope that it will be discovered the earth is flat after all. In fact, he goes as far as to suggest that "anyone today who doubts that the variety of life on this planet was produced by a process of evolution is simply ignorant" (Dennett, 1995, p. 46). The evidence for evolution is overwhelming. The fossil record shows unambiguously that species have changed over time and that most are now extinct (current estimates are around 99%).[6] Structural similarities among species provide strong evidence for a common origin. As the biologist Mark Ridley noted, if species "had been created separately there would be no reason why they should show homologous similarities" (Ridley, 1985, p. 9). The same argument applies to numerous other findings, including the striking and otherwise inexplicable similarities found across vertebrates during the early phases of embryonic development (Ayala, 1997). For example, non-aquatic vertebrate embryos, including those of humans, have gill slits. Similarly, for a period of time human embryos have tails. All this evidence was available to Darwin and his immediate successors. The strongest evidence for evolution has been uncovered since. Probably the best evidence comes from molecular biology, which has documented the universality of the molecular code (Ayala, 1997). Not only is the fact of evolution established beyond reasonable doubt; the broad outline of the modern theory of evolution is as well established as any theory in science. No evolutionist would deny that many questions remain. How did life begin? How does speciation occur?

[6] Biologists sometimes suggest that, to a first approximation, *all* species are extinct (Pinker, 1994).

What is the relative importance of selection versus genetic drift, or of natural selection versus sexual selection? Is the gene the only important level of selection? Has life evolved on other planets? However, the fact that evolution did take place is no longer in question.

The History of Life on Earth

One of the most profound implications of evolutionary theory is that all life on earth is one large family (albeit a dysfunctional family in which the family members have a nasty habit of eating one another). Every human being is related to every other human being. Chimpanzees and other apes are more distant relatives; our pet cats and dogs more distant relatives still. The grass beneath your feet and the bacteria in your gut are yet more distant relatives. Ultimately, all existing life can be traced back to a common ancestor,[7] and all life that has ever existed on earth can be placed on one family tree. Scientists have pieced together an outline of this tree (Ayala, 1997). The first self-replicating molecules formed around four billion years ago through a process of chemical evolution, a process in which chemistry slowly evolved into biology (Stewart-Williams, 2003b). The next major milestone in evolutionary history was the evolution of the cell (Dennett, 1995). Multi-cellular life made its appearance only within the last billion or so years, and it is only within the last half billion years that life has colonized the ever-shifting land surfaces of this planet. Microbes were the first to colonize this relatively small portion of the planet's living space, followed by plants. Plants opened the way for animals, first among them insects and amphibians. Reptiles evolved from amphibians, and mammals and birds from reptiles. The

[7] This was not the first self-replicating entity, but the last common ancestor of all currently existing life. Note that there is no suggestion that life originated on this planet only once – this may or may not be the case – but only that all life now is related.

first primate appeared around 55 million years ago, and the last common ancestor of humans and modern apes lived between four and seven million years ago.

Conclusion

Evolutionary theory presents a radically different view of the world than the pre-Darwinian alternatives, and the implications of the theory are not limited to the field of biology. An important recent development, for example, is the increasing realization that our evolutionary history has direct implications for the nature of human psychology. This in turn may have implications for, and be informed by, the innate ideas debate in philosophy.

Chapter II: Evolutionary Psychology

In the distant future I see open fields for far more important researches. Psychology will be based on a new foundation, that of the necessary acquirement of each mental power and capacity by gradation.

-Charles Darwin, The Origin of Species, *1859, p. 449.*

The tabula *of human nature was never* rasa *and it is now being read.*

-William D. Hamilton, 1997.

This chapter outlines the field of evolutionary psychology. The focus will be the pivotal assumptions, theories, and findings in the area, with a special focus on material that will be important to the later discussion of the links between evolutionary psychology and the innate ideas debate in philosophy. Most evolutionary theorists maintain that not only does the body have its origin in evolution, but so too does the mind. Evolutionary theory does not answer the deeper question of why matter apparently has the capacity to become conscious when it is organised and functioning in a particular way (Chalmers, 1996; T. Nagel, 1986). Nonetheless, accepting that it does have this capacity, the theory explains how it is that some of the matter on at least one planet is in this peculiar state. Put simply, the basic design of the mind, like any other complex aspect of the organism, is the product of the accumulation of variants that enhanced the inclusive fitness of the bearers of those variants.

The chapter begins with a brief discussion of the evolution of the mind, and a comparison of traditional and evolutionary approaches in psychology. It then presents an overview of the evolutionary perspective on the mind. Following this is a survey of proposed adaptations designed to tackle specific adaptive challenges. The chapter concludes with a look at some of the criticisms that have been raised regarding evolutionary psychology, and some of the alternative approaches that have been proposed to the mainstream evolutionary psychology I discuss in this chapter.

The Evolution of Mind

To begin adding flesh to the skeletal suggestion above, I will return to the genes'-eye perspective and the metaphor of genes struggling for survival in the gene pool. According to this view, genes have one ultimate 'goal': to increase in frequency. This ultimate goal gives rise to various secondary goals. These can be construed as specific adaptive challenges faced by genes in their struggle to replicate themselves via their survival machines. The most important of these secondary goals is that their vehicles reproduce, and this in turn means that they need to survive for long enough to do so. The challenges of survival and reproduction can be broken down into sub-goals. For instance, in order to survive and persist in the face of entropy, gene vehicles must obtain energy (Dennett, 1995). This usually involves utilising the energy of the sun, which is the main source of the energy in circulation on earth. In plants, this adaptive challenge is met through the process of photosynthesis. Animals, on the other hand, obtain the sun's energy indirectly, through eating plants or other animals. This in turn gives rise to another adaptive challenge: avoiding being eaten by other gene vehicles. Genes face many such challenges, and often the solution to one gives rise to many others.

Genes in animals have 'discovered' a general strategy not found in plants to meet adaptive challenges. The strategy is rapid movement or *behaviour* (Dawkins, 1989). The capacity for rapid movement allows animals to respond quickly to the environment. This would be of little use unless animals also obtained immediate information about the environment, and thus motor behaviour and sensory organs presumably coevolved. Initially, the link between sensory input and behavioural response was relatively direct. In some branches of the tree of life, however, the capacity for more complex intermediate processing evolved. This intermediate processing, or at any rate some aspects of it in some animals, is what we call *mind*. So, a curious fact about natural selection is that, though it is a completely mindless process, a process without foresight, it has given rise to creatures with minds and limited foresight.

Traditional versus Evolutionary Approaches to Psychology

As with any aspect of the phenotype, the mind/brain is the joint creation of the genotype and the developmental environment. Therefore, even accepting that the human mind has its origin in evolution, it remains an open question how much of the specific structure and content of the mind is innate or 'hard-wired' and how much is to be attributed to experience. At one end of the spectrum is the view that the human mind is a blank slate or *tabula rasa*, shaped almost entirely by experience or culture. In order to explain how this blank slate is filled, theorists have typically posited one or a few very general, content-independent learning mechanisms, such as associational learning, imitation, reasoning, or a capacity to acquire culture. Blank slate views have an initial plausibility; after all, human behaviour and thinking is incredibly flexible in comparison with that of other animals (Gazzaniga, 1992). Note, though, that even advocates of views at this end of the spectrum would have to attribute at least some things to innate sources. For instance, strict behaviourists would have to concede at a minimum that the capacity to learn through association is innate, as are certain unlearned reflexes, and primary reinforcers and punishers. Similarly, those who emphasise the influence of culture in furnishing the mind with its specific content must posit at least an innate capacity to learn culture. Beyond this, however, an extreme blank slate position would deny that any of the content or structure of the human mind is innate.

Few modern theorists would agree to a strong version of this position. Most accept, for instance, that the human brain is specialised for various tasks involved in sensory perception (for example, detecting edges); that we are predisposed to learn some associations more readily than others; and that a small number of motivations and emotions have an innate basis (Tooby & Cosmides, 1992). Nonetheless, according to the emerging field of evolutionary psychology, the mainstream of social science still falls too close to the blank slate end of the spectrum, and ignores or underestimates the role of evolution in shaping the mind and behaviour. Evolutionary psychologists claim that many aspects of behaviour and psychology that are often explained as a product of environmental or socio-cultural causes have an evolutionary origin. This includes some of the average psychological differences between the sexes, parental love and rejection, sibling rivalry, romantic love, sexual jealousy, human mating patterns, and, as I discuss in Chapter 7, even some moral impulses and aesthetic preferences (Daly & M. Wilson, 1988; Orians & Heerwagen, 1992; Tooby & Cosmides, 1992). According to the evolutionary perspective, these and many other aspects of human mind and behaviour have their origins in the 'adaptive challenges' faced by genes.

The Evolutionary Psychologist's View of the Mind

One of the key differences between traditional and evolutionary approaches is that, rather than positing a few general mechanisms, evolutionary psychologists assume the mind is a collection of many specialised components (Gallistel, 1995; Tooby & Cosmides, 1989).[1] These components, known variously as modules, mental organs, Darwinian algorithms, or evolved psychological mechanisms, were designed to solve relatively specific adaptive problems in the environment in which we evolved. For convenience, they can be divided into two classes: affective and cognitive. The affective components include motivation/reward systems, emotions, and preferences. The cognitive components are information processing mechanisms such as those involved in sensory perception and language. In the following sections, I will look in more detail at the affective and cognitive components of the mind from an evolutionary perspective, and ask how much of the structure and content of the mind can plausibly be attributed to evolution. Before this, though, I will consider the relationship of mind to behaviour.

Behaviour

It is important to emphasise that for any particular processing ability or component of mind to evolve, at each step in its evolution, it must have influenced behaviour. If it did not, it could have no bearing on inclusive fitness and could not be selected (Buss, 1999). This is a point that will be reiterated throughout this thesis: In the final analysis, the innate components of the mind must be understood in terms of their typical contribution to behaviour. We can be more specific. Behaviour can be divided (loosely but usefully) into two kinds: voluntary and involuntary (Dennett, 1991). A number of adaptive challenges are handled by involuntary behavioural mechanisms. These include various unlearned reflexes,

[1] This, at any rate, is the mainstream view in evolutionary psychology at present.

such as shivering and sweating, which are involuntary mechanisms designed to maintain an appropriate body temperature. Although we may be conscious of these behaviours, they are not (normally) consciously controlled processes or the result of conscious deliberation. This distinguishes them from voluntary behaviour. Voluntary behaviour is more complex and flexible than involuntary behaviour. It also appears to be linked more closely to the conscious activity of the brain. This leads to the suggestion that the evolved mechanisms associated with conscious brain activity (the collection of which we call the conscious mind) were selected because of the complexity and flexibility of the behaviour that they make possible. That is, these mechanisms must be understood largely in terms of their role in *voluntary* behaviour. This is a point that will be important in subsequent chapters, as I explore the possibility that people possess innate mental content related to certain issues in philosophy.

Motivations

Another key difference between voluntary and involuntary behaviour is that voluntary behaviour is typically motivated, in the sense of being 'driven' by a conscious desire. Motivations bear an interesting relationship to the metaphorical goals of genes. As noted, the ultimate 'goal' of genes is to replicate themselves, and this gives rise to the secondary goals of survival and reproduction. For genes housed in animal bodies, these secondary goals can be divided into such sub-goals as: obtaining oxygen, obtaining food, avoiding becoming food for another gene vehicle, avoiding toxins and disease, resting, selecting habitats, selecting and attracting mates, cooperating with conspecifics, and helping offspring and other kin. These adaptive challenges are, first and foremost, the 'goals' of genes, not the goals of organisms. However, one way that genes have of achieving their metaphorical goals is to make them our literal goals. In other words, natural selection sometimes favours the evolution of explicit motivations related to solving these adaptive challenges. For instance, as well as being handled by involuntary mechanisms, the adaptive challenge of temperature regulation is handled with voluntary behaviour. We have an evolved preference for a certain range of temperatures, and when we are too cold or too hot, we are motivated to redress this situation. The behaviour through which this is accomplished is not directly shaped by natural selection. For genes, these and other goal-directed activities are merely means to the end of propagating themselves. However, to this end, they have become ends in themselves to their vehicles.

It is well to remember that genes do not *always* attain their 'goals' by making them our goals (indeed, this is part of the reason it is useful to think in terms of adaptive challenges of *genes* as opposed to individuals). To illustrate, I will make what at first may appear to be a surprising claim: It is possible that most animals have no motivation to survive or reproduce. Instead, they have a range of specific motivations and behavioural tendencies, including motivations to eat, drink, copulate, and run away from certain stimuli. These lead them to act *as if* they have the more abstract goals of survival and reproduction; however, they need not actually possess these goals. (This issue will be revisited in Chapter 3, when I introduce the concept of 'implicit ideas'.) Failure to distinguish the metaphorical goals of genes from the literal goals of individual animals could lead to misunderstandings of the claims of evolutionary psychology. In light of this possibility, evolutionary psychologists emphasise that they do not claim that people have an evolved motivation to pass on their genes. "If that's how the mind worked, men would line up outside sperm banks and women would pay to have their eggs harvested and given away to infertile couples" (Pinker, 2002, pp. 53-54). Instead, people seek to satisfy more specific evolved motivations related to specific sub-goals, such as the desire for sex (Symons, 1992). The fact that the main biological 'goal' of sex is pregnancy does not mean this is why we have sex. Sometimes it is, but often we have sex simply as an end in itself. Although the ultimate reason we possess this motivation is that it led to the propagation of the genes of our ancestors, this is not to say that this metaphorical biological goal is our literal goal, either consciously or unconsciously.

Language

The suggestion that at least some motivations have an innate basis is relatively uncontroversial. So too is the suggestion that certain information processing mechanisms have evolved that are specifically designed for the task of sensory perception. The debate gets more heated when it is suggested that various 'higher' cognitive abilities are products of evolution. One such suggestion is the capacity to acquire and use language. Language acquisition clearly has an experiential basis. Children born in China learn Chinese; children born in France learn French. However, as the linguist Steven Pinker (1994) has pointed out, it is equally clear that our genetic makeup plays a role. After all, people often take kittens and puppies to live with them, and these infant animals are exposed to language, just as human children are. But only the humans acquire language. The question is: Does this reflect a very general cognitive ability found in humans, or do we have specific cognitive adaptations to learn and use language?

Pinker (1994) assembled various lines of research supporting the view that language is a specific adaptation rather than "the clever solution to a problem thought up by a generally brainy species" (p. 45). These arguments are important to the present thesis, as they serve as a model for arguing for the innateness of any aspect of mind. First, no mute culture has ever been reported. Second, although languages differ in the number of words they possess, all are roughly equivalent in terms of the sophistication of their structure. In contrast, the sophistication of mathematical reasoning varies a great deal between cultures. Third, when groups of people with different languages are thrown together, adults invent hybrid pidgin languages, which possess little grammar. The next generation of children then spontaneously devise and settle on rules of grammar in the course of their interactions, producing new grammatical languages called Creoles (Bickerton, 1991). This suggests that, just as some songbirds have a sensitive period for learning their song, humans have a sensitive period related to the acquisition of grammar. Fourth, language appears to have specific seats in the brain (although see Mueller, 1996). Conditions such as Broca's aphasia and Specific Language Impairment (SLI) involve a loss of language but not a general loss of intellectual ability. Conversely, people with William's syndrome have very low general IQs (around 50), but language skills that in many ways are quite advanced (Badcock, 2000; but see Karmiloff-Smith, 2000). Other empirical evidence consistent with the innateness of language acquisition include the existence of language universals such as the active-passive distinction, and grammatical categories such as nouns and verbs (Dixon, 1977).

There are also theoretical reasons to accept that the human brain is specialised for language acquisition and use. The linguist Noam Chomsky (1959, 1965, 1980) argued forcefully that a general learning program would be unable to acquire a language. According to his *argument from the poverty of the stimulus*, the input available to the language learner (i.e., the language use of those in the young child's environment) is insufficient to infer the underlying rules of grammar. There are too many possible ways the evidence could be interpreted. Thus, the brain must have specialised programs for acquiring grammar, which make certain implicit assumptions about the grammatical structure of the language(s) the child will encounter, and thus limit the range of possible interpretations. (This style of argument will be employed in later sections.) Taken together, the evidence and arguments suggest that language is an adaptation rather than a by-product of more general abilities. In other words, it is "is a topic like echolocation in bats or stereopsis in monkeys, not like writing or the wheel" (Pinker & Bloom, 1992, p. 451).

The Environment of Evolutionary Adaptation

A central claim associated with evolutionary psychology is that the blueprint of the human mind was drafted not in the modern environment, but largely in the environment of our ancestors. It is estimated that for around 99% of the time that hominids have existed, they lived in hunter-gatherer tribes in the African savannah.[2] As a result, the mind is designed to deal with the adaptive challenges associated with that environment and that lifestyle. The typical environment associated with our evolution during this period is referred to as the *environment of evolutionary adaptation* (EEA; Tooby & DeVore, 1987). In the EEA, people lived in relatively small, kin-based groups, with perhaps 50 to 200 other individuals (Dunbar, 1993). Males tended to hunt and females to gather, and males tended to control the resources. Long-term pair bonds were common but polygyny and short-term sexual liaisons were also practiced (Buss, 1999). Life expectancy was shorter than it is in modern developed nations, and people were less protected from dangerous animals and other environmental threats (Badcock, 2000).

Since the invention of agriculture around 10,000 years ago, humans have radically transformed their environment. In evolutionary terms, this is a short period of time, and biologically we are largely the same animals that once roamed the earth in hunter-gatherer tribes (Symons, 1979). In effect, we have an ancient brain in a modern world (Allman, 1994). As R. Wright (1994) put it, we "live in cities and suburbs… all the while being

[2] Thus, to a first approximation, hominids have only ever lived in hunter-gatherer tribes. Note, though, that not all accept this figure. Other estimates place it around 70 or 80 percent (Janicki & Krebs, 1998).

pushed and pulled by feelings designed to propagate our genes in a small hunter-gatherer population" (p. 191). The mismatch between the EEA and the modern environment accounts for some human behaviours that go against the evolutionary 'goal' of reproduction. This includes the use of birth control technology, which may initially seem to contradict the evolutionary perspective. Complex adaptations take a long time to shape and birth control is of very recent origin (Symons, 1992). However, as Pinker (1997) pointed out: "Had the Pleistocene savanna contained trees bearing birth-control pills, we might have evolved to find them as terrifying as a venomous spider" (p. 42).[3]

Evolutionary psychologists have conjectured that in some ways humans are not particularly well adapted to modern industrialised societies, with their sedentary lifestyles, fixed places of residence, separation from close kin, and societies thousands of times larger than those in which our species evolved (Badcock, 2000; Hedrick-Wong, 1998). The mismatch between the modern environment and the environment in which we evolved may give rise to some unique problems of modern living. For example, humans are thought to have innate preferences for foods high in fat, salt, and sugar, and because such foods were not available in abundance in the EEA, there was no selection pressure to evolve any restrictions on these preferences (Buss, 1999; Eaton & Konner, 1985). In the modern developed world, however, sugar and fats are readily available. As a result, we often eat too much of these foods, to the detriment of our health. These taste preferences are one of a number of examples of aspects of human psychology that seem poorly matched to the modern environment but which would have been useful in the environment of our

[3] The EEA obviously shared many features with other environments. As such, many cognitive adaptations may have been shaped before the Pleistocene, and remain in a similar form to that found in our pre-human ancestors. In addition, Sterelny (2003) argues that we may have adaptations for features of human life more recent than the last 10,000 years, including adaptations to agricultural living.

ancestors. Such findings are difficult to explain in non-evolutionary terms. They should also open the sceptic's mind to the possibility that natural selection is responsible for other aspects of psychology, for it would be surprising if selection had only shaped those characteristics of the mind we cannot imagine having any other explanation. Just as anatomical and physiological design flaws argue for evolution over divine creation, mismatch between the mind and the modern environment argues for an evolutionary perspective in psychology over the view that we have escaped our evolutionary origins and are shaped almost exclusively by experience.

Adaptations for Individual Survival, Reproduction, Kin Altruism, and Group Living

Having sketched a general outline of evolutionary psychology, I will look at some of the psychological adaptations that evolutionary psychologists argue have evolved in our species in response to various adaptive challenges. This includes adaptations for predator avoidance, mating, parenting, and reciprocal altruism. The purpose of this section is to provide an overview of the most important findings in evolutionary psychology, and to summarise some of the evidence supporting the accuracy of this approach. In the course of the discussion, I will also introduce various ideas that will be important in later chapters.

Avoiding Predators and Other Environmental Dangers

Humans appear to have a variety of adaptations designed for the avoidance of predators, aggressive conspecifics, and other dangers. Various stimuli, including loud sounds, sudden movements, and pain, activate the fight-or-flight response, which prepares the body for rapid action (Maier, 1998; Marks & Nesse, 1994). In the identification of threats, we tend to be biased toward false positives (Evans & Zarate, 1999; LeDoux, 1996). This makes sense in evolutionary terms, as the cost of a false positive (e.g., avoiding a vine because you mistook it for a snake) is less than the cost of a false negative (e.g., *not* avoiding a snake because you mistook it for a vine). (This idea – that selection can favour certain perceptual and cognitive biases – will be important in later chapters. For instance, in Chapter 6, it is proposed that we possess a bias toward assuming correlated events are causally linked.)

Once threats are identified, the emotion of fear appears to play an important role in meeting them (Nesse, 1990). Fear is associated with a variety of behavioural responses aimed at protecting the individual. These include escape, avoidance, warning displays, defensive aggression, submission, and immobility (Maier, 1998; Marks, 1987). In many cases, our fears are tuned to specific threats that our ancestors faced. Research has shown that people are more likely to form some phobias than others (another example of preparedness). These phobias appear to relate to threats faced by our hunter-gatherer forebears. Even people living in modern environments are more likely to develop phobias of ancestral threats, such as snakes and spiders, than they are of developing phobias of items much more dangerous to them in their modern environments, such as guns and electrical outlets (Öhman & Mineka, 2001; Seligman, 1970, 1971; Seligman & Hager, 1990).[4]

Other examples of the fine-tuning of human fears to the needs of our ancestors come from the sub-field of developmental evolutionary psychology (Bjorklund & Pellegrini, 2002). It is notable that some fears emerge around the time the associated adaptive threats would have arisen in the EEA (Marks, 1987). For instance, infants typically start to show a fear of heights and strangers at around six months, which is also around the same age that they start being able to move around on their own (Buss, 1999).

[4] For an alternative interpretation of this pattern, see Davey (1995).

Reproduction

These and other psychological adaptations increased the likelihood that our ancestors would survive. However, the bottom line in evolution is reproduction (of self or kin). Consequently, this is an area in which it would be expected that natural selection would craft many specific adaptations (Buss, 1999). Like most animals and many plants, humans reproduce sexually. Sexual reproduction gives rise to many adaptive challenges, many of which are handled through voluntary behaviour. Probably the most important is the challenge of selecting and attracting appropriate individuals with whom to mate (Buss & Schmitt, 1993; Tooby & Cosmides, 1992). Adaptations related to reproduction, and also those related to parenting, differ in an important way from the adaptations discussed so far, as in both areas the ideal strategies for propagating genes can differ depending on whether they occupy a male or a female vehicle. Thus, whereas adaptations are usually found in all members of a species, adaptations related to reproduction and parenting often differ between the sexes (Buss, 1999; G. C. Williams, 1966).

Darwin (1871) noted a widespread trend in the animal kingdom: Females in many species are choosier than males about who they will have sex with, and males are more eager for sex and compete among themselves for access to females. In his theory of sexual selection, Darwin drew attention to the importance of female choice and male competition in evolution (see chapter 1). However, he was unable to explain why the sex difference tended to be in this direction in the first place. Robert Trivers (1972/2002) set forth his answer to this question in a classic paper in which he linked sexual selection to differential parental investment. His *theory of parental investment and sexual selection* makes two predictions for species in which the average level of parental investment made by one sex is greater than that made by the other.[5] First, the sex that makes the larger investment will be more selective about their sexual partners. Second, the lesser investing sex will compete for access to the greater investing sex. Thus, Trivers tied parental investment to intersexual selection and intrasexual selection, respectively.

To understand the logic behind Triver's (1972/2002) predictions, we need to ask: What mating strategy would be most likely to maximise an individual's inclusive fitness? The importance of this question lies in the fact that the genes contributing to such a strategy are those that are most likely to be selected. It turns out that, as a result of differing levels of parental investment, the optimal strategy can vary between the sexes. In many species, the female's minimum investment in offspring is higher than that of the male. To begin with, a female's gametes (eggs) are by definition larger than a male's gametes (sperm), and thus require more energy to produce. Furthermore, among mammals, the obligatory female investment is particularly high, due to internal fertilisation in females. In *Homo sapiens*, for example, a female must invest a minimum of around nine months into the production of any offspring. The male, in contrast, need only invest the time and energy it takes to impregnate her. As a result of differences in parental investment, the maximum number of offspring females in many species can produce is considerably less than the maximum number a male can produce.

What are the optimal strategies for passing on one's genes in this situation? Because high-investing females are limited in the number of offspring they can produce, they cannot greatly increase their reproductive success by mating with a large number of males. The best way for them to increase the number of surviving offspring is to make better mating

[5] Parental investment is defined as "*any investment by the parent in an individual offspring that increases the offspring's chances of surviving (and hence of reproductive success) at the cost of the parent's ability to invest in other offspring*" (Trivers, 1972/2002, p. 67).

decisions – to aim at quality rather than quantity. This is an important selection pressure, and accounts for the fact that females in many species are choosier than males about their sexual partners. The situation is very different for males. Unlike females, if a male has sex with many partners, he *can* greatly increase the number of offspring he produces. Thus, while the ideal strategy for females is largely limited to making better choices, genes in males also have the option of maximising reproductive success by aiming at quantity rather than quality. In many species, natural selection has taken this path. Males in some species take any possible opportunity to mate, and polygyny (a mating system involving one male and many females) is also relatively common in the animal kingdom (Badcock, 2000; Pinker, 1997). It is not the case, however, that males in all species adopt a quantity-over-quality strategy. Some tend toward monogamous pairing, which is associated with a high level of male parental care.

In species in which the male strategy is to have as many offspring as possible rather than to invest heavily in a smaller number, a new complication arises. Because any particular female can only produce a finite number of offspring, if one male impregnates many females, many males will impregnate none. In other words, in such species there is higher level of *reproductive variability* among males than among females. As a consequence, there is great competition among males (in evolutionary terms) to be the one who succeeds in reproducing. This selection pressure in turn leads to greater *sexual dimorphism* in that species. Males in species with high reproductive variability are typically larger, stronger, more aggressive, and more willing to take risks than females (Daly & M. Wilson, 1983). Gorillas are an example of a polygynous species and have a high level of male reproductive variability. Male gorillas must fight to acquire and retain a harem. As a result of this selection pressure, male gorillas are about twice as heavy as females (Pinker, 1997).

A different pattern is found among species with monogamous mating and high male parental investment. First, consistent with the theory of parental investment and sexual selection, when males make a large investment they become choosier about whom they have sex with, and females may compete among themselves for male investment. Furthermore, in monogamous species, the difference in the reproductive variability of the two sexes is reduced. As a result, there is less intrasexual competition and less sexual dimorphism. Gibbons illustrate this point nicely. This ape species is monogamous and male gibbons exhibit a high level of parental investment. As would be predicted from Triver's theory, gibbon males and females are virtually the same size (R. Wright, 1994). Further support for Triver's (1972/2002) theory comes from dimorphic species that buck the usual trend that females choose and males compete. In several species of the pipefish seahorse family, for instance, the males are choosier than the females, and the females tend to be larger and compete for the best males. The exceptions prove the rule, however, for seahorse males incubate the females' fertilized eggs in their pouches and thus invest as much or more into offspring than females. Other sex-role reversed species include the Mormon cricket and the Panamanian poison-arrow frog (Trivers, 1985).

Now the big question: Do variables such as parental investment and reproductive variability have any relevance to humans? The answer appears to be that they do (Bjorklund & Shackelford, 1999). Among humans, most long-term relationships are (largely) monogamous. However, casual sexual relations are not uncommon and humans in some cultures also engage in polygamous relationships (Buss, 1999). This may suggest that mating systems in humans are variable and a product of culture, rather than a product of evolutionary forces. But although they are variable, human mating systems do seem to fit within the same laws that describe and predict mating patterns in other species. They may thus have an evolutionary basis. Let us begin by considering monogamous mating among humans. As noted, most long-term human relationships are monogamous, and this is the case even in cultures that permit polygyny (Badcock, 2000). Following the trend found in the rest of the animal kingdom, the high level of monogamous pairing in humans is associated with a high average level of male parental care. Given that both monogamous mating and high male parental investment are the norm across human cultures (Buss, 1999), an evolutionary explanation is at least plausible. Other considerations provide further support for this explanation. Parental investment is costly and reduces males' opportunities for other matings, and as a result we would predict that human males would not be indiscriminate about who they form long-term pair bonds with. This is precisely what is found (Buss & Schmitt, 1993; Kenrick, Sadalla, Groth, & Trost, 1990). Like females, males choose the best long-term mate they believe they are able to obtain (Maier, 1998). Note that there may be no strong evolutionary pressure toward monogamous relationships among humans lasting for life. Human pair bonds may originally have evolved only to bring up a single child through the first four years (H. E. Fisher, 1992).

Although there is a strong trend toward monogamy among humans, we are certainly not completely monogamous. Polygyny is more common among humans than it is among gibbons, but less common than it is among gorillas. Consistent with an evolutionary interpretation of this fact, the level of sexual dimorphism found in humans is intermediate between that of gibbons and gorillas. We are "a moderately sexually selected species" (Crawford, 1998, p. 12). For instance, though human males are on average larger and more physically aggressive than females, this difference is not as great as that found in gorillas.

Human females also tend to mature sexually before males, which is typical of polygynous species (Badcock, 2000). Although only a minority of human relationships are polygynous, this does seem to be a persistent trend in human behaviour (R. Wright, 1994). Furthermore, although polygyny is not uncommon, cultures with long-term polyandrous mating systems are rare (Badcock, 2000). This makes evolutionary sense, and is consistent with the general trend found among mammals.

In addition to forming long-term mating arrangements (both monogamous and polygynous), there is evidence that humans have a long history of casual sex (Buss, 1999). In species in which females sometimes mate with more than one male within the length of time sperm can survive in the female's reproductive tract, there is selection pressure for larger numbers of sperm and thus larger relative testicle size (Shackelford & LeBlank, 2001). For the monogamous gibbon, the relative size of males' testicles is low, whereas for the promiscuous chimpanzee it is high. In human males, the relative testicle size is intermediate between that of chimpanzees and gibbons (R. Wright, 1994). This suggests that, over the period of our evolution, humans were less promiscuous than chimps but more promiscuous than gibbons.[6] The fact that this behaviour has had evolutionary consequences does not mean it necessarily has an evolutionary origin. However, certain lines of evidence suggest that it does. First, casual sex is found in all existing societies (Buss, 1999).[7] Second, in short-term mating a familiar sex difference emerges again. Although males are almost as demanding as females about long-term partners, when it comes to short-term sexual encounters they are notably less demanding than females (Buss & Schmitt, 1993;

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[6] In the past, researchers learned about pre-historic societies solely through the methods of such disciplines as archaeology. It is a fascinating implication of the evolutionary perspective that we can now surmise things about the lifestyles of our ancestors – including aspects of behaviour that are usually kept secret - by looking at anatomical features such as testicle size.

[7] According to one commentator, the typical human mating pattern is "monogamy plagued by adultery" (Ridley, 1994, p. 170).

Kenrick et al., 1990). This makes evolutionary sense in light of the fact that a short-term encounter is more likely to involve high investment for the female than for the male.

I have suggested that the most advantageous mating strategy for genes differs depending on whether they are housed in male or female vehicles. Genes do not control behaviour directly, of course, and nor are these strategies conscious intentions possessed by individuals (people do not sit down and calculate which mating strategy will best propagate their genes). So how do genes implement the strategies? According to evolutionary psychologists, it is through preferences, motivations, and cognitive biases (Buss, 1992; Ellis, 1992; Haselton & Buss, 2000). However, before looking at some of the differences in male and female sexual psychologies, attention should be drawn to the fact that there are many areas of similarity, as many of the adaptive challenges connected with reproduction are identical regardless of sex. For instance, genes in both sexes face the challenge of avoiding incest. Mating with close kin increases the likelihood that offspring will have genetic defects. One way that this challenge is dealt with in humans is a phenomenon known as the *Westermarck effect*. This refers to the finding that people who grow up together tend not to be sexually attracted to one another (Bevc & Silverman, 2000; Lieberman, Tooby, & Cosmides, 2003; Sheper, 1983). Because humans usually grow up with kin, this tendency lessens the chances of incestuous mating, with its attendant dangers. (In Chapter 7, I consider possible sex differences in the strength of moral predilections related to incestuous mating.)

Another aspect of the sexual psychologies of both males and females is a preference for certain physical characteristics that in the past were associated with an enhanced likelihood that any offspring would survive to reproduce. Many of the physical traits humans find attractive are indicators of good genes or good health (Buss, 1999;

Shackelford & Larsen, 1997, 1999, 2002; Singh, 1993, 1995). There is some overlap between these categories. Health is partly a product of genes, and thus good health is an indicator of good genes. Health is also a product of non-inheritable environmental factors. Nevertheless, this is still relevant to mating decisions. People in poor health have lower reproductive potential, and contagious diseases or parasites may be passed on to offspring. Among the traits indicative of health that people find attractive are a clear complexion and an absence of disease or sores. Conversely, indications of disease, deformity, and old age are found unattractive by both sexes. Another important physical marker of good genes, good health, and resistance to local parasites is facial and bodily symmetry (Gangestad & Thornhill, 1997; Grammar & Thornhill, 1994; Thornhill & Gangestad, 1993). In favour of the view that these standards of physical beauty are innate, there is evidence that they emerge as early as two or three months of age, and are consistent across cultures and races (Buss, 1999; Jones, 1996). As well as physical features, both sexes also tend to prefer personality traits indicative of compatibility and good potential for parenting. These include traits such as kindness and intelligence (Buss, 1989).

In addition to these commonalities, men and women show marked differences in the standards they use in choosing mates. These differences have been found in all the cultures that have been surveyed and make sense in light of the different challenges faced by genes in male versus female vehicles (Buss, 1989). Some of the most important differences stem from the fact that, on average, it is more advantageous genetically for a male to pursue a short-term strategy than it is for a female. This accounts for the finding that, although both short-term sexual encounters and committed relationships may be desirable to members of both sexes, on average, males have a stronger desire for casual sexual liaisons and sexual novelty, whereas females have a stronger desire for committed relationships (Buss, 2000;

Buss & Schmitt, 1993; R. Clark & Hatfield, 1989; Ellis & Symons, 1990; Schmitt et al., 2003; Schmitt, Shackelford, & Buss, 2001; Schmitt, Shackelford, Duntley, Tooke, & Buss, 2001; Symons, 1979). In addition to cross-cultural self-report data, the evidence for this sex difference includes the fact that men are virtually the sole consumers of pornography, and women virtually the sole consumers of romance novels (Pinker, 1997).

To delve more deeply into the evolutionary contribution to male and female sexual psychologies, I will focus on each sex in turn, beginning with females. The ultimate goal of genes in females is to maximise reproductive output. This goal can be divided into two major sub-goals: Mate with a male with the best genes possible and acquire long-term investment. I have already looked at the physical preferences related to the first goal. As far as the second is concerned, the evidence suggests that female preferences in a long-term partner have been shaped by adaptive challenges such as finding a male who is willing and able to invest in offspring, likely to be a good parent, and physically able to protect her and her offspring (Buss, 1989, 1999). Women tend to value wealth and social status in a potential mate more than do males.[8] They also place more importance on traits that predict these things, such as ambition, industriousness, and assertiveness (Buss, 1999; Kenrick et al., 1990).[9] A potential mate's resource-providing potential is more important to females than to males because in the EEA, males controlled most of the resources (Buss, 1996). Females also tend to prefer males somewhat older than themselves, which may be because in our ancestral environment older males were likely to have accrued more resources and status (Buss & Schmitt, 1993; Kenrick & Keefe, 1992). When the greater desire of females for partners with resources and status is considered alongside the greater desire of males for

[8] Status indicates control of resources (Buss, 1999).

[9] These female preferences would have created selection pressure for a male motivation to strive for wealth and status (Ridley, 1994), just as peahen preferences created selection pressure for large, colourful tails.

multiple partners, an explanation for the variable long-term mating strategies found in our species starts to emerge. It has been proposed that in societies in which there are some wealthy males and some poor males, the preferences of males and females conspire to make polygyny (or furtive polygyny) more likely. On the other hand, in economically egalitarian societies (usually societies in which everyone is poor), monogamy is the norm (Alexander, 1979).

Another adaptive challenge shaping female preferences is that of determining whether a male is willing to commit to a long-term relationship, as opposed to pursuing a short-term sexual strategy. On average, females prefer to delay having sex with a new partner for longer than do males, resulting in a longer courtship and more time to assess a male's character and intentions (Buss, 1999). Other female preferences relate to both willingness to invest and good parenting potential. This includes the preference for males who show signs of commitment and love, dependability and emotional stability, and who interact well with children. Finally, the adaptive problem of finding a male who is able to protect a female and her offspring is solved in part by the female preferences for size and height, strength, athletic ability, and bravery (Buss, 1999; Buss & Schmitt, 1993).

Although sex within the context of a long-term relationship may usually have been the optimal course for genes in females, short-term mating may also sometimes have been advantageous. There is speculation that short-term sexual behaviour among females is shaped in part by evolutionary influences. Women engaging in affairs are more likely to have sex with their lovers when they are ovulating (and thus more likely to conceive), and more likely to have sex with their husbands when they are least likely to conceive (Buss, 2000). They are also more likely to have an orgasm during extra-pair copulations, and female orgasm increases the chances of getting pregnant (Baker & Bellis, 1993;

Shackelford et al., 2000). If this is a product of selection, it suggests one evolutionary reason for short-term mating among women: The genes giving rise to these tendencies may have been 'pursuing' a cuckold strategy. As noted, genes in female are most likely to be propagated if she mates with a man with good genes, and also obtains high quality male parental investment. However, these need not come from the same man (Ridley, 1994).

There are other reasons that short-term mating among females may have been genetically advantageous. First, it may have provided a way of obtaining resources and protection (Buss, 1999). Second, although obtaining both investment and good genes is the ideal outcome, a sufficient quantity of either may compensate for the absence of the other, if there are no better options. A female can typically obtain a better male (in evolutionary terms) if she offers sex without commitment (Maier, 1998). Mating with a highly attractive male may be advantageous enough genetically to offset the costs of foregoing paternal investment, because it increases the likelihood that offspring will be attractive and thus that they will reproduce. In support of this analysis, there is evidence that females have higher standards for physical attractiveness, resources, and status in a short-term mate (Buss, 1999; Buss & Schmitt, 1993; Gangestad & Simpson, 1990). This can be contrasted with the finding noted earlier that males have lowered standards for short-term liaisons. Given the possible differences in parental investment stemming from short-term mating, this sex difference supports the evolutionary interpretation of the short-term sexual behaviour of males and females.

The 'goal' of genes in males is the same as that in females: to maximise reproductive output. However, the means to this end differ. Males tend to place more emphasis on physical attractiveness than do females in choosing a mate (Buss, 1989). Male judgements of physical attractiveness are shaped strongly by the adaptive challenge of choosing a mate with high reproductive potential. Reproductive potential reaches a peak in females in their early twenties and thereafter declines much more rapidly than it does for males. Consequently, whereas females tend to be attracted to older males, the average male's physical preferences relate to signs of youth. Neotenous facial traits such as large eyes and a small nose are found more attractive in female faces (Johnston & Franklin, 1993; Jones & Hill, 1993). Other attractive features include good muscle tone, smooth skin, full lips, lustrous hair, and youthful, energetic behaviour (Buss, 1999). Another discovery concerns women's waist-to-hip ratio (WHR; Singh, 1993; Singh & Luis, 1995). Although there are cross-cultural differences in the ideal weight for women, the preferred WHR is always roughly the same (0.7). This is the classic hourglass shape, and is associated with greater levels of health and reproductive capability (Singh, 1993).

Another important variable related to reproduction in humans is *paternity uncertainty*. Although females can be virtually certain they are the parents of their offspring, males often cannot. In a group-living species with high male parental investment, this raises a new adaptive challenge for genes in males: avoiding being cuckolded. The genes of a male who invests his time, energy, and resources into another male's children will not be represented in the next generation. On the other hand, any inheritable trait that lessens the chances of being cuckolded is likely to be passed onto offspring. This selection pressure may account for the finding that males tend to prefer someone who is not sexually promiscuous when choosing a long-term partner or legal spouse (although in short-term mating, promiscuity may be irrelevant or even desirable in a female; Buss & Schmitt, 1993). Paternity uncertainty may also account for the sexually proprietary psychology typical of males (M. Wilson & Daly, 1992). Although both sexes are prone to sexual jealousy, males tend to be more distressed than females about their partner's sexual infidelities. Females, on the other hand, are more distressed than males by *emotional* infidelities; that is, forming a close emotional bond or falling in love with another female (Buss, Larsen, Westen, & Semmelroth, 1992; Buss, Shackelford, & Kirkpatrick, 1999; Buunk, Angleitner, Oubaid, & Buss, 1996; Shackelford, Buss, & Bennett., 2002).[10] This sex difference is thought to reflect the differing adaptive challenges facing males and females in the EEA: avoiding being cuckolded versus avoiding losing long-term male investment. Contrary to claims made by social scientists such as Margaret Mead (1928), jealousy in romantic relationships appears to be universal across human societies (D. E. Brown, 1991), and may have the evolutionary function of motivating efforts to prevent a mate's infidelities or desertion.

Kin Altruism and Parenting

The topics of mating and reproduction naturally lead on to that of parenting. But before looking at the evolutionary psychology of parenting, it will be useful to elaborate on the issue of kin selection and biological altruism (introduced in chapter 1). According to the genes'-eye view of evolution, the genes that are selected are those whose effects increase the likelihood that they will be replicated. This results in the selection of genes that, metaphorically speaking, selfishly seek the goal of self-replication. As Dawkins (1989) noted: "That selfishness will usually give rise to selfishness in individual behaviour. However… there are special circumstances in which a gene can achieve its own selfish goals best by fostering a limited form of altruism at the level of individual animals" (p. 2). One such circumstance is when the individuals in question are relatives. The behaviour of sterile castes of eusocial insects provides an example of kin-based biological altruism. Just as describing genes as selfish is purely metaphorical, describing the behaviour of insects as

[10] Not all studies have replicated this result; see, for example, Hupka & Bank (1996).

altruistic is also metaphorical. When a bee stings a perceived invader, it presumably has no awareness of the sacrifice it is making and is not motivated by concern for the well being of others. In contrast, in humans and probably some other species, the adaptive problem of helping kin is dealt with in part through the evolution of genuine psychological altruism toward kin. This genuine altruism is a subset of biological altruism (and has, interestingly enough, provided the metaphor to describe the more general phenomenon of which it is a part).

Several factors are relevant to understanding the evolutionary contribution to altruism among kin. The most important is relatedness (Burnstein, Crandall, & Kitayam, 1994). Relatedness refers to the proportion of genes we share with other individuals, over and above the genes that all members of a species share (Dawkins, 1989). This variable is measured using the *coefficient of relatedness* (S. Wright, 1922). For first-degree relatives (direct offspring, siblings, and parents), the coefficient of relatedness (r) is .5. This means that, for any gene in an organism that is not universal to the species, the likelihood that it will also be found in a first-degree relative is 50% (Dawkins, 1979). For second-degree relatives (grandparents, grandchildren, aunts, uncles, and half-siblings), r is .25, and for third-degree relatives (e.g., first cousins), r is .125. For purposes of comparison, it is the convention to speak of organisms as being 100 percent related to themselves ($r = 1$). Identical twins also share 100 percent of one another's genes (as would clones).

According to Hamilton's rule, an inherited tendency toward altruistic behaviour will be selected if the coefficient of relatedness is greater than the reproductive costs of altruistic behaviour to the altruist (c) divided by the reproductive benefits to the recipient (b), $r > c/b$. This rule describes an evolvability constraint (Buss, 1999): Variants breaking this rule will not be selected (at least not through kin selection). On the other hand, there is no implication that kin altruism *must* evolve, but only that if the appropriate variants become available they will be selected. An initial precondition for the evolution of kin altruism is that organisms must have some reliable means of recognising kin, for example, through smell, phenotypic similarity, or early-life association (Crawford, 1998). Once this demand is satisfied, evolution will tend to favour adaptations that help the individual more than first-degree relatives, first-degree relatives more than less related kin, and kin more than unrelated strangers (Buss, 1999). J. B. S. Haldane (1955) hinted at the behavioural and psychological effects of relatedness when he quipped that he would lay down his life for more than two siblings or eight cousins. A more serious analysis derived such predictions as that cooperation, feelings of closeness, and cultural recognitions of the closeness of kin will be related to genetic relatedness (Daly, Salmon, & M. Wilson, 1997). A great deal of evidence corroborates such predictions and testifies to the importance of relatedness for psychology. For instance, people are more likely to help kin than non-kin in life-or-death situations (Burnstein et al., 1994). Similarly, grief in response to the death of a loved one increases as a function of genetic relatedness (Crawford, Salter, & Jang, 1989; Littlefield & Rushton, 1986; Segal, S. M. Wilson, Bouchard, & Gitlin, 1995).

Parenting

Parenting is the most important example of kin altruism (Dawkins, 1989). Mammals invest more time and energy into their offspring than any other class of animal, and humans are no exception to this trend. In fact, the need for parental input is particularly high in our species. Human offspring have the longest period of dependency of any animal on earth, and newborn humans are extremely vulnerable. As such, it is reasonable to suppose that parental behaviour among humans has been shaped in important ways by natural selection. From a gene-selectionist perspective, the ultimate goal of parenting is to ensure that direct offspring will reproduce, and to this end, members of parental species help their offspring to survive and grow. Selection favours the evolution of parental behaviour aimed at satisfying the 'goals' of the genes of offspring. Some of these goals relate to the evolved motivations of the offspring themselves, such as the desire for food and an appropriate temperature. Other aspects of parental behaviour include the provision of protection and opportunities for offspring to learn (Maier, 1998).

Males and females are equally related to their own offspring, and thus if relatedness were the only relevant variable, the sexes would be equally parental. But among parental land animals, females are usually the sole providers or main providers of parental care (Dawkins, 1989). Once again, humans are no exception to this trend. Mother-child bonds and father-child bonds are found in all cultures, but in all cultures, the mother-child bond is stronger, as indicated by such variables as the amount of time mothers vs. fathers spend with their children. This is true even in Western cultures, despite the widespread ideal of sexual equality (Buss, 1999). To explain this sex difference, we must invoke variables other than relatedness. One important variable is *paternity uncertainty* (Daly & M. Wilson, 1995). Because women are less likely than men to invest inadvertently in other women's offspring, the advantages of parenting would have been greater on average for genes in women than in men. Furthermore, when time is devoted to parenting, potential matings are missed. This is a greater cost for genes in males than in females, because increased matings can greatly increase the number of offspring a male has but not the number a female has (Alcock, 1993).

Nonetheless, human males in all cultures invest heavily in offspring. Why might this be? Sexual selection may provide a partial explanation: A female preference for males who were willing to commit and invest in offspring may have created selection pressure for these traits (Buss, 1999). Given this female preference, males can obtain a better mate if they are willing to commit (Maier, 1998). Male parental investment has also been linked to the idea that our species has evolved to hunt and eat meat (Tooby & DeVore, 1987). Meat is a concentrated food source and would have made providing for offspring very economical, thereby increasing the benefit-cost ratio of male parental input.[11] Finally, the great vulnerability of human offspring may have made male parental investment highly advantageous to the genes giving rise to this tendency (Gaulin & McBurney, 2001).

What sort of psychological mechanisms underlie parental behaviour? Just as various characteristics of potential mates activate cognitive-emotional responses related to mating, so too certain characteristics of children elicit parental motivation and feelings of love. These include smallness, a round head and face, chubby cheeks, large eyes in the middle of the face, a small nose, and short limbs (Lorenz, 1970). John Bowlby's (1969) attachment theory highlights various co-adapted mechanisms of mother and child. Certain innate behaviours, such as crying, may be adaptations designed to gain attention and elicit appropriate responses from parents, such as feeding and protection. Similarly, just as a kitten's purring may reinforce appropriate behaviour in the parent for the mutual benefit of the genes in both parties, so too may this function be served by a human infant's smiling (Dawkins, 1989). Infants and parents appear to be biologically predisposed to form emotional bonds with one another, and an infant's smiling may help cement these bonds (Pinker, 1997).

The evolved psychological mechanisms underlying parental behaviour appear to be sensitive to relatedness. It has been suggested that, on average, natural parents care more

[11] This leads to the interesting and unexpected conclusion that human traits related to high male parental investment, such as monogamy and the similar size of males and females, have their origin in the fact that we are meat eaters.

profoundly for children than do stepparents (Daly & M. Wilson, 1988, 1998). One study, though careful to emphasize that child abuse by stepparents is rare, found that it is 40 times more common than abuse by genetic parents (Daly & M. Wilson, 1985). Children are also more likely to be killed by stepparents than by genetic parents (Daly & M. Wilson, 1988), and the methods of killing tend to be more violent in the case of stepchildren than genetic offspring (Weekes-Shackelford & Shackelford, in press). These findings are not meant to imply that killing unrelated offspring is an adaptation; instead, they provide indirect support for the notion that parental bonds are more common and stronger in regard to related children than non-related children.

Another variable relevant to parenting and kin bonds is reproductive potential. As noted in the discussion of mating preferences, one indicator of reproductive potential is age. Adults tend to value their children more than they value their parents, despite being equally related to both (Daly & M. Wilson, 1988). They are also more likely to leave an inheritance to their children than to parents or siblings (Smith, Kish, & Crawford, 1987). Both findings may relate to the fact that children, being younger than the other kin members, have a higher average reproductive potential. Furthermore, the grief experienced when a child dies is greatest at about the ages that reproductive potential is highest (Crawford et al., 1989). Another indicator of reproductive potential is health. Parents tend to show more favourable responses to healthier babies (Mann, 1992), and parental neglect and abuse is higher than average for children with handicaps and congenital abnormalities (Daly & M. Wilson, 1981; Lightcap, Kurland, & Burgess, 1982). These findings can be related to a suggestion made by Daly and M. Wilson (1988, 1995), that human infanticide has an evolutionary basis. As noted, parental species usually let weak or deformed offspring die. In support of the notion of an evolutionary contribution to infanticide among humans, it has been found that, across cultures, infanticide is most common when it is unlikely that the child will survive for long enough to reproduce (e.g., when the child is sickly or deformed, or the mother has inadequate support or resources), and when the mother is young and thus has more fertile years ahead of her (Daly & M. Wilson, 1988).

Reciprocal Altruism

Kin selection provides a powerful explanation for kin altruism. The existence of non-kin altruism among humans is more difficult to explain in evolutionary terms. The problem is this: In order to be selected, altruistic behaviour must be advantageous to the altruist (or, to be more exact, to the altruist's genes). However, according to the biological definition, an altruistic act advantages others at the expense of the altruist. Given this difficulty, it may seem plausible to attribute non-kin altruism solely to social learning or culture. This conclusion may be premature, however. Altruism among unrelated individuals is found also in other species, and in particular among mammals. For instance, it is seen in blood sharing among vampire bats (Wilkinson, 1984), in patterns of helping among vervet monkeys (Seyfarth & Cheney, 1984), and in the social grooming engaged in by chimpanzees and other primates (Ayala, 1997). It seems reasonable to suggest that this behaviour in other animals has an evolutionary origin. However, if non-kin altruism can evolve in nonhuman species, we have reason to consider the possibility that non-kin altruism in humans also has an evolutionary origin.

The question is, though, how could non-kin altruism increase the frequency of the genes giving rise to it? According to the theory of *reciprocal altruism*, altruistic behaviour can enhance inclusive fitness *if* help given is likely to be returned (Trivers, 1971/2002). Reciprocal altruism involves exchanges of helping behaviour that, if they were to occur in one direction, would increase the fitness of the recipient but reduce the fitness of the altruist

(Essock-Vitale & McGuire, 1985). Mutual cooperation can be more beneficial to both parties than putting the same efforts into directly self-interested pursuits. For instance, if I have more food than I can eat and you have none, and if I give you some of my food, my loss is smaller than your gain. If you later reciprocate in similar circumstances, we have made what economists call a *gain in trade* (Cosmides & Tooby, 1992). The main barrier to the evolution of non-kin altruism is *the problem of cheating*. Even when mutual cooperation is more advantageous than directly selfish behaviour, it is more advantageous still to receive help but not to reciprocate. Thus, even if there were ever a population of unconditional altruists (a highly unlikely scenario), a mutant gene for non-reciprocation would inevitably flourish and soon replace the genes for altruism (Dawkins, 1989).

Although cheating would be selected over unconditional altruism, these are not the only possible alternatives. To evaluate different strategies, researchers often turn to computer simulations. A political scientist named Robert Axelrod (1984) initiated work in this area. Axelrod ran a series of computer tournaments in which different strategies repeatedly encountered one another, and in each encounter had the option to cooperate or not. Axelrod invited people to submit programmes designed to produce the best outcome for themselves. Points were awarded in the following order, ranked from highest to lowest: receiving help but not helping, mutual helping, mutual selfishness, and helping but not being helped in return. The results took many by surprise. The strategy that obtained the best outcome overall was a programme called Tit for Tat. This simple strategy involved cooperating on the first encounter with any other player, and thereafter simply matching that player's last move, cooperating if they cooperated and defecting if they defected. Trivers (1985) described the rule on which Tit for Tat was based as: "First, do unto others as you wish them to do unto you, but then do unto them as they have just done unto you" (p.392). In a later tournament designed to simulate natural selection, Tit for Tat became the dominant strategy. One of the keys to the success of this strategy was that it had a way of dealing with the problem of cheating: It simply ceased to extend cheats further help. Although the simulations were highly simplified, they suggested that selection for individual advantage could indeed favour reciprocal altruism.

For an animal to enact a Tit for Tat strategy, it need not actually possess the goal of profiting through the exchange of favours (G. C. Williams, 1966).[12] Trivers (1985) suggested that certain emotional responses prompt reciprocal behaviour in humans, and probably also in other species. For instance, liking facilitates the establishment and maintenance of reciprocal relationships and friendships: We are more likely to help those we like and to like those who help us. Sympathy motivates us to help those most in need. Gratitude and a sense of indebtedness motivate us to return good for good. Guilt serves as an internal warning of the possible negative consequences of being caught or punished for taking more than you give. Anger and moral indignation motivate us to withdraw help to exploiters or to punish them (Boyd & Richerson, 1992). Trivers (1971/2002, 1985) suggested that these emotional responses constitute an evolved moral psychology. In other words, many of our basic moral impulses were crafted by natural selection to facilitate reciprocal altruism and to deal with the problem of cheating (see Chapter 7).

Cosmides and Tooby (1989, 1992) have speculated about the information processing mechanisms underlying reciprocal altruism in humans. They argued that our brains are specialised to represent costs and benefits independently of the particular items exchanged; to calculate the value of what we have done for others and the value of what

[12] Thus, although altruistic behaviour may tend to advantage the altruist, this does not mean that this advantage is necessarily the altruist's goal. In other words, apparent altruism may often be genuine (at least in the sense that helping others may be intrinsically reinforcing), and not disguised selfishness.

they have done for us; and to compare these judgements (Cosmides & Tooby, 1989). They also suggested that the human mind has a mechanism specifically designed for detecting cheaters on social contracts (Cosmides & Tooby, 1992). This conclusion is supported by research concerning people's performance on the Wason logical reasoning task. In its original form this task involves four cards (Wason, 1968). Each card has a letter on one side and a number on the other. Two cards are presented number-side up and two are presented letter-side up (e.g., E, J, 6, 7). The participant's task is to turn over only the card or cards necessary to determine whether a particular rule is true or false. The rule is: "If a card has a vowel on one side, then it has an even number on the other side." Most people turn over the E card, which is a legitimate way to test the rule. However, a logical implication of the rule is that if a card does *not* have an even number on one side, then it does not have a vowel on the other. Thus, to test the rule, not only the E card but also the 7 should be turned over. Yet whereas most participants turn over the E, far fewer turn over the 7. A greater number turn over the 6, despite the fact that regardless of what letter is on the other side, it would neither support nor disconfirm the rule.

In certain circumstances, however, this limitation in people's logical reasoning virtually disappears (Cosmides & Tooby, 1992). For example, in one study the abstract task was replaced with a scenario related to drinking age (Griggs & Cox, 1982). Again four cards were used. On one side of each was the age of a person drinking in a bar and on the other side was the name of the beverage that person was drinking. Two of these cards were placed with the beverages face up and two with the ages face up (e.g., Coke, Beer, 16, 22). The rule was: "If a person is drinking beer, then the person must be over 19 years of age." The correct cards to turn over in order to test this rule are the Beer card and the 16. Notice that the logical form of this version of the task is identical to the original. Nevertheless, Griggs and Cox (1982) found that in this task 73 percent of people got the correct answer, whereas none of the people doing the standard abstract test did.

Cosmides and Tooby (1992) argued that results like these can be accounted for on the hypothesis that natural selection has shaped a cognitive mechanism specifically designed to detect cheaters on social rules. In a series of studies, they eliminated various alternative explanations – for instance, that it was the task's concrete nature or familiar content that facilitated better reasoning. They also ruled out the possibility that the result could be accounted for as a by-product of a more general ability, such as better reasoning about social rules or better reasoning concerning violations of rules in general. These findings support the notion that improved conditional reasoning occurs only for the violation of social contracts of the abstract form 'if you take the benefit, then you pay the cost' (Cosmides & Tooby, 1992, p. 182).[13] They also hint again that the mind/brain is specialised for some tasks and not others: It is designed for detecting cheats, but not for abstract logical reasoning in general.

Culture and Evolution

Evolutionary psychologists argue that various aspects of mind and behaviour that are typically viewed as products of culture have an evolutionary origin. It would be unfortunate if this were taken to imply that culture is unimportant. Culture is probably the defining characteristic of our species, and no picture of *Homo sapiens* would be complete without mention of it. An evolutionary perspective contributes to our understanding of culture in a number of ways. The task is complicated, however, by the fact that the term

[13] Cosmides and Tooby's (1992) findings have been replicated (Gigerenzer & Hug, 1992). For a summary of criticisms of the cheater detection module hypothesis, see Barrett, Dunbar, and Lycett (2002, pp. 281-288).

may be used in different ways. Sometimes it may refer to a loosely defined set of behaviours, beliefs, and values that characterises a people, regardless of the origin of the differences. This definition is assumed when any differences between groups lead us to say they have different cultures. On the other hand, a more restrictive definition would limit the term to behaviour, beliefs, and values *acquired through cultural transmission*. The difficulty that may arise if these two usages are not clearly distinguished is that culture in the first sense (group differences) may be mistaken for culture in the second. That is, all psychological and behavioural differences between groups may be assumed to be a product of cultural transmission.

Evolutionary psychologists argue that although this is often the case, some group differences have a direct evolutionary origin. This is not to say that the differences are due to genetic differences among groups. Although some *individual* differences are due to differences in genetic makeup, evolutionary psychologists maintain that virtually all differences between groups are accounted for by differences in experience. Furthermore, they hold that the basic design of the human mind is the same in all humans. These claims may seem to suggest that the evolutionary approach is equipped only to explain human universals, such as nepotism, stranger anxiety, incest avoidance, and language (Janicki & Krebs, 1998). This conclusion would be misguided, however. To begin with, the same underlying preferences and motivations may give rise to different patterns of behaviour in different contexts. For instance, I noted earlier how the same evolved mate preferences could lead to either monogamy or polygamy depending on the distribution of wealth in a society. Furthermore, some group differences may arise when the same evolved mechanisms are activated to differing degrees in different environments (Tooby & Cosmides, 1992). For example, evolutionary psychologists have found that in cultures with a higher prevalence of parasites, more importance is placed on physical appearance in selecting a long-term mate (Gangestad & Buss, 1993), and that in cultures in which food availability is highly variable, there is more sharing of food than is found in cultures where food is usually readily obtainable (Cosmides & Tooby, 1992). Evolutionary rationales have been proposed for both findings. They are thus possible examples of differences between groups that are not due to cultural transmission.

Of course, not all between-group variations in behaviour and thought can be explained in this way. Reading, complex mathematics, formal logic, and agriculture are not innate capacities triggered in some environments but not others; they are tools that have developed in some cultures and which are acquired through cultural transmission. Nonetheless, an evolutionary analysis may help to illuminate our understanding of these aspects of culture. For a start, culture is made possible by the basic evolved design of the mind (which is why humans can acquire these cultural tools whereas other animals cannot). Furthermore, biological evolution may shed light on the specific content of our cultural products, for culture may embody various aspects of evolved human nature (Blackmore, 1999). First, our tools, practices, and rituals are likely to reflect our evolved needs and wants. Second, although different cultures have different myths and stories, these often centre on fitness-related themes such as sex, love, aggression, deception, and danger (Jobling, 2001; Pinker, 1997).

None of this should obscure the fact that culture has a life of its own, at least partially independent of biological evolution (Dennett, 1995). To illustrate: Plato and Aristotle were no doubt far more intelligent than most people living today, but most people today have a vastly more accurate picture of the universe than did these philosophers. This has nothing to do with biological evolution; it is entirely a product of the accumulation of knowledge made possible by language and cultural transmission. Various theorists have proposed that cultures evolve in a manner analogous to biological evolution. The key point now, though, is that culture is at least somewhat independent of biological evolution, and that cultural products need not be advantageous to genes (Dawkins, 1989).

Criticisms of Evolutionary Psychology

Various criticisms have been levelled at the evolutionary approach to psychology (Lickliter & Honeycutt, 2003b; H. Rose & S. Rose, 2000; Scher & Rauscher, 2003; Sterelny, 2003). In this section, I deal with some of the more important of these. First, I consider the idea that evidence used to bolster evolutionary hypotheses can also be explained in socio-cultural terms. Then I consider a recent edited book, *Evolutionary Psychology: Alternative Approaches* (Scher & Rauscher, 2003), which provided a number of challenges to the ideas I have presented in this chapter. Finally, I consider a recent article by Lickliter and Honeycutt (2003b), which argued that contemporary evolutionary psychology must be radically modified in light of Developmental Systems Theory. Although I reject some of the challenges, I concede that some may ultimately necessitate changes to contemporary evolutionary psychology. However, I argue that such changes will constitute refinements of current mainstream views, rather than the wholesale rejection of these views. As such, the conclusions I reach in the remainder of this thesis should be relatively untouched by any foreseeable changes in contemporary evolutionary psychology.

First, consider a common criticism of evolutionary psychology: Evolutionary hypotheses are all very well but that what they seek to explain can just as well be explained in purely socio-cultural terms (Eagly, 1997; Eagly & Wood, 1991; Wallen, 1989). An initial response to this criticism is that one could just as well argue that socio-cultural explanations are all very well but that what *they* seek to explain can just as well be explained in *evolutionary* terms. Thus, to the extent people are persuaded by the criticism, it may simply reveal their pre-existing commitment to socio-cultural explanations. A second point is that in some cases there is evidence favouring evolutionary explanations over socio-cultural alternatives. Cases of evolutionary mismatch are one such example. There are also various studies that aim to pit evolutionary hypotheses against socio-cultural hypotheses (e.g., Fenigstein & Peltz, 2002; Townsend, 1989). In many cases, though, as critics rightfully point out, unambiguous evidence for evolutionary explanations is lacking. This is not, however, an argument against evolutionary hypotheses nor an argument for socio-cultural hypotheses. Both classes of hypotheses are contenders. Nonetheless, because socio-cultural explanations are more widely accepted in the social sciences, the burden of proof may tend to fall largely to advocates of the evolutionary hypotheses to make their case. In the absence of such proof, people may simply continue to assume the truth of socio-cultural explanations as a default position.

It is possible to argue, though, that in many cases the default position should be the evolutionary explanation, and that advocates of socio-cultural explanations should share (or even shoulder) the burden of proof. Many aspects of human behaviour and society are found also in other species. This includes territoriality, aggression, and status hierarchies (Maier, 1998). It also includes average sex differences such as the greater choosiness and higher level of direct parental investment by females. When speaking of other species, theorists inevitably explain these phenomena in evolutionary terms. No one would wish to argue, for instance, that dogs are territorial purely through the influence of canine culture. Given that we accept evolutionary explanations for these phenomena in other species, it seems tenuous to argue that the same phenomena in humans are wholly a product of a completely different cause: learning or culture. Admittedly, it is possible. However, we should have a strong reason to make this exception. Without such a reason, the default assumption should be that we are continuous with the rest of nature and thus that these examples of human behaviour have an evolutionary basis (which does not imply that the environment has no influence on their expression). If anything, the onus of proof should be on advocates of the socio-cultural perspective.

However, even if this argument were accepted, it might still be objected that the evolutionary psychology I have described in this chapter is not the only possible evolutionary psychology, and that there are various alternative approaches emerging. A recent edited book championed this position (Scher & Rauscher, 2003; see also Heyes & Huber, 2000). There are many important and interesting ideas in this collection, and various challenges to some of the better-known claims associated with the evolutionary approach to psychology. In some cases, however, it seems unnecessarily divisive to argue that these hypotheses represent alternatives to mainstream evolutionary psychology, or to 'narrow' evolutionary psychology as the editors chose to call it.[14] For instance, Hrdy's (2003) ideas concerning evolved context-sensitive female mating preferences are perfectly consistent with inclusive fitness theory, and may be better viewed as competing hypotheses within mainstream evolutionary psychology than as an alternative to this approach. Of course, it depends how one defines mainstream evolutionary psychology. But this raises another issue: It is far from clear that it is possible or desirable to divide evolutionary psychology into competing and non-overlapping approaches. To do so may be analogous to trying to divide people into discrete personality types, as opposed to thinking in terms of a number

[14] This is an unfortunate label. Statements such as "our purpose is not to be critical of narrow evolutionary psychology" (Scher & Rauscher, 2003, p. xii) sound somewhat self-contradictory, and might be more convincing had they chosen a less pejorative phrase.

of continuous traits. By grouping together some of the better-known findings and assumptions associated with evolutionary approaches to psychology, the editors may encourage an all-or-nothing mentality, in which people reject the entire package in response to certain weaknesses or faults, real or perceived. Ketelaar (2003) has suggested that people too often do just this. It may be more productive to accept or reject each claim on a case-by-case basis.

In saying this, however, I am certainly not denying that there are many legitimate criticisms of the ideas and assumptions I have investigated in this chapter. For instance, the nature and extent of the mind's modularity is still an open question (Bechtel, 2003; Karmiloff-Smith, 2000; Quartz, 2003). Similarly, the proper conceptualisation of the EEA is strongly debated (Hrdy, 2003; Sterelny, 2003). There are also difficulties with certain claimed adaptations, including emotions such as jealousy. As Sterelny (2003) noted, "jealousy does not have the features that *unambiguously* mark adaptations: complex, coadjusted and coordinated structure" (p. 104). However, none of these criticisms is inconsistent with the inclusive fitness perspective, and therefore even if they ultimately necessitate changes to the picture of our evolved nature that I have painted in this chapter, they may provide little threat to my arguments in the rest of the thesis.

On the other hand, there are also a number of challenges to the inclusive fitness perspective. Most contemporary evolutionary psychologists reject the possibility of group selection (Buss, 1999). However, some theorists argue that, in certain circumstances, group selection can in fact occur (Caporael, 2003; D. S. Wilson, 2003; D. S. Wilson & Sober, 1994). If this proves to be an accurate claim, it would appear to be a greater threat to the foundations of contemporary evolutionary psychology than the criticisms considered in the previous paragraph, and thus a greater threat to my thesis. Nonetheless, although modern advocates of group selection challenge a *strict* inclusive fitness perspective, they still acknowledge the importance of the gene as one level of selection, and accept the definition of evolution as a change in the frequency of genes (D. S. Wilson & Sober, 1994). The major change would be that adaptations do not simply reflect selection pressures for inclusive fitness, but instead represent a compromise between selection for inclusive fitness and selection for group fitness. If the group selectionists are right, inclusive fitness theory is not completely accurate - but nor is it completely misguided. Predictions from inclusive fitness theory, including those outlined in the present thesis, might still prove relatively accurate.

A more radical departure from the inclusive fitness perspective is found in Developmental Systems Theory (DST; Gray, 1988; Griffiths & Gray, 1994; Oyama, 1985; Oyama & Griffiths, 2001). A recent article in *Psychological Bulletin* (Lickliter & Honeycutt, 2003b) presented the DST case against contemporary evolutionary psychology (see also Lickliter & Honeycutt, 2003a). The authors argued that there has been a conceptual revolution in biology over the last few decades, and that evolutionary psychology involves an outdated, gene-centred view of evolution. They questioned the strong emphasis on genes found in evolutionary psychology, and the view that genes are stable and privileged units of heredity, impervious to external influences and containing "instructions for building organisms" (p. 820). To understand evolution, they claimed, it is essential to understand how organisms develop. In their view, evolutionary psychologists ignore development, or misrepresent it as "the unfolding or expression of a genetic program" (p. 819). Lickliter and Honeycutt rejected the view that genes direct development. There is no master controller of development, they suggest; instead, control is distributed across the multiple elements involved in development.

Various criticisms can be raised concerning DST. For instance, it is not clear that the sort of functional analyses made by evolutionary psychologists are completely uninformative or misguided in the absence of an explicit understanding of development (Bjorklund, 2003). To take a simple example, it seems perfectly reasonable to speculate about the adaptive function of birds' wings in the absence of a thorough understanding of the developmental process that gives rise to these appendages. Furthermore, various criticisms can be raised concerning Lickliter and Honeycutt's (2003b) characterization of evolutionary psychology. They claimed that evolutionary psychology ignores development, but in many cases evolutionary psychologists have taken an explicitly developmental stance (e.g., Baron-Cohen, 1995; Buss, et al., 1992; Tooby, Cosmides, & Barrett, 2003). They also talked about a conceptual revolution that evolutionary psychologists are unaware of, but many of the specific findings that they discussed in this regard (e.g., the fact that environmental inputs trigger gene activity) are neither revolutionary nor unknown to evolutionary psychologists (Krebs, 2003; Tooby et al., 2003). Another example: In places, the authors appeared to claim that evolutionary psychologists hold that genes are all-important in shaping the phenotype, and note that DST "effectively undermines the notion that genes can be primarily responsible for the production of phenotypes" (p. 821). However, evolutionary psychologists do not hold that genes alone are responsible for the phenotype (Boyd & Richerson, 1985; Buss & Reeve, 2003; Evans & Zarate, 1999; Krebs, 2003; Kurzban, 2002; Tooby & Cosmides, 1992).

It is fair to say, though, that evolutionary psychologists consider genes more important in the developmental process than do advocates of DST. According to Lickliter and Honeycutt (2003b): "Genes cannot be characterized as occupying a privileged position in the development of an organism" (p. 824). Perhaps evolutionary psychologists have been remiss in characterizing genes as the sole controllers of development. However, there may still be a sense in which genes occupy a privileged position in the developmental process. For a start, although they are not all-important, genes do exert a strong influence on development. Genetic variance among individuals can explain as much as half of the variance among individuals in personality traits (Plomin & Caspi, 1999) and in intelligence (Plomin & Spinath, 2004). Similarly, identical twins are often strikingly similar to one another, even when reared apart. This suggests that, although a focus on genes will not tell us everything about human behaviour and mind, it may tell us much.

Perhaps Lickliter and Honeycutt's (2003b) most important challenge to a strict inclusive fitness/selfish gene perspective is the existence of extragenetic inheritance (see also Caporael, 2003). Among the extragenetic elements that can be inherited are:

> ...cytoplasmic chemical gradients, basal bodies and microtubule organizing centers, DNA methylation patterns, membranes, and organelles.... Changes in these and other extragenetic elements (independent of changes in DNA) can cause heritable variation that appears in all the cells that descend from a given egg cell. (Lickliter & Honeycutt, 2003b, p. 825)

It should be recognised that some evolutionary psychologists are incorporating extragenetic inheritance into their theorizing (Tooby et al., 2003). However, the existence of extragenetic inheritance might necessitate a change to the inclusive fitness/selfish gene theory presented in this thesis. For instance, instead of selfish genes, it may be necessary to think in terms of 'selfish units of inheritance,' where the unit of inheritance is defined more widely than gene. However, rather than a fatal blow to the selfish gene approach, the acknowledgement of extra-genetic inheritance may be more accurately viewed as a refinement or qualification. As noted, genes can account for up to 50% of the variance in personality traits and intelligence. The same cannot be said for cytoplasmic chemical gradients, basal bodies, and the rest. Therefore, among endogenous factors shaping the phenotype, genes are particularly important. And to the extent that genes are important in shaping the phenotype, the inclusive fitness perspective will help to explain the human mind and human behaviour. Extra-genetic inheritance or not, it may still be very close to the truth to say that the function of an adaptation is to enhance the inclusive fitness of its bearer. This has an important implication for the present thesis: Even if the existence of extragenetic inheritance necessitates changes to inclusive fitness theory, this theory may still be a close enough approximation that the conclusions of my thesis will survive the transition.

At this stage, it is unclear what the implications of DST might be for evolutionary psychology. Lickliter and Honeycutt (2003a, 2003b) adopt an adversarial stance, and suggest that DST is incompatible with contemporary evolutionary psychology. However, others take the less extreme position that DST will not radically alter the focus or conclusions of evolutionary psychology, and suggest instead that the two approaches can be reconciled (Bjorklund, 2003; Krebs, 2003). In the meantime, for evolutionary psychologists wishing to incorporate the insights of DST, it is difficult to know how to proceed. As presented by Lickliter and Honeycutt (2003b), DST does not offer any clear predictions or any alternative explanations of the findings detailed in this chapter (Buss & Reeve, 2003; Tooby et al., 2003). Certainly, it would be rash to argue that the inclusive fitness/selfish gene perspective is the last word on evolution. However, it does seem reasonable to retain this perspective until it is demonstrated that an alternative formulation represents a better approximation.

Conclusion

Evolutionary psychology is an important new approach that provides compelling explanations for many aspects of human behaviour and mind. According to evolutionary psychologists, the mind is a collection of components crafted by natural selection to deal with specific adaptive challenges faced by our human and pre-human ancestors. These components include various information processing mechanisms, such as those involved in perception, language, and social exchange. They also include various preferences, including preferences related to food, landscapes, and mates. Evolution has shaped particular motivations or goals, and also adaptations that lead us to act as if we had other goals that in fact we do not possess. For any component of mind to evolve, each step in its gradual evolution must have had behavioural implications that increased the likelihood that the genes giving rise to it would predominate in the gene pool.

Evolutionary psychology introduces various new variables into the explanation of human behaviour and mind. *Relatedness* is associated with non-reciprocal altruism and lessened sexual attraction, and is also relevant to the strength of parental love and other kin bonds. *Reproductive potential* and *fertility*, as indicated by age and health, are relevant to mating preferences (especially men's), and to the strength of kin bonds. *Parental investment* helps to account for various psychological sex differences that are found in all cultures and are consistent with trends found in the rest of the animal kingdom. These include men's greater desire for sexual variety, and women's greater sexual choosiness, particularly in short-term sexual liaisons. *Reproductive variability* among males helps to explain the fact that, on average, men are larger and more aggressive than are women.

Finally, *paternity uncertainty* helps to explain why men are typically less parental than women, and why men are more prone than women to violent sexual jealousy.

The evolutionary perspective places humans within an explanatory framework that also encompasses other animals, a framework that links the purring of a kitten with the smiling of an infant human; the sterility of the worker bee with the loving bonds and altruism that typically exist between human kin; and the preference of peahens for well-formed peacock plumage with the human preference for facial and bodily symmetry in a mate. The evolutionary approach can also account for many things that other psychological theories cannot, including such findings as that even in modern environments people more readily acquire phobias of snakes, spiders, water, and heights than of uniquely modern threats. In the following chapters, I will consider what philosophy can offer evolutionary psychology, and the implications evolutionary psychology might have for philosophy.

Part II:

Evolutionary Psychology and the Innate Ideas Debate

Chapter III: Innate Ideas after Darwin

Philosophical Darwinism has at long last provided a real explanation of the origin of a priori *knowledge – where both Plato and Kant had failed and where Locke had been driven to the extraordinarily wrongheaded supposition that it did not exist.*

-Peter Munz, Philosophical Darwinism, *1993, p. 220.*

The goal of the remainder of this work is to explore the ways in which evolutionary psychology and philosophy can inform one another, focusing on the philosophical question of innate ideas. In this chapter, I provide an overview of the implications of an evolutionary perspective for the innate ideas issue, and for the major philosophical movements associated with this issue. The question of innate ideas concerns the origin and appropriate means of justification of knowledge. The modern philosophers dealing with this issue are generally divided into two camps: the empiricists and the rationalists. The empiricists include Locke, Berkeley, and Hume. The rationalists include Descartes, Leibniz, and Spinoza. The debate originally centred on the question of whether certain ideas were innate.[1] The rationalists claimed that some ideas are innate, whereas the empiricists denied this. Later, the debate divided into two separate questions: (1) is there any innate mental content (as opposed to innate content-free processing abilities)? (2) Are there any innate domain-specific processing abilities (as opposed to innate general-purpose abilities)? An evolutionary perspective has important implications for both of these issues.

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[1] The rationalists tended to use the term 'ideas' to denote concepts or beliefs (Stich, 1975).

This chapter begins by defining innateness, and distinguishing the innate from the *a priori*. Following this is a sketch of the innate ideas controversy prior to Darwin. Having outlined the historical debate, I then provide an analysis of the ways in which an evolutionary approach to psychology transforms the issue. This approach suggests various hypotheses that can be applied to rationalist and Kantian suggestions for innate ideas: (1) The ideas proposed as innate are indeed innate, and are products of natural selection. This option affirms the rationalist/Kantian position in regard to the existence of innate ideas, but also necessitates a radical reworking of this position, with implications for the function, subject matter, and accuracy of innate ideas. (2) The ideas proposed as innate are not innate, and are not ideas that people necessarily possess at all; however, they are implicit in evolved patterns of behaviour and thought. (3) The ideas proposed as innate are not directly innate, but are more likely than other ideas to form or to be accepted, as an indirect result of the evolved design of the human mind. The goal of this chapter is not to argue for any particular evolved innate ideas, although several hypothetical examples will be provided for illustrative purposes. Instead, the goal is to set the stage for later explorations, by proposing a framework for dealing with any suggested innate idea, and by surveying the more general implications of evolutionary psychology for the innate ideas debate.

Defining Innateness

Before going any further, some initial discussion concerning the troublesome concept of 'innateness' is necessary. This concept is widely used, and even its critics concede that it is intuitively appealing (Griffiths, 2002). Unfortunately, however, those using the term rarely spell out precisely what they mean by it, and there are actually several distinct meanings in circulation (Gray, 1988). These include 'present at birth', 'not learned', 'developmentally fixed', and 'in the genes' (Ariew, 1996; Bateson, 1991). To make some sense of the concept, I propose to start with a basic intuition: that arms and teeth are innate but tattoos are not. My aim is to define *innateness* in a way that encompasses this intuition, but one that sidesteps some of the common criticisms of the innate-acquired distinction.[2]

We can begin by eliminating 'present at birth'. Granted, tattoos are not present at birth and we do not consider them innate. However, teeth are also not present at birth, and it seems more reasonable to say that teeth are innate than to say that tattoos are. This suggests that 'present at birth' does not quite capture what we mean by innateness, and hints that innate traits may form after birth. Furthermore, in response to the idea that traits present at birth are innate, critics commonly point out that we learn from experience even in the womb (Elman, Bates, Johnson, Karmiloff-Smith, Parisi, & Plunkett, 1996). If 'innate' were equivalent in meaning to 'present at birth', this would not be a criticism, because traits learned prior to birth would be considered innate. They are not, which suggests that presence at birth is not the definition of innateness. Instead, people may view presence at birth as an *indicator* of innateness. They may assume (falsely as it turns out) that if a trait is present at birth, it could not be learned or otherwise acquired. So, perhaps that is the core of innateness: Innate traits are those that are not learned or acquired. Scholz (2002) affirmed this view when she noted that "to call an idea or principle 'innate' is to claim that it is unlearned" (p. 739).

[2] It might be suggested that common usage of a term is a poor criterion for defining that term. However, if the way we used words was irrelevant to the issue of defining them, I could decide to define water, say, as the noise you get when you rub two sticks together, and no one could object that this sound is not what people refer to when they use the word.

This is acceptable as far as it goes. However, it is a negative definition, defining innateness only in terms of what it is not. If possible, a positive account should also be provided. One way that this has been attempted is in terms of developmental fixity. A recent example of this general approach is Ariew's (1996, 1999) account of innateness as canalisation. According to Ariew (1999):

> The degree to which a trait is innate is the degree to which its developmental outcome is canalized. The degree to which a developmental outcome is canalized is the degree to which the developmental process is bound to produce a particular endstate despite environmental fluctuations. (p. 117)

Developmental fixity may often coincide with judgments of innateness; however, it is not clear that it captures the meaning of the term. It could be argued that a trait is not innate because it develops consistently across fluctuating environments; rather, it develops consistently across fluctuating environments *because it is innate*. The mere fact that this sentence makes sense suggests that the concepts of innateness and developmental stability are not equivalent - if they were, it is unclear what the sentence would mean. (Compare: A liquid is not water because it is H_2O; it is H_2O because it is water. We agree that water is H_2O, and consequently, this sentence does not make sense.) In short, developmental fixity is not what we refer to when we speak of innateness. Like presence at birth, developmental stability may be better construed as an indicator of innateness rather than a definition. Moreover, it might be argued that the developmental fixity approach to innateness simply highlights a form of evidence that a trait is not learned or otherwise acquired from the environment. It is therefore unclear that this approach says anything more than does the negative characterization of innateness.

Another attempt to provide a positive definition of innateness is the idea that innate aspects of the organism are 'in the genes'. Block (1981) took this approach when he suggested that aspects of mind and mental content are innate if they are "determined by the genes, rather than learned or otherwise determined by the environment" (p. 280). An immediate criticism of this definition is that no feature of any organism is completely due to genes or completely due to the environment. Variance in the length or strength of people's arms, or the quality of their teeth is not due only to genetic variance; non-genetic factors (e.g., nutrition) also play an important role. So, if innate means 'in the genes', these components of the phenotype cannot be classed either as innate or as acquired. It might still be appropriate, though, to talk about the innate (i.e., genetic) *contribution* to a particular feature. Note, though, that this stipulation may only apply to one type of description of the phenotype, namely, that used when discussing individual differences. It does not seem so problematic to say that the *design* of these phenotypic features - aspects common to arms and teeth in general - is innate. Clearly, arms and teeth could not develop in the absence of an appropriately supportive environment. Nonetheless, the design inherent in these features may trace largely to information in the genome (unlike the design of a tattoo). So, there may be two senses in which the term *innateness* can be used. When discussing individual differences, we can speak of the innate contribution to individual variation; when discussing the general design of a phenotypic feature, we can say simply that it is innate.

This seems promising. However, there are certain difficulties with the notion that genes contain information (Griffiths & Gray, 1994; Oyama, 1985). A sequence of DNA has no information or 'meaning' in itself, but only in a particular developmental context. For a start, a DNA sequence would mean nothing in the absence of the cellular machinery necessary to translate it into a protein. However, this may not be a fatal flaw but rather a qualification to the above idea. It might still be appropriate to say that the design inherent in a phenotypic feature originates in information in the genes, as long as we specify that this is only a meaningful assertion within a specified developmental context (Sterelny & Kitcher, 1988). Outside such a context, the concept of innateness may be meaningless, but within it, the concept may still be useful.

Gene-based definitions of innateness were not available to the philosophers engaged in the original innate ideas debate. The only common ground linking this debate to the present day understanding of cognitive development is the negative conception of innateness: Innate aspects of mind are those that are not learned or otherwise derived from experience. However, there is one last complication to consider. This concerns the notion of *a priori* beliefs. To say that a belief is *a priori* can mean one of two things: (1) it is not acquired via experience or empirical investigation; or (2) it is derived from reasoning alone (Carruthers, 1992; Hart, 1975).[3] Any innate mental content would be *a priori* in the former sense, but not the latter. It will become apparent, though, that the early rationalists did not always distinguish the innate from the *a priori* (Stich, 1975). Many claims that certain ideas are innate might be better interpreted as claims that these ideas are derivable from reason alone.

To recapitulate the major conclusion of this section, there are two senses in which the term *innateness* can be used: (1) The design of a phenotypic feature is innate if a) it is not derived from experience, and b) it can be traced to information contained in the genome (given a particular developmental context). (2) A trait is innate to the extent that inter-individual variance in that trait is attributable to differences in genes.

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[3] The *a priori* can be contrasted with *a posteriori*, which means derived from experience.

Innate Ideas Before Darwin

Empiricism and rationalism are two major epistemological orientations. It is useful to divide the major claims of each group into two categories: descriptive and prescriptive. (1) Descriptive claims. The descriptive claims concern the origin of our knowledge. Roughly speaking, the empiricists held that our concepts, and the propositional beliefs composed of these concepts, ultimately have their origin in personal experience. According to the rationalists, on the other hand, some concepts and beliefs are innate.[4] These ideas are not derived from experience, but are imprinted on the mind or soul before birth. (2) Prescriptive claims. The prescriptive claims concern the best means of obtaining knowledge. Here, the empiricists emphasized the place of experience, particularly sensory experience, in the establishment of our knowledge of the world (Hume, 1748/1955). The rationalists, in contrast, denied that the senses could provide an adequate or infallible foundation for knowledge. Instead, they put their faith in reason. This faith was grounded in the observation that our most perfect and certain knowledge – knowledge of the truths of mathematics, geometry, and logic - is known through the faculty of reason (Ayer, 1936). It is reason that perceives the innate ideas imprinted on our minds. According to many rationalists, these ideas come from God. God would not deceive, and therefore, if an idea is innate, it must be true (Descartes, 1641/1986).

Origins of the Debate

The debate between the rationalists and the empiricists in the seventeenth and eighteenth centuries was one of the opening events in the history of modern philosophy. However, like so many other philosophical issues, its roots can be found in Plato (380

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[4] Some read Plato and Descartes as claiming that *all* ideas are innate (Scruton, 1995).

BCE/1975, 380 BCE/1985). Plato taught that our knowledge of the Platonic forms is innate. He reasoned that concepts such as *straight line* and *triangle* are *a priori*, on the grounds that we do not encounter any genuinely straight lines or perfect triangles in nature, and therefore these concepts could not derive from experience (Moser, 1987). Instead, experience simply awakens buried memories of the world of forms, memories acquired through direct acquaintance with the forms prior to birth (Scott, 1995).

Later rationalists put forward various other suggestions for innate ideas, including principles of common sense, morality, and theology. The modern discussion of innate ideas began with Descartes. Descartes (1641/1986) spoke of “the true ideas which are innate in me, of which the first and most important is the idea of God” (Fifth Meditation, Paragraph 11). In support of the conclusion that this idea was innate, he employed an argument similar to that used by Plato to argue for the innateness of concepts such as *triangle*. He argued that our concepts of God’s infinite perfections could not be a product of experience, for we never encounter these perfections in our experience. Therefore, they must be innate. In addition to the concept of God, Descartes suggested that concepts such as *self*, *substance*, and *identity* are innate (or *a priori*). Other innate ideas claimed by rationalist philosophers include the concepts and principles needed for logic and mathematics (Leibniz, 1704/1981), knowledge of the freedom of will and the immortality of soul (Carruthers, 1992), and the concept of the Divine Right of Kings (Grayling, 1995).

Whereas the rationalists allowed an innate origin for some mental content, the standard empiricist view was that all such content derives from experience. Complex concepts are built out of simpler concepts, and ultimately trace to simple constituents derived directly from experience (Katz, 1981). To a first approximation, the empiricist position is summarized in Aristotle’s dictum that there is nothing in the intellect that is not present first in the senses. However, despite a strong emphasis on the senses, many empiricists allowed for other forms of experience. Locke (1689/1959), for instance, recognized the introspective observance of the workings of one's own mind as another source of experience. The important point, though, is that the empiricist position involved the denial of innate ideas. This does not mean that the empiricists rejected the idea that *any* aspect of the mind was innate. Hume (1739/1978) allowed that the mind operates on experience in accordance with various simple and domain-general principles, such as the principle of association. Similarly, Locke acknowledged that various appetites were innate, as was the capacity for memory and imagination. His famous claim that the mind at birth was a 'blank slate' (or *tabula rasa*) must therefore be taken as a denial of the innateness of any specific mental *content*. That is, the capacity for knowledge may be innate, but knowledge itself is derived entirely from experience. (The empiricists' blank slate position is sometimes also taken as a denial that we possess cognitive mechanisms dedicated to specific domains of thought, as opposed to domain-general innate faculties; Carruthers, 1992.)

The Locke-Leibniz Debate

Locke was one of the staunchest opponents of the Platonic/Cartesian theory of innate ideas (Adams, 1975). In his 1689 *Essay Concerning Human Understanding*, he launched a sustained attack on this theory, arguing that there are no innate logical, mathematical, metaphysical, or moral principles. One of his main arguments began from the premise that, if an idea is innate, there should be universal consent for that idea. However, noted Locke, there are no ideas to which all would consent. Take, for example, such logical principles as the law of identity ('what is, is'), and the law of non-contradiction ('it is impossible for the same Thing to be and not to be'). Locke pointed out that large portions of humankind are simply unaware of these principles, and that "all children and idiots have not the least apprehension or thought of them" (Book I, Chapter I, Section 5). Moreover, newborns clearly possess no ideas at all. And even if there *were* universal assent to any idea, this would not be sufficient to justify the conclusion that the idea was innate. Other conditions may suffice to produce assent. Locke also took aim at the rationalist view that reason reveals truths that were already within us. Reason, he argued, is the capacity to derive *new* truths from existing premises. We have no grounds to assume that such truths existed within us prior to the exercise of reason, and if we *do* assume this, we would have to accept that we never derive from reason anything that we did not already know. We would also have to accept that we possess minds absurdly well stocked with innate ideas. Overall, Locke's attack was successful in undermining the Platonic/Cartesian vision of innate ideas as sophisticated abstract principles imprinted on the mind or soul at birth and revealed by reason. Nonetheless, it remains possible that aspects of mental content, or certain domain-specific processing mechanisms, are innate.

Locke's arguments provoked a famous rebuttal from Leibniz. In his effort to salvage the notion of innate ideas, several distinct conceptions of this notion can be discerned. One relates to his response to Locke's suggestion that large parts of humanity are unaware of logical principles such as the law of non-contradiction. As Leibniz (1704/1981) noted, everybody does "use the principle of contradiction (for instance) all the time, without paying distinct attention to it.... we use these maxims without having them explicitly in mind" (Book I, Chapter I, p. 76). To illustrate: "the conduct of a liar who contradicts himself will be upsetting to anyone, however uncivilized, if the matter is one which he takes seriously" (p. 76). Unfortunately, it is not completely clear what Leibniz is claiming here. His liar example could be taken to mean that the law of non-contradiction is in the mind but unconscious, or alternatively that this principle is not in the mind but merely implicit in our characteristic tendencies of thought and behaviour. This is an issue I will return to later.

Another Leibnizian attempt to characterize innate ideas suffered from a similar ambiguity. In contrast to Locke's (1689/1959) metaphor of the mind as "white paper, void of all characters" (Book II, Chapter I, Section 2), Leibniz (1704/1981) likened it to a block of marble:

> If there were veins in the block which marked out the shape of Hercules rather than other shapes, then that block would be more determined to that shape and Hercules would be innate in it, in a way, even though labour would be required to expose the veins and to polish them into clarity, removing everything that prevents them being seen. This is how ideas and truths are innate in us - as inclinations, dispositions, tendencies, or natural potentialities. (Preface, p. 52)

Again, this claim suggests several interpretations. The least plausible is that innate ideas are inborn but unconscious, and that experience may simply trigger the awareness of these latent ideas ('polish them into clarity'). Another interpretation is that certain elements of mental content are innate but do not develop until after birth. Just as humans are born with a 'disposition' or 'potential' to develop teeth, we may also be born with a disposition or potential to develop certain beliefs about the world, or to understand certain principles. So, a concept or belief may be "innate in the sense of being innately determined to make its appearance at some stage in childhood" (Carruthers, 1992, p. 51). Both of these conceptions of innate ideas would meet Locke's argument that infants at birth do not possess any concepts or beliefs. A final interpretation is that certain beliefs come naturally to the human mind, whereas others go against the grain (the marble is 'more determined' to some shapes than others). Beliefs that come naturally to us would not be directly innate; however, the innate design of the mind would presumably determine which come naturally and which do not.

Kant

Another important contributor to the innate ideas debate was Immanuel Kant. Kant's system was pivotal in the history of philosophy. One of its goals was to synthesize the empiricist and rationalist positions, and for this reason, some philosophers prefer not to place Kant into either category (Scruton, 1995). Nonetheless, on the innate ideas question, he endorsed a version of the rationalist viewpoint. According to Kant (1787/1933), the mind possesses certain inherent tendencies of interpretation. For instance, the tendency to construe experience in terms of such things as space, time, and causation are innate to the human mind. These and other categories, or forms of perception, provide the underlying structure of our experience. Space, time, and causation are not *derived* from experience; instead they are *presupposed* in our experience. We do not *discover* up and down, near and far, before and after, cause and effect; the human mind *contributes* these elements to experience. Likewise, the concept of object is not *derived* from experience, but instead is *presupposed* in the experience of any particular object. This notion of innate ideas is very different to the Platonic/Cartesian conception; instead of propositional content imprinted on the mind, the Kantian *a prioris* are better viewed as the framework of our experience of the world.

Kant (1787/1933) argued that all experience is a compound of the contribution of the world and the contribution of the mind. The unique part of his system, however, was his *transcendental idealism* (Walker, 1982). Although Kant claimed that the tendency to organize experience in terms of space, time, and causation were innate to the mind, he did not suggest that these contributions *matched* the nature of the world-in-itself (*ding-an-sich*). On Kant's view, space, time, and causal relationships do not exist beyond the mind. Within the framework of the Kantian *a prioris*, the empiricists were basically correct that the way to acquire knowledge is through the senses and empirical investigation. However, it is not possible to step outside the framework and know the world-in-itself. Ultimate reality to Kant was completely, irrevocably unknowable. (This, at any rate, is a common interpretation of his philosophy.) Like the Copernican claim that the earth revolves around the sun, Kant's view was a reversal of the common sense perspective. As such, he modestly described his system as a Copernican Revolution in philosophy. He also claimed that the categories are fixed and immutable, and are necessary truths about all possible experience. As Kant said: "Any knowledge that professes to hold *a priori* lays claim to be regarded as absolutely necessary" (1933, A xvi).

Modern Contributions to the Innate Ideas Debate

In the late nineteenth and early twentieth centuries, the dominant position on the issue of innate mental content was the empiricist position, at least among Anglo-American scholars. Anthropological research emphasized cross-cultural variance, appearing to support Locke's contention that the human mind is a blank slate (Honderich, 1995). Furthermore, a strong empiricist orientation was embodied in the early behaviourist movement in psychology (J. B. Watson, 1924). However, in the second half of the twentieth century, the view that some mental content or domain-specific mechanisms were innate started making some inroads. The main front on which the empiricist-rationalist debate was fought was language. Noam Chomsky (1959, 1965, 1980) persuasively challenged B. F. Skinner's (1957) view that the general learning principles of operant conditioning were sufficient to account for language learning. Chomsky pointed out that, in a few short years, children effortlessly and unconsciously learn grammars that linguists are still struggling to explicate fully, and do so on the basis of extremely fragmentary evidence. This led him to the conclusion that some very detailed information about language must have an innate basis. Although the question is far from closed, the widespread support for the nativist position demonstrates a swing away from an extreme anti-rationalist position on the issue of innate mental content.

Innate Ideas After Darwin

Chomsky's seminal work reawakened interest in the question of innate ideas. However, by the time this work began attracting attention, another area of scholarly inquiry – an area with the potential to provide a far greater reworking of the question of innate ideas – was already a century old. This was, of course, the theory of evolution by natural selection (Darwin, 1859). The most obvious way in which an evolutionary approach to psychology might shed new light on the innate ideas controversy is by way of the suggestion that any innate mental content is a product of natural selection (blind variation and selective retention). The main task of the rest of this chapter is to explore the implications of this possibility for the innate ideas debate. However, the idea that innate content is a product of selection is not the only suggestion consistent with an evolutionary perspective. There are at least two other hypotheses that can be applied to any suggested innate idea. These will also be outlined in this section.

The Evolution of Innate Mental Content

Darwin himself was the first to hint that an evolutionary interpretation of innate ideas might be possible. In one of his notebooks, he wrote: "Plato says in Phædo that our '*necessary ideas*' arise from the preexistence of the soul, are not derivable from experience - read monkeys for preexistence" (Darwin, 1987, p. 551). Darwin's contemporary, Herbert Spencer (1897), echoed this view when he suggested that "what is *a priori* for the individual is *a posteriori* for the species" (cited in Capek, 1975, p. 96). Lorenz (1941/1982) developed this theme in a paper titled *Kant's Doctrine of the A Priori in the Light of Contemporary Biology*, which advocated an evolutionary account of the Kantian categories. These various suggestions were the first stirrings of a new movement in epistemology, later dubbed *evolutionary epistemology* (D. T. Campbell, 1974/1982). The common thread of the evolutionary epistemologist's approach to innate ideas is the notion that these ideas evolved through natural selection (Wuketits, 1984). On this view, innate ideas are biological adaptations, just like teeth and claws. Of course, it is highly unlikely that every innate idea suggested by the rationalists is a product of evolutionary selection – in many cases, the rationalists were no doubt simply wrong. However, the idea that such content is a product of evolution is a hypothesis that can be applied to any proposed innate idea.

An evolutionary interpretation radically alters our view of the innate ideas issue. Plato believed that innate ideas stemmed from communion with the forms prior to birth, whereas Descartes and other rationalists believed that God had implanted them in the human psyche. On a modern view, however, "the mechanism for acquiring innate knowledge is genetic transmission, through the medium of brain structure" (Jackendoff, 1994, p. 30). The genes underlying such knowledge are presumably subject to selection, and new variants are produced by sexual recombination, random mutation, and the like.

Some evolutionary epistemologists, such as Lorenz (1941/1982), have spoken of the "species-preserving function" of innate content (p. 128). However, on a standard Neo-Darwinian interpretation, the function of any innate mental content would not be to contribute to the survival of the species or group, or even to the individual's survival and reproductive success. Instead, the primary biological function of any innate content would be to contribute to the inclusive fitness of the organism possessing these ideas; that is, the survival and reproductive success of the organism and/or the survival and reproductive success of the organism's kin, weighted for the degree of relatedness (Hamilton, 1964/1996). This can generally be taken as equivalent to the suggestion that the primary function of any innate mental content is to promote the replication and persistence of the genetic material that contributes to that content (Dawkins, 1982). Of course, to describe the function of any trait in these ways overlooks the fact that no trait perfectly accomplishes this idealized function. A better way to frame things might be to suggest that, at each blind step in the gradual shaping of any innate mental content, the variant that was selected was the one that, on average, increased its bearers' inclusive fitness, relative to other available variants in our ancestral environment (the environment of evolutionary adaptation, or EEA). That is, at each step, the average benefit-cost ratio to the genes involved must have been higher than that of other versions of the same gene.

The products of selection are likely to be species-typical. Therefore, any adequate account of innate mental content must accommodate the well-documented differences in the professed belief systems of different individuals and of people in different cultures. One solution involves distinguishing between higher- and lower-level mental content. Higher-level content is more closely associated with language; lower-level content is more closely associated with perception. An example will help to illustrate the distinction. Most scientifically literate people today hold the higher-level belief that apparently solid objects consist mainly of empty space. However, at a lower, perceptual level, they still have the sense that objects are solid. Any innate contributions to our representation of the world may exist at the lower level, in content more closely related to perception than to language or abstract thought. Individual and cultural variation may exist largely at the higher level (Sperber, 1994). Often, though, higher-level content may follow lower-level content. Kant's forms of space and time are candidates for perceptual level innate content; they are not propositional beliefs about space or time but innate patterns of interpretation.

Empiricism and Rationalism After Darwin

Evolutionary theory has various implications for the empiricist-rationalist debate. The rationalists were generally less naturalistically oriented than the empiricists, and this may account for some of the empiricist resistance to the theory of innate ideas (Carruthers, 1992; Lamprecht, 1927). An evolutionary approach removes this barrier, by providing a naturalistic account of the origin of any innate mental content. Not only that; it provides positive reasons to expect such content. As Sober (1994) noted, there are some circumstances in which selection will favour the capacity to learn, but others in which it will favour '*a priori* prejudice'. The more biologically useful a particular tendency of belief is, the more advantageous it may be to hardwire that knowledge rather than each individual having to relearn it (Anders, 1994). On the other hand, if an organism can just as easily learn it, there is no reason that an *a priori* prejudice would be favoured. So, when an aspect of mental content is biologically important and difficult to learn, it is likely to be furnished as an *a priori* prejudice (Sober, 1994).

If we accept, then, that there is probably some innate mental content, should we then conclude that rationalism is correct and empiricism false? This is the verdict some have reached. Sober (1994) suggested that "the theory of evolution provides an empirical reason to doubt that empiricism is correct" (p. 59). Similarly, Chomsky (1975) suggested that the innateness of components of the language faculty resolves the empiricist-rationalist debate in favour of rationalism. However, these claims must be carefully qualified. At best, they apply to the question of the existence of innate ideas. The empiricists might have been wrong about this issue, but this provides no reason to reject their prescriptive claims. Innate ideas or no innate ideas, the best way to gain accurate beliefs may still be to test them against experience (Carruthers, 1992). Furthermore, even if we do restrict our focus to the question of innate ideas, it would still be too simple to claim that the empiricists were wrong and the rationalists were right. An evolutionary perspective necessitates far reaching changes to the traditional rationalist and Kantian positions. These will be considered in the following sections.

The Subject Matter of Innate Ideas

One major challenge to the rationalist position concerns the subject matter of any innate content or innate domain-specific mechanisms. The rationalist suggestions for innate ideas often centred on philosophical, mathematical, and scientific beliefs (Scott, 1995). However, from an evolutionary perspective, innate mental content is less likely to deal with abstruse intellectual issues than it is to deal with everyday matters related to the survival and reproduction of self and kin. According to evolutionary psychologists, evolved aspects of the mind/brain are designed to deal with persistent adaptive challenges facing our human and pre-human ancestors, and the more important the challenge, the more likely it is that selection will have crafted mechanisms specifically designed to deal with it (Cosmides & Tooby, 1994; Tooby & Cosmides, 1992). Among the more important adaptive challenges facing our ancestors were obtaining food, mating, parenting, helping kin, maintaining relationships and alliances, and defending against predators and dangerous conspecifics (Buss, 1999). As such, conceptual distinctions such as animal vs. non-animal, human vs. non-human, male vs. female, kin vs. non-kin, friend vs. foe, edible vs. inedible, and predator vs. prey are more plausible candidates for innate aspects of psychology than are such lofty concepts as *God* or *number* (see Chapter 4).

The concept of God is not the only rationalist innate idea that looks implausible from an evolutionary perspective. It was mentioned earlier that Plato argued that concepts such as *triangle* and *straight line* are innate. To the evolutionist, this is far from a compelling thesis. As any school child will testify, an explicit understanding of geometry is of little use outside the classroom, and although a minority of modern children may eventually go into careers that involve the use of geometry, in the EEA this was never the case. The concept of the Divine Right of Kings is even less evolutionarily plausible. Monarchies are relatively recent social systems, and are not believed to have existed in hunter-gatherer societies (Buss, 1999). Besides, even if they had, it is not obvious that an innate belief in the Divine Right of Kings would aid in the proliferation of the genes contributing to this belief.

Although innate content is likely to concern matters related to evolutionary fitness, this does not rule out the possibility that there exists some innate content related to philosophical issues, for some philosophical issues may overlap with fitness considerations. Where this is the case, the philosophical literature may inform research in evolutionary psychology by providing hypotheses for innate mental content. Interestingly, one philosopher who might offer a great deal in this respect is not a rationalist but an empiricist. Hume argued that it was part of human nature to believe that there is an external reality, that all events have causes (the principle of universal causation), and that the future will resemble the past and the unknown resemble the known (the inductive principle; Grayling, 1995).[5] Perhaps because of Hume's naturalistic orientation, these beliefs seem more plausible candidates for evolved mental content than many of the suggestions of the classical rationalists. It is not difficult to imagine that early *Homo sapiens* who believed in an external world outperformed Stone Age solipsists, or that those of our ancestors who used past experience to predict future contingencies were at a selective advantage (see Chapters 5 and 8).

More generally, it is possible to provide principles for determining whether any proposed innate ideas are evolutionarily plausible. Here the philosophical literature may again provide guidance. Kant (1787/1933) rejected as topics of knowledge any issues that could not be decided by appeal to experience, and which made no difference to experience. This includes the topics of monism versus pluralism, and materialism and idealism.[6] Leaving aside the issue of whether knowledge on such issues is possible, for present purposes what is significant is that it can be assumed that selection will not have furnished any innate content related to these issues. If no conceivable experience could enable us to choose between idealism and materialism, or monism and pluralism, it is difficult to see how any belief on these topics could be selectively relevant. If our experience of the world would be the same either way, presumably our behaviour would also be the same. But if an aspect of mental content does not have behavioural implications, it could not influence the organism's inclusive fitness and thus could not evolve through natural selection (Buss, 1999).

[5] Although Hume (1748/1955) denied that we possess innate ideas (Section II, n1), the claim that these beliefs are part of human nature is not so distant from the rationalist claim that we possess innate ideas.
[6] The logical positivists (e.g., Carnap, 1967), though not natural allies of Kant, took a similar position, arguing that such issues were simply meaningless.

Innate concepts and beliefs must relate to parts of the universe that were perceptible to our hunter-gatherer ancestors. For instance, we might have an innate concept of *contamination*, but could not have an innate concept of *germ*. It can also be assumed that any innate content must relate to long-term environmental regularities. This is because, when it comes to complex adaptations, natural selection works slowly, and so cannot track short-term environmental change (Munz, 1993). Various rationalist suggestions for innate aspects of mind relate to long-term regularities, and thus are potential candidates for evolutionary products. This includes Kant's forms of space and time. Other long-term regularities that might be represented in innate aspects of mind include the causal structure of reality (the fact that some events cause others); the solidity of objects; and the effects of gravity. (On the other hand, if knowledge of these parts of the world is easily and reliably learned, there is unlikely to be any innate content related to them.)

The Accuracy of Innate Ideas

Another implication of an evolutionary account of innate ideas concerns the accuracy of these ideas (see Chapter 9). The rationalists commonly viewed the innateness of an idea as a justification for that idea (Lamprecht, 1927). However, if innate ideas come from natural selection rather than God, there is no guarantee that these ideas will be accurate (Callebaut & Pinxten, 1987; D. T. Campbell, 1974/1982). First, selection does not produce perfection. It is limited to selecting among those variants that are thrown up by chance. But even if it did produce perfection, the ultimate criterion for selection is not accuracy but genetic usefulness. Therefore, selection may sometimes favour adaptive falsehoods (Stich, 1990). Innate content or mechanisms may in some cases be accurate within the range of conditions for which they evolved, but outside this range, may be inapplicable. If, for the sake of argument, causal reasoning has an innate basis, it may be appropriately applied within the realm of everyday human life, but not to the quantum realm, or to such otherworldly questions as why there is something rather than nothing. Lorenz (1941/1982) summed it up when he noted that, if the *a priori* categories of thought are understood as evolved organs, they cannot be viewed as absolute truths but must instead be viewed as "inherited working hypotheses" (p. 133). The rationalists may have been correct in thinking that there is some innate contribution to our view of the world; however, they were wrong in thinking that innate ideas are necessarily accurate, and wrong in thinking that they constitute a perfectly secure basis for knowledge.

Biologizing Kant

As noted, Lorenz (1941/1982) suggested that an evolutionary interpretation could be made of Kantian philosophy. In this section, I assess this view, and survey the implications of an evolutionary perspective for Kantian philosophy. According to Lorenz's naturalistic Neo-Kantian approach, the human mind has certain categories and intuitions that meet the definition of the Kantian *a prioris*: They exist prior to experience and are prerequisites for experience. Kantian categories such as space, time, and causality are species-typical phenotypic features shaped by the process of natural selection. As Lorenz (1977) put it, "the categories and modes of perception of man's cognitive apparatus are the natural products of phylogeny and thus adapted to the parameters of external reality in the same way, and for the same reasons, as the horse's hooves are adapted to the prairie, or the fish's fins to the water" (p. 37).

Some have welcomed the notion of biologizing Kant (D. T. Campbell, 1974/1982), but others are more sceptical (Lewontin, 1982; Lorenz, 1977; Ruse, 1986, 1988; Sober, 1981). For instance, Hahlweg and Hooker (1989) suggested that "it is questionable whether it is such a good idea to align modern evolutionary theory with the thought of a philosopher who was decisively non-naturalistic" (p. 5). Granted, some of Kant's categories might be plausible candidates for innate aspects of mind, aspects that have an evolutionary origin. However, Kant is not unique in this respect. I have already mentioned that it might even be possible to derive hypotheses for innate content from the empiricist, Hume. It must also be granted that there are certain similarities between Kant's philosophy and an evolutionary account of our epistemological apparatus. For instance, as Ruse (1989) noted, both hold that our understanding of the world is constrained by the nature of our minds, and that we do not simply perceive the world as it is. But it is somewhat misleading to call any approach Neo-Kantian, on the basis of these gross similarities. Although Kant did emphasize the idea that the mind puts limits on what we may experience, it is not this general point but his transcendental idealism that is the unique part of his philosophy.[7]

The key components of transcendental idealism are the claim that our epistemological apparatus does not match reality but rather contributes the structure to phenomenal reality, and the claim that reality-in-itself is ultimately unknowable (other, perhaps, than by transcendental deductions). In contrast, most evolutionary epistemologists accept that there is a mind-independent, structured external reality, and that an evolutionary perspective is consistent with the possibility of objective knowledge of this reality, albeit imperfect and incomplete knowledge (Bartley III, 1987; D. T. Campbell, 1974/1982; Lorenz, 1977; Vollmer, 1998; exceptions include A. J. Clark, 1986; Ruse, 1986, 1989, 1990). As was mentioned earlier, Kant described his system as a Copernican Revolution in philosophy. Vollmer (1984) argued that it was instead "an anti-Copernican counter-revolution, since he put man back at the center of the world" (p. 81). Kant's position was a

[7] The same point applies to the trend of labelling as Neo-Kantian modern theories in psychology that stress that our experience is the joint product of mind and world (e.g., Marr, 1982; Shepard, 1984).

variant of the view that 'man is the measure of all things'. But "evolutionary epistemology takes man off the center again making him an insignificant spectator of cosmic processes – which include him" (Vollmer, 1984, p. 81).[8] In short, an evolutionary analysis of the mind reverses the direction of Kant's so-called Copernican Revolution in philosophy. The correspondence between reason and reality is not due to reality conforming to reason. Instead, "Reason tells us about reality because reality shapes reason" (Nozick, 1993, p. 112). On these grounds, Lorenz (1977) later decided that his identification of our evolved mental apparatus with Kant's *a priori* was "an erroneous view" (p. 7).

There are various other ways in which an evolutionary interpretation of innate ideas clashes with Kantian philosophy. Like Descartes and other Continental philosophers, Kant held that there is an unbridgeable gulf between humans and animals (Ruse, 1986). However, evolutionary theory recasts humans as one species among billions, and stresses our kinship with (other) animals (Stewart-Williams, 2003a). From an evolutionary perspective, the natural assumption is that human epistemological mechanisms are continuous with those of non-human animals. As such, there is no difficulty for the evolutionist in extending the concept of innate ideas to other species. Furthermore, where commonalities in innate content are found across species, evolutionary theory informs us that this may be a product of a common origin, or of convergent evolution (Fodor, 1981). Note, though, that "What is an *a priori* prejudice for one species may be a product of learning for another" (Sober, 1994, p. 51).

Another implication is that an evolutionary perspective undermines Kant's idea that the forms that shape our experience are logically fixed (Munz, 1993). Kant (1787/1933)

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[8] Vollmer also made the bold suggestion that: "In that sense, evolutionary epistemology is a *truly Copernican turn in epistemology*" (p. 81). Given that transcendental idealism is far from a majority viewpoint, this is perhaps an overstatement.

claimed that the rules by which we must constitute our experience are necessarily true, and their contradictions necessarily false. However, if innate content is viewed as an adaptation, categories such as space, time, and causation are "not necessarily static, complete, unchangeable or consistent" (Vollmer, 1984, p. 111).[9] Consequently, innate content may vary among species, raising the issue of the cross-species epistemological relativity of our conceptual frameworks and representations of the world (Wuketits, 1984). Consider an analogy:

> The hydrodynamics of seawater, plus the ecological value of locomotion, have independently shaped fish, whale, and walrus in a quite similar fashion. But the jet-propelled squid reflects the same hydrodynamic principles in a quite different, but perhaps equally 'accurate' and 'objective' shape. (D. T. Campbell, 1974/1982, pp. 100-101)

The body plans of fish and squid are very different, but are adaptive responses to the same features of reality. In a similar way, the innate knowledge possessed by different species may be very different, even when it consists of an adaptive response to the same features of reality. Overall, then, it does not seem appropriate to link an evolutionary account of our epistemological mechanisms to Kantian philosophy. Rather than biologizing Kant, evolutionary theory is largely inconsistent with Kant.

Interim Summary

I have considered the possibility that some innate ideas may be adaptations crafted by natural selection. However, various thinkers have cautioned against the over-enthusiastic and uncritical application of adaptationist explanations (Gould & Lewontin, 1979; G. C.

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[9] Kant realised that a biological interpretation of his categories could be made, but rejected this possibility, as it would remove the element of necessity from the categories (Robinson, 1976).

Williams, 1966). As such, it must be stressed that other approaches to the problem of innate ideas are consistent with an evolutionary approach to psychology. Two will be explicated in the following sections. Both involve denying that the ideas claimed to be innate really are innate at all. At the same time, though, both involve the claim that these ideas may be related in an important way to the innate design of the mind.

Implicit Ideas: Do We Have Innate Ideas or Do We Just Have No Idea?

The rationalists suggested that certain ideas are innate; the empiricists countered that they are learned. The next hypothesis to consider is that neither view is correct. For most people, these ideas are neither learned nor innate; they are not ideas that they hold at all, unless they have explicitly thought about the matters in question. But although the ideas are not innate, nor are they completely unrelated to the innate nature of the mind. We do not literally possess these ideas, but we may be hardwired to act and think *as if* we did. The hypothesis is that many so-called innate ideas are *implicit* in evolved patterns of thought and behaviour. This view must be distinguished from the notion that such ideas are unconscious. While such a distinction may sometimes be difficult to make in practice, the theoretical difference is easily expressed: An unconscious innate idea is embodied in the brain; an implicit idea is not.[10]

There is no reason that this approach to innate ideas need necessarily be associated with evolutionary theory - after all, Leibniz can be interpreted as holding this conception of innate ideas. However, evolutionary considerations do make this conception more salient. It is common to think that animals possess an evolved survival urge, and this position

[10] Note that I use the term *implicit* here in a different way than it is used in cognitive psychology. Memory researchers, for instance, talk of implicit memories, which are, more or less, unconscious memories.

certainly seems plausible in light of their typical behaviour. The problem is, though, that it is unlikely that most animals have a self-concept, and equally unlikely that they possess an understanding of death (Maier, 1998). Without a concept of self, how could an animal desire the continuation of the self? Without an understanding of death, how could an animal desire the avoidance of death? These considerations lead to a conclusion that might initially seem surprising: Most animals have no explicit motivation to survive. Similarly, it is unlikely that most animals have a desire to have offspring. Instead, they have a range of specific evolved motivations and behavioural tendencies, including motivations to eat, drink, copulate, and run away from certain stimuli. These lead them to act *as if* they have the more abstract and generalized goals of survival and reproduction, when they do not. These are neither conscious nor unconscious goals; they are simply not goals at all. Just as most animals act as if they possess the goals of survival and reproduction, but do not, humans may have an innate tendency to act and think as if they possess certain underlying concepts or beliefs, which they do not possess at all.

To illustrate how this approach to innate ideas would work, we can use a hypothetical example. Consider the proposal that Hume's principle of universal causation is an innate idea. One hypothesis we might entertain is that this is actually true, and that the principle is a product of natural selection. Another hypothesis, however, is that this idea is merely implicit, perhaps in an evolved capacity for causal reasoning (see Chapter 6). On this view, the idea that all events have causes is not innate, but neither do most people *learn* that all events have causes. Instead, those who come into contact with philosophy learn that possibly this is not the case. This does not challenge a pre-existing but unconscious view; it is their first belief on the topic. Admittedly, whenever a particular event grabs our attention, we may assume it has a cause. However, unless we have explicitly thought about the issue, we may not have the generalized belief that *all* events have causes. When and if we do think about the issue, the idea that all events have a cause may immediately seem more plausible to us, not because we already held the belief at an unconscious level, but because this generalization is *consistent* with the way we naturally think about particular events. In a sense, an evolved faculty for causal reasoning, assuming one exists, would depend for its usefulness on the (approximate) truth of the statement that all events have causes. However, a person need not understand this principle in order to engage successfully in causal reasoning, anymore than a bird need understand the principles of aerodynamics in order to use its wings to fly.

If this approach to innate ideas were widely applicable, the implication would be that we know much less than we appear to know. Pre-philosophically, people might not believe that all events have causes, that there is an external world independent of perception, or that 'it is impossible for the same Thing to be and not to be'. Observing people's behaviour - including our own past behaviour - it may seem plausible to attribute these beliefs to them. However, with the exception of the more philosophically minded, they may not hold these beliefs at all. This conclusion is interesting and unexpected, but is it more interesting than accurate? Can we really believe that, just as most animals have no motivation to survive or reproduce, most people walk around with no knowledge of space, time, or the existence of an external world? For now, I will say only that some examples are more plausible than others, and that it is possible that, though the implicit ideas hypothesis might not apply to all suggested innate ideas, it does apply to some (see in particular Chapter 8).

Intuitive Ideas

There is one last hypothesis to consider. This is derived from Leibniz's marble block analogy. Certain ideas, though not innate, may be more likely to form or be accepted by the human mind, as an indirect result of its innate design. I will refer to these as 'intuitive ideas'. Although the suggestion that these ideas are innate would not be strictly true, neither would it be completely misguided, as they are related in an important way to the evolved design of the mind. An example is the rationalist suggestion that the concept of God is an innate idea. As Locke (1689/1959) pointed out, there are peoples who do not possess this concept, and this implies it is probably not innate. Nonetheless, the concept of God may be an idea that sits naturally in the human mind (unlike, say, Bohr's complementarity principle). It is widely accepted that God and other religious conceptions are highly anthropomorphic. It has also been suggested that anthropomorphism, and the tendency to err toward anthropomorphic interpretations of ambiguous stimuli, have an evolutionary origin (Guthrie, 1994). An innate tendency to anthropomorphize may explain both the origin of the God concept and also its perennial popularity. Thus, the concept of God may be an intuitive idea: not innate, but also not unrelated to the innate design of the mind. Intuitive ideas are not directly selected for in the process of evolution; they are not adaptations, but are by-products of adaptations. Unlike genuine innate content, a particular intuitive idea may not be found in all cultures.

Conclusion

I have outlined three hypotheses that an evolutionist might apply to any proposed innate idea or innate mental content: (1) it is genuinely innate; (2) it is not innate but implicit in evolved aspects of thought and behaviour; and (3) it is not innate, but is intuitively plausible as an indirect consequence of the evolved design of the mind. This constitutes a framework for dealing with any rationalist suggestion that a given idea is innate. Of course, not all suggestions for innate mental content will fit into one of these categories. Furthermore, there is probably some overlap between the categories of implicit and intuitive ideas. This is because ideas that are implicit in people's behaviour and thought are likely to be more intuitively plausible to them, if and when they turn their minds to these matters. The main focus of this chapter has been the implications of evolutionary psychology for the philosophical issue of innate ideas. However, we have also already seen how the philosophical literature can inform evolutionary psychological speculations concerning innate mental content, by suggesting hypotheses for evolved innate content or specialised mechanisms. These include logical and mathematical principles, moral beliefs, belief in freewill, and Kant's forms of space and time. Further suggestions derive from Hume's work: belief in an external world, the inductive principle, and the principle of universal causation. Although in this chapter I have considered some of the implications that would follow from the existence of innate mental content, I have yet to establish that any such content exists. In the next five chapters, I will consider some specific suggestions about innate content from an evolutionary perspective. The following chapter considers possible innate influences on our conceptual frameworks.

Chapter IV: Elements of an Evolved Conceptual Framework

Our cognitive and perceptual categories, fixed prior to individual experience, are adapted to the external world for exactly the same reasons as the hoof of the horse is already adapted to the ground of the steppe before the horse is born and the fin of the fish is adapted to the water before the fish hatches.

-Konrad Lorenz, 1941.

Though words may not match precisely across languages, the conceptual framework in which they find their place is a common human property.

-Noam Chomsky, Language and Problems of Knowledge, *1988, p. 32.*

In this chapter, I consider the possibility that evolutionary forces have contributed to some specific distinctions and content in our conceptual frameworks. It is sometimes suggested that the ways in which people carve up the flow of their experience – that is, people's conceptual frameworks – are shaped largely by general mechanisms of concept formation, or by the essentially arbitrary categories made available by their language or culture. However, there are strong evolutionary grounds to suppose that certain basic conceptual distinctions have an innate basis, and that the tendency to make these distinctions contributed to the persistence of the genetic material contributing to that tendency. The goal of this chapter is to sketch a speculative outline of the basic categorical framework of human experience, and to summarize relevant evidence for the universality, innate origin, and evolutionary importance of the elements in this framework. Among the most fundamental elements of the proposed framework are the distinction between self and not-self, and the concept of *physical object*. These elements underlie our basic perceptual representation of the world. Other suggested components include such distinctions as that between animate and inanimate, human and non-human, male and female, and kin and non-kin. These distinctions may be tied to characteristic affective and cognitive responses that typically helped to solve adaptive challenges faced by our hunter-gatherer ancestors, or by earlier, pre-human ancestors. Finally, it is argued that the capacity to frame mentalist concepts has an evolutionary innate basis. Taken together, these elements constitute an intuitive ontology, and form the skeletal structure of human phenomenology.

Concepts, Innateness, and Evolutionary Theory

Concepts are among the most important constructs in theories of the mind (Margolis & Laurence, 1999). They are sub-propositional units, such as *green*, *grass*, and *green grass*, which are used to divide the otherwise chaotic flow of experience into meaningful chunks. One of the major tasks facing concept theorists is to provide an account of the origin of concepts. Discussion of this issue goes back at least as far as the empiricist-rationalist debate in the seventeenth and eighteenth centuries. As noted in Chapter 3, the empiricists argued that all our concepts derive from experience, whereas the rationalists argued that some concepts have an innate basis. Until recently, there has been no naturalistic account of the origin of any innate mental content. As a result, naturalistically oriented thinkers have tended to shy away from anything resembling the rationalist position (Carruthers, 1992). But, as various commentators have recognized, Darwin's theory of evolution by natural selection radically changed the landscape in regard to the question of innate mental content (Lorenz, 1941/1982; Plotkin, 1993). Most important, the theory provides a naturalistic account of the origin of any innate conceptual content: If any concept or conceptual distinction is a product of selection, each stage in the cumulative shaping of that distinction was presumably advantageous to the genes contributing to it, because it enhanced direct fitness (the survival and reproductive success of self) and/or indirect fitness (the survival and reproductive success of other kin, weighted for degree of relatedness).

Before looking at some specific suggestions for evolved tendencies of conceptual organization, I will endeavour to pre-empt some possible objections to my general position. The first point to make clear is that I do not deny that there are differences in the conceptual frameworks found in different individuals and cultures. Clearly such differences exist. What I maintain is that there are some basic conceptual distinctions that are found across cultures, and that in some cases a general mechanism of concept formation alone is insufficient to account for this universality. Furthermore, even in cases where a general mechanism may account for the universality of a concept, it may be unable to account for the fact that, when we encounter instances of these categories, they commonly elicit certain species-typical affective and behavioural responses. In short, certain concepts may have a specific innate basis. In positing an innate basis to these distinctions, I do not claim that learning is irrelevant. In fact, one of their functions may be to direct our attention to certain parts of the world, so as to facilitate learning about matters of evolutionary significance.

The Distinction between Self and Not-Self

Arguably, the most fundamental distinction in our representation of the world is that between self and not-self. The self is the referent of terms such as *I* and *me*. However, although we may not be aware of this, we use these terms in different ways at different times. Sometimes the body is construed as part of the self ('that hit me'), whereas at other times it is construed as distinct from the self ('that hit my body'). In the following, I will limit myself to the former definition, that is, the self as the whole organism. The first task, then, is to explain why a tendency to partition the world into the-organism-that-is-me versus everything else might have an evolutionary origin. There is a rather obvious clue in the fact that the organism is an important unit in evolution. In humans and most sexually reproducing species, the replication success of the genes in any particular genome depends primarily on the survival and reproductive success of the organism in which that genome is found. As such, there would be a selective advantage in a tendency to distinguish self from not-self, coupled with motivational dispositions that guide voluntary behaviour that tend to favour the interests of the self.

The conscious concept of self may be a product of a general selection pressure to create boundaries distinguishing the organism from the rest of the environment. As Dennett (1991) pointed out, "if you are setting out to preserve yourself, you don't want to squander effort trying to preserve the whole world: you draw the line. You become, in a word, *selfish*" (p. 174). Non-conscious analogues of the self-other distinction can be seen in various products of natural selection. This includes the immune system, which attacks entities it encounters that are 'categorized' as not-self. (Autoimmune disorders involve mistakenly categorizing aspects of self as not-self.) Similarly, the self-other distinction is implicit in the fact that animals usually only eat parts of the environment other than themselves. For simpler organisms, organisms with simple and relatively inflexible patterns of action, there is presumably never any conscious understanding of this distinction. Instead, their hardwired patterns of behaviour simply lead them to act *as if* they possessed such an understanding. However, the same selection pressures that shaped these behaviours, and shaped the immune system, may also have given rise in some lineages to a conscious understanding of the self-other distinction.[1] The concept of self may therefore be one example of a wider biological phenomenon, of which the immune system and other adaptations are also examples.

Why might a conscious understanding of the self-other distinction be evolutionarily useful, and what might it achieve that the implicit understanding could not? To answer this question, it may be useful to consider the characteristics of conscious mental processing in general. It appears that consciousness is most strongly associated with the execution of novel and unpractised behaviours; well-practised and habitual behaviours tend not to occupy the spotlight of consciousness. If consciousness in general is associated with novel behaviour, it seems reasonable to suppose that the biological function of a conscious understanding of the self-other distinction relates to novel behaviour. This distinction may be an evolutionarily crucial ingredient in the formulation of any new behavioural plan. Though such plans are not directly innate, the disposition to distinguish self from other may be. This proposal ties the conscious understanding of the self-other distinction to the flexibility of human behaviour.

What evidence is there that this conceptual distinction is innate? If it were a product of selection, we would expect it to be universal across cultures. Some have suggested just this. For instance, in his book, *Human Universals*, the anthropologist Donald Brown (1991) reported that people in all cultures "distinguish the self from others" (p. 135). But surely, it might be argued, it would be easy to find counterexamples to this assertion. According to the Buddhist teaching of 'No self' (anātman), for example, the self-other distinction is an illusion (D. E. Cooper, 1996). This suggestion may seem strange to most Westerners. However, the denial of the

[1] It is reported that mystics and people using hallucinogenic drugs sometimes have the experience that there is no distinction between themselves and external objects. In evolutionary terms, this perception is functionally equivalent to an immune disorder. Both involve the failure of a mechanism involved in distinguishing self from not self.

reality of self provides no evidence that the concept is not universal. After all, to deny the concept, one must possess the concept in the first place. So, the doctrine of anātman does not eliminate the possibility that the concept of self is universal.

Another objection might be that the concept of the individual self is a product of individualistic Western culture, and that the idea that it is universal simply betrays an ethnocentric bias. According to social psychologists, cultures vary on a continuum spanning from individualism to collectivism (Franzoi, 1996). In individualistic cultures, people typically put the individual above the group, but in collectivist cultures, people put a greater premium on the group. But this is another red herring. The individualism-collectivism dimension relates to the *value* people in different cultures officially attach to the individual versus the group; it is not a question of whether or not they divide the world into individuals.[2] Certainly, people sometimes construe themselves as components of more inclusive entities (e.g., the family, the group or nation, the biosphere), but this is not inconsistent with the notion that they possess the self-other distinction also. I do not claim that people have no concept *other* than self.

However, even if it is accepted that the concept of self is universal among human cultures, this does not necessarily mean it is innate. The universality of the distinction may reflect the fact that it is just too obvious to miss. As Hirsch (1982) noted:

> The ordinary distinction between 'me' and 'not-me,' between that which does and that which does not lie within the boundaries of a single self, seems at least on first reflection completely

[2] Also, it is important not to exaggerate or polarize the differences between individualistic and collectivist societies. After all, it was a leader of the United States – the most individualistic country in the modern world (Hofstede, 1983) – who famously urged people to ask not what their country could do for them but what they could do for their country. Furthermore, even in collectivist countries such as China, individuals are exalted (e.g., Confucius, Mao Tse Tung).

> inevitable. It is difficult even to understand the suggestion that this distinction might be arbitrary, or that it might legitimately be redrawn in some other way. (p. 286)

The body is the only part of the universe that is directly controllable by the mind/brain, and is the only part of the universe from which the mind/brain receives sensory input concerning contact with other objects, temperature, etc. This may make the boundaries of the self so obvious that no innate contribution is required beyond the basic design of the sensory-motor apparatus, in addition to an ability to form concepts. This general argument will surface again later in the discussion, and one of the goals of this chapter is to try to shake any confidence you might have that our subjective sense of the obviousness of a conceptual division is good evidence that it is simply given in experience or could be easily learned. There is evidence suggesting that the tendency to distinguish self from not-self is something over and above an awareness of sensory input from the periphery. Certain brain lesions can result in the sense that parts of one's body are no longer parts of oneself, despite the fact that the individual is still fully aware of these parts. According to Melzack (1992):

> Patients who have suffered a lesion of the parietal lobe in one hemisphere have been known to push one of their own legs out of a hospital bed because they were convinced it belonged to a stranger. Such behavior shows that the damaged area normally imparts a signal that says, "This is my body; it is a part of my self. (p. 93)

There is no indication that this is simply part of a general disruption in the individual's conceptual abilities.[3] That the awareness of self in humans can be selectively impaired suggests that distinguishing between self and not-self is something

[3] Mental events are also tagged with this sense of 'mineness.' People with psychosis sometimes believe that thoughts are being planted in the their minds by external agencies; this presumably involves a failure of the brain to label aspects of its activity as its own.

that the brain has specifically evolved to do. Furthermore, these examples demonstrate that the boundaries of self *can* be redrawn. The upshot is that the subjective obviousness of a conceptual distinction does not necessarily mean that there is no need to posit an innate basis to that distinction. Indeed, the idea that a division has an innate basis may *explain* the sense of obviousness. That is, we have some reason to accept that the concept of self has an innate origin.

The Object Concept

Another plausible element of an evolved conceptual framework is the concept of *object*. Like the self-other distinction, this concept is absolutely fundamental to our experience of the world (Baillargeon, 1999). The application of the object concept involves grouping some sensations into wholes, while excluding others. However, it also goes beyond simply putting borders around portions of the sensory landscape. It incorporates the assumption that identified wholes persist through time, and continue to exist even when outside the range of the senses (what Piaget called *object permanence*; see Chapter 5). Spelke (1990, 1991) has attempted to explicate some of the other assumptions that people make about objects. Her suggestions have a *prima facie* plausibility, and include: (1) Cohesion. All the parts of an object move together. (2) Continuity. Objects occupy connected paths in space and time. (3) Solidity. Two objects cannot occupy the same portion of space simultaneously or pass through one another intact. (4) No action-at-a-distance. Objects only affect one another if they collide or otherwise make contact.

Various commentators have suggested that the object concept has an evolutionary origin (Jackendoff, 1987; Keil, 1979; Leslie, 1994, 1995). As D. T. Campbell and Paller (1989) wrote: “The perceptual reification of independent objects…

will have been naturally selected for the usefulness available when stable discreteness, manipulability, and reoccurrence are typical" (p. 239). It is not difficult to imagine how an understanding of objects could contribute to adaptive behaviour. First, an understanding of the solidity of objects allows us to weave our way around impenetrable portions of the environment, such as trees, rocks, and other people. Second, the ability to predict the future motion of objects allows us to take anticipatory action, such as moving to avoid a collision with a rapidly approaching object. Third, an understanding of objects allows us to manipulate the environment to satisfy evolved needs and motivations, for instance, guiding certain objects into our mouths for nutritional purposes, and using other objects as tools or projectiles.

There are various lines of evidence supporting the view that the object concept has an evolutionary origin. Leibniz claimed that language is the window to the mind, and as such, universal components of language may reveal universal components of the human mind. All languages have words for objects (Dixon, 1977). In fact, across cultures, objects are one of the most common concepts that our words label (D. E. Brown, 1991). Beyond this, Spelke (1991) has suggested that continuity and solidity are assumptions found in all humans. An understanding of object permanence has also been experimentally demonstrated in other species, including non-human apes and dogs (Wynne, 2001). Note that the presence of the object concept in other animals militates against the idea that this concept is just an artefact of certain human languages, and is acquired when we acquire such a language. It seems more likely that it is the other way around: that the object concept provides basic perceptual units that serve as a necessary foundation for the acquisition of language (D. T. Campbell & Paller, 1989).

Again, it might be argued that even if the object concept is universal across cultures, and even across species, there is no reason to think that it is innate. Another explanation would be that the concept is universal because objects themselves are universal, and the mind simply registers this obvious fact. A possible flaw in this objection may be revealed with a poverty-of-the-stimulus argument (Laurence & Margolis, 2001). There are in principle an infinite number of ways to divide up and interpret the immediate data of our senses, and without some guiding 'assumptions' built into the perceptual system, we would be unlikely to hit upon the correct interpretation (Dennett, 1987; Marr, 1982). One such assumption is that the world has three spatial dimensions. The visual system is 'designed' to translate a two-dimensional pattern on the retina into an understanding that there is a three-dimensional object a certain distance away. In this sense, the assumption of three-dimensionality may be built into the preconscious information processing structures of the visual system (Marr, 1982).

Suggestive empirical evidence for the innate origin of the object concept comes from research in developmental cognitive psychology. This research suggests that infants' understanding of objects is remarkably similar to that of adults. For instance, ingenious experiments by researchers such as Spelke and Baillargeon have demonstrated that infants as young as three-and-a-half months represent the continued existence and continued motion of objects hidden from view (Baillargeon, 1999; Carey & Spelke, 1994). Spelke (1990) has also shown that infants expect objects to be cohesive and solid. The fact that some basic components of the object concept emerge as young as three or four months is not conclusive proof of innateness. Nonetheless, it does make it less plausible that the concept could be acquired solely from experience. Infants of this age have limited sensory and motor abilities. Consequently, they have only very restricted experience from which to build their understanding of objects

(Pinker, 1997). At the very least, the evidence is consistent with the innateness hypothesis.

Animal Versus Non-Animal

So, there is reason to believe that humans have been 'designed' by natural selection to construe the external world in terms of objects in space (one of which is them). Among these objects, certain important distinctions are drawn, and some of these are plausible candidates for evolved tendencies of cognition. One area in which such distinctions might be found is the biological domain. Various possibilities could be suggested here, including the tendency to distinguish between biological and non-biological entities; to divide the former group into plants and animals; and to divide plants and animals into species. Although people in all cultures are thought to make these distinctions (Atran, 1990), there is little agreement on whether this is the result of cognitive specializations related to the biological world or general conceptual mechanisms (Geary & Huffman, 2002). In this section, I will focus on the distinction that I consider most plausibly explained in terms of evolutionary selection: that between animal and non-animal, or between animate and inanimate entities. There are a variety of reasons to suppose that humans might be specialized for the rapid detection of animals, including one another, from among the objects in their environment, and to attend preferentially to these parts of the environment. These will be discussed more fully in the next section. The basic idea, though, is that animate agents generally have greater evolutionary relevance (e.g., are more useful or more dangerous) than inanimate objects.

Many elements of the basic object concept apply to animals and non-animals. For example, members of both categories are solid, and move on connected tracks through space and time. But there are also differences. Arguably, the most important is that, whereas inanimate objects only move when external forces act on them, animals exhibit unpredictable, self-generated motion. There is widespread agreement that such motion is one of the key criteria by which animals are distinguished from non-animal (Heider & Simmel, 1944; Leslie, 1994, 1995; D. Premack, 1990; Spelke, Phillips, & Woodward, 1995). Like many other animals, we may be specialized to identify and attend to patterns that have a vertical axis of symmetry (Dennett, 1991). This pattern is biologically important because it tends to indicate, first, that another animal is present, and second, that it may be facing you and observing you.

If the animate concept can be linked to innate aspects of the human mind, it should be found in all human cultures. Consistent with this prediction, D. E. Brown (1991) reported that the concept is a semantic universal. But is it really the same concept across cultures? The American linguist Benjamin Whorf (1956) suggested that, although the Hopi Indians of Arizona distinguish between animate and inanimate, they place items such as clouds and stones in the animate category. This may seem to undermine the notion that they possess the same conception of animacy as is common in the West. However, Whorf's conclusion is highly suspect. It stemmed from an analysis of the grammatical structure of the Hopi language, but the same method would lead to conclusions such as that French people believe that tables are female and all cats are male (Yule, 1996). In any case, there is no claim that any evolved conceptual division will always be uniformly deployed. As long as familiar, local animals are universally classed as animate, it is no threat to an evolutionary account that the concept is sometimes also extended somewhat beyond this. Indeed, there are grounds to expect that, when in doubt, people will tend to err on the side of assuming stimuli are animate rather than inanimate. For obvious reasons, it is less costly in fitness terms to mistake a vine for a snake than it is to mistake a snake for a vine. Thus, the prevalence of animistic and anthropomorphic thinking in the belief systems of the world makes good sense from an evolutionary psychological perspective (Guthrie, 1994).

Unlike more fundamental concepts, such as the object concept, the universality of the animate-inanimate concept could plausibly arise from a general conceptual ability. However, there are other lines of supporting evidence. Infants distinguish between animate agents and inanimate objects from as early as three months (D. Premack, 1990). There is also suggestive, though not conclusive, evidence that specific areas of the brain are involved in processing information about animals. For instance, one research group has reported that different areas of the brain are activated in response to animals versus tools (Martin, Wiggs, Ungerleider, & Haxby, 1996). Similarly, Caramazza, Hillis, Leek, and Miozzo (1994) reported a suggestive case study of selective deficits for animal terms but not artefact terms in one patient, and artefact terms but not animal terms in another. Also, H. Damasio, Grabowski, Tranel, Hichwa, and A. R. Damasio (1996) have reported selective deficits in naming animals.

Human versus Non-Human

Just as the concept of object can be divided into animals and non-animals, the concept of animal can be divided into humans and non-humans. The human/non-human distinction is deep seated, and implicit in various psychological tendencies. For instance, we fear negative evaluation almost exclusively by members of our own species. Thus, people may feel self-conscious when observed by a crowd of people, but are unlikely to feel self-conscious in the presence of, say, a flock of seagulls. But is there an innate contribution to the human/non-human distinction, and to our typical responses to entities assigned to each category? Some evidence suggests there might be.

The concept of human is a semantic universal (D. E. Brown, 1991), and from a very young age, infants can distinguish conspecifics from others (Morton & Johnson, 1991). There is also good reason to think that natural selection would favour this capacity. Our species-typical relationships with other humans differ markedly from those we have with members of other species, in ways that have clear evolutionary relevance. Some non-humans are potential predators and prey. In contrast, some humans are potential mates, others are kin, and others still are friends, allies, leaders, and subordinates. Some are also rivals for mates and status. If these different relationships have an evolutionary origin, they presumably rest on an innate tendency to distinguish humans from other animals, and on innate patterns of response to entities categorized as one or the other.

The capacity to distinguish conspecifics from others is widespread in the animal kingdom. As Kaspar (1984) remarked: "For a shark it is necessary to distinguish its own species from its prey; this means that it needs an inborn picture of what a member of its species looks like" (p. 59). This ability can be related to a number of adaptive tasks, including mating, feeding, and predator avoidance. From an evolutionary perspective, sexual behaviour is most usefully confined to members of one's own species (more specifically, to members of the other sex; see below). The fact that there is occasional cross-species sex does not invalidate this claim; the vast majority of sexual acts throughout the animal kingdom are within-species. The ability to distinguish conspecifics from others also relates to the adaptive challenge of feeding, and is particularly relevant to species that eat meat. Eating members of one's own species may carry a greater risk than eating members of other species, due to the danger of picking up species-specific parasites (Maier, 1998). Ruse and E. O. Wilson (1986) hypothesize that repugnance toward cannibalism is likely to be a species-typical adaptation. Again, cannibalism in humans is not unheard of, but it is relatively rare. In summary, for various evolutionary reasons, it is plausible that selection would equip us with a tendency to distinguish conspecifics from others.

Social Concepts

Males and Females

The category of human is further divided in various ways that relate to evolutionary challenges. Perhaps the most important division is between male and female. Not surprisingly, the evolutionary relevance of this distinction is tied primarily to mating. Sex and reproduction are absolutely crucial in evolutionary terms. Every one of your ancestors and mine succeeded in producing offspring, and in doing so, passed on any inheritable traits that increased the likelihood that they would produce offspring. This includes any genetic contribution to psychological traits. What might be the evolutionary function of a tendency to distinguish own-sex from other-sex conspecifics? As noted, sexual behaviour is most usefully confined to members of the other sex. This selection pressure applies to all species that reproduce sexually, and explains why heterosexual behaviour is more common than homosexual behaviour throughout the animal kingdom.[4] Such behaviour in humans is mediated, at least in part, by sexual and romantic responses. The evolutionary function of the male-female distinction may relate to these responses, which are more commonly elicited by people classed as members of the other sex. Of course, few people attempt to engage in sexual or romantic relationships with everyone classed as a member of the other sex. But people categorized as members of the other sex may be more likely than same-sex individuals

[4] This is not to imply that there is anything wrong with homosexuality. It would be decidedly odd to derive moral lessons from evolutionary considerations. As R. Wright (1994) pointed out: "Just because natural selection created us doesn't mean we have to slavishly follow its peculiar agenda. (If anything, we might be tempted to spite it for all the ridiculous baggage it's saddled us with.)" (p. 37).

to be evaluated as potential short-term or long-term mates, and more likely to become the focus of sexual and romantic feelings.

According to D. E. Brown (1991), the concepts of female and male are semantic universals, and across cultures, humans "have a sex terminology that is fundamentally dualistic" (p. 134). Again, this may be necessary for innateness, but not sufficient. What reason might we have to think that the male-female distinction has an innate origin? If its evolutionary function relates to mating, it would only be relevant when applied to humans rather than other animals. As such, it would be predicted that it is only with other humans that we would usually employ the distinction. This seems plausible. After meeting someone for the first time, we might fail to recall, say, the colour of that person's clothes, but we would not fail to recall whether our new acquaintance was male or female. In contrast, we often have no interest in whether members of other species are male or female. It is typically enough to know the species to which they belong. This is consistent with an evolutionary account of the male-female distinction, and with the fact that a person's sex tends to be a central element in our mental image of that person. These considerations should at least render plausible the hypothesis that the capacity to distinguish males and females has an evolutionary origin.

Kin and Non-Kin

Another important social distinction from a Darwinian perspective is that between kin and non-kin. There are various adaptive challenges that make it plausible that selection would favour a capacity to make this distinction. The main one is the appropriate deployment of non-reciprocal altruism. It was mentioned earlier that one of the ways that genes can be selected is if they increase the chances of the survival and reproduction of an organism's genetic kin, relative to rival alleles. Consequently, selection will sometimes craft adaptations that contribute to the survival and reproductive success of kin, particularly closer kin (who share more genes). In humans, non-reciprocated generosity is more common among kin than non-kin (Burnstein et al., 1994; Essock-Vitale & McGuire, 1985; Hames, 1988). This behaviour is presumably mediated in part by cognitive-affective states, such as familial love or a sense of duty to kin. The ability to distinguish kin from non-kin is presumably tied to the appropriate elicitation of such states. As Geary and Huffman (2002) put it: "The selective advantages of a kin bias would favor cognitive and affective mechanisms that enabled the parsing of conspecifics into kin and nonkin and the preferential treatment of the former" (p. 684).

There is some research consistent with the notion that the kin versus non-kin distinction has an innate basis. Kinship terminology is found in all cultures (D. E. Brown, 1991; Daly et al., 1997), and even when the terminology of a culture does not make distinctions based on the degree of genetic relatedness, people are perfectly aware of who their closest kin are (Chagnon, 1994). Geary and Huffman (2002) suggested that: "The categorical significance of kin... is most strongly reflected in the motivational disposition for humans to form families and wider kinship networks of one form or another in all cultures" (p. 684). Furthermore, the psychological capacity to distinguish kin from non-kin is not unique to our species. For instance, Seyfarth and Cheney (1988) reported that vervet monkeys track family members. If the distinction has an evolutionary origin in other species (I am assuming it is not simply a product of vervet monkey culture), it seems reasonable to suggest it might have an evolutionary origin in humans as well.

Mind

So far, I have looked at concrete entities, such as objects, animals, and conspecifics. These concepts may be found in many other species. One set of concepts that may be largely unique to humans is mentalist concepts. As the ability to mentally represent the environment evolves in a lineage, a new entity arrives in that environment: representations themselves. These are then available for organisms to track. Most species appear not to have taken this 'option'. However, one of the distinguishing features of *Homo sapiens* is our ability to represent representations, an ability known as 'theory of mind' (ToM). Various theorists have suggested that the human brain is specialized for thinking about minds - that is, thinking about people's conscious thoughts, beliefs, feelings, motivations, and intentions (Baron-Cohen, 1995; U. Frith, 1989; Leslie, 1994; D. Premack & Woodruff, 1978). On this view, the belief-desire model of mind and behaviour is not a cultural product. Instead, we are innately disposed to construe people as possessing conscious mental states, such as beliefs, desires, and intentions, and to explain voluntary behaviour in terms of constructs such as these.

The presence of ToM may only become apparent when we encounter someone in whom it is absent. A number of researchers have suggested that ToM is absent or poorly developed in people with autism (Baron-Cohen, 1995; U. Frith, 1989; Leslie, 1992). An important component of ToM is the understanding that other people's beliefs can differ from one's own, and that beliefs can be false. In most people, the understanding of false beliefs develops by about four or five years of age (Leslie, 1994). However, autistic children continue to find it difficult or impossible to understand that others can have false beliefs. It is thought that such problems might underlie autistic symptoms such as deficits in social interaction and communication. Baron-Cohen (1995) coined the term *mindblindness* to describe this component of autism. Autistic people are not completely mindblind; they may be better described as mind-*myopic* (Badcock, 2000). Most animals are probably mindblind, but some of our close relatives, such as chimpanzees, may also be mind-myopic (Dunbar, 2000; D. Premack, 1988; D. Premack & Woodruff, 1978; Whiten, 2001).[5]

A number of suggestions have been made concerning the evolutionary function of ToM. One view is that the capacity to represent the motivations, intentions, and beliefs of others allows us to predict their behaviour (Baron-Cohen, 1995; Leslie, 1994). Understanding that others have belief states and intentions also seems to be part-and-parcel of the capacity to comprehend and successfully use language (Baron-Cohen, 1999). Another social skill that characterizes our species is purposeful deception (Byrne & Whiten, 1988; Humphrey, 1988). Deception involves shaping false beliefs, and purposeful deception presupposes an understanding that beliefs may be false. Employed in the service of evolved motivations, the ability to deceive would enjoy a selective advantage. It would also create selection pressure for ToM itself; after all, not only does the ability to understand beliefs and intentions make deception possible, but it can also help to defend against deception. Finally, in addition to understanding conspecifics, ToM may have helped our ancestors to understand and predict the behaviour of other animals, including predators and prey (Mithen, 1996).

But what evidence and arguments are there that the ability to frame mentalist concepts has an innate basis? First, it might be possible to invoke a poverty-of-the-stimulus argument to show that such concepts are probably not derived solely from personal experience. In principle, we could interpret people's behaviour (our own included) in infinitely many ways. But no one spontaneously interprets behaviour in, say, the non-mentalist terms of the early behaviourists. It is sometimes commented that,

[5] These terms are relative, of course; *we* would be considered mind-myopic by an intelligent being with a more formidable intuitive psychology than our own.

when 'off duty', even radical behaviourists do not explain behaviour in such terms (Dennett, 1991). Across cultures, people (including off-duty behaviourists) appear to explain behaviour in terms of desires, beliefs, and intentions (but see Lillard, 1998). Wierzbicka (1992) noted that in all languages there are words for such mentalist terms as *think*, *know*, *feel*, and *want*. Similarly, D. E. Brown (1991) reported that people in all cultures "have a concept of the person in the psychological sense.... They understand the concept of intention. They know that people have a private inner life.... can feel pain and other emotions" (p. 135). He also noted that, across cultures, people use language to deceive, a talent that implies an understanding that other people may possess false beliefs. Furthermore, there is research suggesting that the timing of ToM's development in children is similar across cultures. For instance, an accomplished understanding of false beliefs develops at around four or five years not only in Western children but in Pygmy children as well (Avis & Harris, 1991). This is consistent with the view that ToM is the product of an innate developmental timetable, and a universal aspect of normal human development. So, the situation appears to be this: the belief-desire model is only one possible interpretation of the evidence, but in every culture, people seem to arrive at this interpretation. This is reason to think that ToM has an innate basis.

However, perhaps I am being too hasty in rejecting the possibility that ToM could be wrested from experience. We do not directly observe mental states in other people, but perhaps it could be argued that we observe them in ourselves and extend them to others by analogy (A. I. Goldman, 1992). This suggestion might initially sound plausible, but only if we maintain a narrow focus on just one species: our own. Adopting a cross-species perspective, we are reminded that, for the vast majority of species, four or five years of experience of their own mental states does not lead to the acquisition of ToM. Therefore, something must distinguish humans from most other animals in this respect. It might be responded that human brains may not necessarily be *specialized* for this task. Our ability to identify mental states within ourselves and extend them to others might be an offshoot of a greater general intelligence found in humans. But this proposal does not square well with evidence that autistic children appear to have a relatively selective loss of abilities (Baron-Cohen, 1995). That the ability to represent representations is impaired in people with autism, while other cognitive abilities remain largely intact, argues that ToM is not simply an offshoot of a general intelligence, or language ability, or anything else, but a specific competency with identifiable seats in the brain.

According to Descartes, one of the primary differences between mind and matter is that matter has spatial dimensions whereas mind does not. Although contemporary thinking tends to the view that mental states are instantiated in the brain, and thus that they are spatially localized after all, Descartes' suggestion may capture something about the way our minds *represent* mental entities. As Jackendoff (1987) noted of emotions: "Unlike body sensations, emotions have no spatial localization at all but simply belong to the 'self'.... This suggests that the relevant level of representation lacks spatial distinctions altogether" (p. 299). The same may apply to thoughts and other inhabitants of the mind. This might help explain why the idea that the mind has spatial dimensions seems counterintuitive, or at any rate is not intuitively obvious: It is a by-product of the innate design of ToM. On this view, mind-brain dualism is an intuitive idea – not innate, but related to the innate design of the human mind.

Conclusion

William James (1978) once suggested that the categories of common sense were a discovery of our distant ancestors, presumably passed on via cultural transmission. I have argued that some of these categories were instead 'discoveries' of natural selection, and that their presence in our distant ancestors helps to explain the fact that these individuals were our ancestors. In several places, I have noted that there are in principle an infinite number of ways to divide up and categorize our experience. If experience itself provided the only guidance we had in this task, we would not expect the inter-individual and cross-cultural commonalities found in people's conceptual frameworks. It would also be a notable coincidence that these frameworks make such sense in evolutionary terms. In addition, there are various lines of empirical evidence supporting the idea that the tendency to divide the world up in certain ways has an innate basis. Taken together, the evidence and arguments suggest that the conceptual framework underlying our experience of the world is not derived solely from experience. Instead, some elements appear to have their origin in the evolutionary history of the species.

Chapter V: Darwin and Descartes' Demon: On the Possible Evolutionary Origin of Belief in an External World

> *Without any reasoning, or even almost before the use of reason, we always suppose an external universe which depends not on our perception but would exist though we and every sensible creature were absent or annihilated.*
>
> *-David Hume,* An Inquiry Concerning Human Understanding, *1848, Section XII, Part I.*

> *Those cousins of our ancestors who could not manage to learn that there was an independently existing 'external world,' one whose objects continued on trajectories or in place even when unobserved, did not fare as well as those who quickly recognized obdurate realities.*
>
> *-Robert Nozick,* The Nature of Rationality, *1993, p. 121.*

In this and the next four chapters, I will look at various suggestions for evolved mental content related to philosophical issues. First, I explore the possibility that the tendency to believe in an objective, mind-independent external world has its origins in innate aspects of the human mind. How can we be certain that our senses provide us with an accurate picture of the world? How can we be certain that there really is an objective world at all, and that all our experience is not simply a vivid dream or delusion? These questions relate to one of the most fundamental and long-standing issues in philosophy: the problem of justifying belief in an external world. The goal of this chapter is not to resolve this difficult philosophical problem. My focus is psychological rather than philosophical, and I will simply assume what many philosophers believe is impossible to prove with absolute certainty: that there is an external world, causing our perceptions and existing independently of them. In making this assumption so casually, I am engaging in precisely the phenomenon that is the focus of the chapter. My contention is that the most intuitively plausible position on this issue for the vast majority of humankind is *metaphysical realism*, the view that there is an independently existing external world. A number of philosophers have suggested that the disposition to form this view is a part of human nature (Hume, 1739/1978; Nozick, 1993; Putnam, 1981). In this chapter, I provide a preliminary and highly speculative sketch of how these suggestions might ultimately be placed within an evolutionary psychological framework. I explore the possibility that the assumption of an external world relates to certain innate aspects of the human mind, shaped by the process of natural selection. My goal is not to establish this position beyond reasonable doubt. I will be content if I can show simply that the position is plausible, and provide the groundwork for further discussion.

The chapter begins with a discussion of the possible evolutionary functions of two major elements of the realist orientation: objectivity and mind-independence. This involves relating these elements to the production of novel yet adaptive voluntary behaviour. Arguments and evidence are then provided in support of the view that these aspects of mind have an innate basis (that is, they are not derived solely from experience, but can be traced, at least in part, to information contained in the materials of development, in particular, the genes). Among the arguments supporting this conclusion is a Chomskyan-style poverty-of-the-stimulus argument derived from the philosophical literature. Finally, the evolutionary account of the subjective-objective distinction leads to the prediction that, in conditions of uncertainty, people will tend to err on the side of assuming the objectivity of their perceptions and other judgements.

The Evolutionary Function of Common Sense Realism

Metaphysical realism incorporates two closely related assumptions. The first concerns what is perceived, the second what is not perceived. (1) Objectivity. The world revealed by the senses is real; we perceive objective parts of reality. (2) Mind-independence. Not only are the things we perceive real, reality continues to exist when unperceived. (So, for instance, Schrödinger's cat is either dead or alive before anyone opens the box.) My position is *not* that these abstract verbal formulations are directly innate. What I propose is that each of our common sense assumptions – objectivity and mind-independence – has its origin in an aspect of mind that evolved to solve distinct adaptive challenges faced by our hominid or pre-hominid ancestors. The aspects of mind I propose are as follows. First, I propose that humans have a sense or feeling of the reality of their perceptual experiences, and that this reflects the operation of an evolved mechanism designed to 'label' activity of the sensory regions of the brain as either objective or subjective. Second, I suggest that humans possess evolved psychological mechanisms designed to represent the continued existence of objective parts of reality (for instance, physical objects) when these are beyond the range of the senses. In the following sections, I flesh out these proposals, and provide an evolutionary rationale for each.

The Objective-Subjective Distinction

To begin with, I will examine the view that we possess a 'perceptual-level' sense of the reality of our sensory experience, and that this is part of an evolved mechanism for distinguishing the objective from the subjective. Whereas it is unlikely to be a controversial claim that people assume the continued existence of unperceived parts of the world, it might be questioned whether we do in fact possess a sense that some of our perceptions are veridical. The argument could be made that, pre-philosophically, we simply act *as if* we hold this belief, but do not actually hold it at all. My first task, then, is to argue that the assumption of objectivity is not merely implicit in our behaviour, but can be linked to genuine mental content.

Support for this conclusion comes from a consideration of atypical states of consciousness. Deviations from the norm can sometimes reveal things about the mind that we might not previously have been aware of. Consider the capacity to construe people as possessing thoughts, feelings, and intentions (ToM). As noted in Chapter 4, most humans have this ability. However, because it comes so naturally to us, we may tend to overlook this fact until we encounter people in whom it is absent, such as people with autism (Baron-Cohen, 1995). The general lesson is that atypical states or conditions may awaken us to aspects of our minds that are so ubiquitous in our experience that we tend not to notice them. An atypical psychological state that may be relevant to the issue of our construal of the external world is the dissociative state of *derealization.* This experience occurs in a number of clinical conditions, and can also occur when people face novel or unusual circumstances, or experience grief or other strong emotions. Individuals experiencing derealization have the sense that the external world is not really real, and often feel that they are in a dream (Davison & Neale, 2001; H. I. Kaplan & Sadock, 1998). Derealization may reveal something about typical human experience that we might not have noticed: that usually we *do* have a sense of the reality of the world. The world around us seems real in a way that memories and sensory imagery do not. This argues against the view that the assumption of the objectivity of perception is merely implicit in species-typical responses to perceptual experience. Derealization indicates that we possess genuine, conscious mental content related to the objectivity of our perceptual experience, even if we have not reflected on this issue.

The next step is to argue that this component of human phenomenology reflects the operation of an evolved psychological mechanism designed to deal with the adaptive challenge of distinguishing aspects of brain activity that relate to external circumstances (i.e., veridical perceptions) from those that do not (e.g., memories and other mental imagery). There is evidence that the same parts of the brain that become more active in response to an external stimulus also become more active when one imagines that same stimulus (Ishai, 1997; Kosslyn, 1994). This raises the possibility that the one could be mistaken for the other, and that, in some sense, the perceptual system must tag sensory experience either as 'real/objective' or as 'subjective'. If this tendency has an evolutionary origin, it must exert some influence on voluntary behaviour. Aspects of mind that do not influence behaviour would have no implications for an organism's inclusive fitness, and could not evolve (Buss, 1999). As such, the first task in providing a Darwinian account of the objective-subjective distinction is to specify how the capacity to make this distinction might link to adaptive voluntary behaviour.

My suggestion is this: Real and imagined stimuli typically call for different behavioural responses. Veridical perceptions often require an immediate response, whereas sensory imagery does not. As a result, it is necessary for an agent to discriminate objective from subjective states (or rather, subjective states that correspond to objective circumstances from subjective states that do not). People unable to differentiate between the subjective and the objective with a reasonable degree of reliability would either fail to respond to many important elements of their environments, or inappropriately respond to imagery and explicit memories as if it were real. This would clearly put them at a selective disadvantage. Individuals capable of making the distinction reliably would typically have survived, reproduced, and aided kin more successfully than those who were not, and thus the genes underlying this capacity would have increased in frequency relative to rival alleles.

Admittedly, veridical perceptions are usually more detailed and complex than mental imagery, and it might be argued that there is little danger that the one could be mistaken for the other. However, the differences between perception and imagery do not mean that the subjective-objective distinction is unnecessary; they just mean that the distinction may usually be easy to make. Indeed, the level of detail and complexity of our experience may be one means by which the perceptual system 'decides' whether a given instance of brain activity should be classed as objective or as subjective. Derealization may involve the temporary malfunctioning of the mechanism involved in making this decision: The brain may misclassify genuine perceptual material as mental imagery. Conversely, the auditory hallucinations commonly found in individuals suffering schizophrenia may be a product of the misclassification of one's own inner speech as an objective part of the external world (Haddock, Tarrier, & Spaulding, 1998; see C. Frith & Dolan, 1996, for an account of the neurological correlates of this clinical deficit).

So, the evolutionary function of the objective-subjective distinction may relate to the fact that perceptual states require different behavioural responses than mental imagery. This suggestion takes the use of mental imagery in human thought as a given. Clearly, though, this is also something that must be explained, and a Darwinian explanation may be appropriate. Without going into too much detail about this matter, which is beyond the scope of the present exploration, it is plausible to suggest that the ability to use explicit memories and mental imagery in thinking evolved as a result of its contribution to long-term behavioural planning. Whatever the reason, though, the link between this ability and the subjective-objective distinction has several implications.

First, it allows us to look more deeply into the evolutionary origins of the capacity to distinguish between the objective and the subjective. It can be presumed that the capacity for image-based thought must have evolved hand-in-hand with the capacity to distinguish veridical perception from imagery. Therefore, the subjective-objective distinction may ultimately have been selected because it made possible mental imagery and explicit memory. Second, it seems unlikely that most other animals use mental imagery or explicit memories in their behavioural planning, and thus we would not expect them to make the objective-subjective distinction. It may be difficult for us to imagine, but it is possible that most other animals *perceive* their environment, but do not 'label' their perceptual states as objective. This is not to say that they experience them as subjective; instead, they may simply not make the distinction.

It is important to stress that I am not arguing for the ultimate validity (or otherwise) of the objective-subjective distinction, or that every component of mental life can be placed neatly and unambiguously into one or the other category. My suggestion is simply that the distinction may have an evolutionary origin. This position only requires that the distinction is valid *enough* to be useful, and that in evolutionarily relevant cases, people will usually class a given instance of mental experience in the same way. For example, when there really is a tiger present, most people in most cultures will class the resulting perceptual experience as veridical and objective, rather than as a memory or mental image.

Mind-Independence

Another reason why it is necessary to differentiate between the objective and the subjective is this: It is often useful to track the continued existence of objective parts of the world that are beyond the range of the senses, whereas this does not apply in the case of sensory imagery. The ability to track parts of the environment is widespread in the biological world.[1] Dennett (1991) goes so far as to compare our abilities to the simpler occurrence of a sunflower tracking the movement of the sun across the sky. He recognized, of course, that there are important differences: "If the sun is temporarily obscured, the sunflower cannot project the trajectory; the mechanism that is sensitive to the sun's passage does not represent the sun's passage in this extended sense" (p. 191). In contrast, we are able to represent items even when we are not in direct causal contact with them, and we are able to track their probable paths. Without this ability, we would in effect be solipsists, treating the immediate evidence of the senses as if it were all that is real. The ability to represent items that are not immediately present to us is thus an important element of everyday realism.

It is not difficult to see how the understanding that unperceived parts of the world continue to exist would be adaptive. To provide a simple illustration, a predator without this understanding would stop pursuing its prey the instant it slipped from view. Solipsistic prey would be similarly disadvantaged. Looking more deeply into the issue, Sober (1994) makes an interesting suggestion concerning the evolutionarily relevant difference between realism and solipsism. His contention is that solipsists can only make inductive inferences based on regularities in their own past experience, whereas non-solipsists can also make abductive inferences (inferences to the best explanation) for these regularities. Abductive inference requires the understanding that reality extends beyond what can be perceived. According to Sober (1994), one of the evolutionary advantages of abduction is that, whereas induction simply allows us to generalize from past experiences to similar experiences, abduction allows us to make sense of novel experiences. So, for instance, a realist who came across a dead antelope

[1] In contrast, it is unlikely that the use of sensory imagery in thought is nearly as common. This has an interesting implication. An ability shared by a number of species may trace to a common ancestor; the more widespread the ability is, the longer ago the common ancestor must have lived and the more ancient the ability. Therefore, assuming the ability to track objects is more common than the use of sensory imagery in thought, this would argue that the former ability evolved long before the latter.

for the first time could infer that a tiger might be nearby, and act accordingly. To a solipsist in the same situation, however, no such inference would be available. The solipsist would clearly be at a selective disadvantage.

The consciously accessible understanding of the mind-independence of objective reality may underpin one of the most characteristic features of human behaviour: our behavioural flexibility. Sober (1994) suggested that "selection will favor nonsolipsism over solipsism only when innate structures are an insufficient guide to effective behavior" (p. 38). Thus, if we were innately 'hardwired' to run away both from tigers and from dead antelopes, there would be no further evolutionary advantage in understanding that the dead antelope indicates that a tiger might be nearby. However, for an animal with few innate behaviours and a high level of behavioural flexibility, a more abstract and general understanding of the world is necessary - an understanding that can underlie a wide variety of novel behaviours. Although these behaviours themselves are not innate, the disposition to form the general understanding that underlies them may be. In Chapter 4, it was suggested that conscious elements of the brain's activity are associated with the execution of novel, unpractised behaviours, and from this it was inferred that the evolutionary function of the conscious understanding of the self-other distinction relates to its role in the formulation of novel behaviours. Here, a similar inference can be made for the conscious understanding of the persistence of the objective world. The fact that this understanding is conscious, rather than unconscious or implicit, suggests that, like the self-other distinction, it is an ingredient in the formulation of new adaptive behaviours.

Evidence and Arguments For and Against Innateness

At the very least, then, the assumption of an objective, mind-independent external world makes good evolutionary sense. In this section, I will explore evidence and arguments for and against the view that this aspect of mental life does indeed have an innate origin. Evolutionary psychologists typically assume that complex products of selection are species-typical (Tooby & Cosmides, 1992). As such, to make the case for the innate origin of the belief in an external world, I must first provide reason to believe that most people do in fact hold this belief. Universality is not sufficient to infer innateness, but according to many evolutionary psychologists, it is a necessary precondition (Pinker, 1994).[2] The first step is to deal with some potential criticisms of the idea that belief in an external world is universal. One is the idea that this belief is unique to modern Western thought. Various thinkers have hinted at this view, the truth of which would undermine the innateness hypothesis. For instance, van Inwagen (1993) has described belief in a mind-independent external world as an element of what he calls the 'Common Western Metaphysic'. The implication is that this view is a part of modern Western culture, and not necessarily found beyond this context. However, there is some reason to question this supposition. For a start, the view is not unique to *modern* Western thought. As Nozick (2001) noted, the idea that "the world exists in a definite state independently of our observations" (p. 133) was traditionally viewed as so certain that it was classed as a metaphysical necessity.[3] Furthermore, indirect evidence suggests that these intuitions are also found in non-Western cultures. In all languages that have been examined, a distinction is drawn between dreaming and reality (D. E. Brown,

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[2] This, at least, is the case for evolutionary products unrelated to reproduction. Where reproduction is concerned, the sexes may possess different evolved psychological mechanisms (Buss, 1999). Frequency dependent selection may also produce non-universal adaptations.
[3] This idea is now challenged by some theoretical interpretations of quantum phenomena, which may help to explain the reputation this area of inquiry has for being counterintuitive.

1991). Without an underlying belief in an external world, it is not clear what this distinction would amount to.

But even if some people in every culture hold this belief, surely there are many who do not. There are some philosophers, for instance, who doubt or deny the reality of an external world (sceptics), and others who deny that the world is mind-independent (anti-realists). This appears to be inconsistent with the innateness hypothesis. However, again there are reasons not to give this argument too much weight. Hume (1739/1978) pointed out that, although sceptical philosophers claim not to believe in an external world, in their everyday reasoning and actions they act suspiciously like they do. A similar point was made by Bertrand Russell (1927), who was fond of telling the story of the woman who claimed to be a solipsist, but wondered why more people were not also. Postmodernists may be a contemporary example. Like traditional idealists or solipsists, some postmodernists deny the reality of an external world; however, in giving lectures and preparing journal articles on this theme, their actions contradict their stated beliefs (A. I. Goldman, 1999). To borrow a phrase used by Hume (1739/1978) in another context, it appears that the belief in an external world is "one of those maxims, which tho' they may be deny'd with the lips, 'tis impossible for men in their hearts really to doubt of" (Book I, Part III, Section III, Paragraph 1). Furthermore, an evolutionary perspective puts an interesting new spin on the issue of radical scepticism. Consider Hume's (1739/1978) comments about his own sceptical inquiries:

> Most fortunately it happens, that since reason is incapable of dispelling these clouds, nature herself suffices to that purpose, and cures me of this philosophical melancholy and delirium, either by relaxing this bent of mind, or by some avocation, and lively impression of my senses, which obliterate all these chimeras. I dine, I play a game of back-gammon, I converse, and am merry with my friends; and when after three or four hour's amusement, I wou'd return to these

> speculations, they appear so cold, and strain'd, and ridiculous, that I cannot find in my heart to enter into them any farther. (Book I, Part IV, Section, VII, Paragraph 9)

The experience Hume describes might profitably be compared to the phenomenon of 'instinctive drift' (Breland & Breland, 1961, 1966). Early behaviourists argued that the process of reinforcement and punishment could shape essentially any behaviour (Skinner, 1938). Instinctive drift was one of a number of discoveries that challenged this assumption. It occurs when animals are trained to act in ways that clash with the behaviours typical of their species. In time, the trained behaviour deteriorates, and the animals revert to more natural patterns of behaviour. Hume's famous passage raises the possibility that something similar happens to people who pry their minds away from the natural intuition that there is an external world. We might maintain such a belief momentarily, but in time we may slide back to more instinctive ways of thinking.

These arguments do not establish beyond any reasonable doubt that the belief in an external world is universal across human cultures; they are suggestive rather than conclusive. However, they do call into question some of the main objections that may be brought against this position. As such, the universality hypothesis remains a live option. Although some profess to deny the existence of an objective world, it is reasonable to think that metaphysical realism is the intuitive position for most people in most cultures, and that it is a candidate for a species-typical component of our worldview. As previously mentioned, though, the universality of this position is not adequate evidence for its innateness. So the next question is: What is the origin of our realist bent? Does it derive from experience, or is there an innate contribution?

There is, unfortunately, little evidence bearing on the issue of the innateness or otherwise of the subjective-objective discrimination. At this stage, the best reason to entertain the innateness hypothesis is simply that it makes good sense from an evolutionary perspective. However, a stronger argument can be made in support of the innate origin of the understanding that the world continues to exist when unperceived. The main argument for this conclusion is a poverty-of-the-stimulus argument (Laurence & Margolis, 2001). This draws on epistemological arguments in the philosophical literature, but turns these to a new purpose. Philosophers point out that no evidence could prove beyond a shadow of doubt that our sensory experience is not all simply a dream or hallucination, or that the world continues to exist when we close our eyes, only to jump back into existence when we open them again. Such possibilities are usually made in the context of asking how we can justify our belief that sensory perception is veridical. But they also raise another question, one more psychological than philosophical: If there is no evidence for this belief, how do we form the belief in the first place? Consider the assumption of object permanence. As Berkeley (1710/1982) and others have noted, it is simply not possible to perceive an unperceived object. Nonetheless, with the (possible) exception of sceptical philosophers, we all assume that objects continue to exist when beyond the range of our senses. Logically, solipsism is as valid an interpretation of our sensory experience as the view that there are objects existing independently of perception. Given that our experience is consistent with solipsism, the assumption of object permanence could not be derived solely from experience. This strongly suggests that there might be an innate contribution.

It might be argued, though, that the assumption that objects persist is a more useful interpretation of the evidence than the solipsist's interpretation, and that this is why people favour realism over solipsism. Without denying that it is a more useful interpretation, it is not clear that this proposal can be made to work. First, a working understanding of object permanence has been established in a variety of non-human animals (Wynne, 2001). Furthermore, research suggests that as soon as infants are old enough to be tested (around three months), they represent the continued existence of objects beyond their field of view (Baillargeon, 1999; Baillargeon, Spelke, & Wasserman, 1985; Carey & Spelke, 1994; Spelke, 1990; but see Haith, 1998).[4] But it does not seem reasonable to suggest that animals or infants reason their way to the most useful interpretation of the evidence. These considerations lend some support to the notion that the assumption of object permanence – one of the key elements in the understanding of the mind-independence of objective reality - has an innate origin.

Assuming Objectivity Over Subjectivity: An Adaptive Bias?

In Chapter 2 it was noted that, in the identification of threats, people (and other animals) err on the side of making false positives (Sober, 1994; Stich, 1990), and in Chapter 4 it was noted that people tend to err on the side of making animistic or anthropomorphic interpretations of ambiguous stimuli (Guthrie, 1994). The evolutionary rationale for these biases is that it is less costly to make false positives than to make false negatives - for instance, it is less costly to judge that a tiger is present when it is not than to judge that it is *not* present when it is – and that selection will favour a tendency to err on the side of the less costly error (Haselton & Buss, 2000). If the tendency to tag parts of experience as objective or subjective has an evolutionary origin, it would be predicted that we possess another adaptive bias: Where there is any doubt or ambiguity, we will assume the objectivity of our perceptual experience. Admittedly, mistaking mere imagery for veridical perception would not be a fitness-enhancing strategy. However, it seems likely that mistaking perception for imagery would have been an even greater threat to the inclusive fitness of our hunter-gatherer

[4] This research challenges Piaget's (1955) early claim that infants prior to two years of age have no conception of a world beyond their subjective experience.

ancestors. Wisniewski (1998) put the point simply: "a person contemplating the veracity of their percepts might be eaten by an approaching tiger" (p. 57). This leads to the prediction that, under conditions of uncertainty, we will tend to err on the side of assuming that our sensory-perceptual experiences are veridical. The same argument applies to other judgements about the world. Ruse (1986) summed up the position as follows: "A tendency to objectify is the price of reproductive success" (p. 172).

Preliminary evidence for the existence of this bias can be found in our own experience: Which is more common, mistaking a dream for reality or mistaking reality for a dream? In support of the view that the objectivity bias extends beyond perceptual states to other judgements, the anthropologist Donald Brown (1991) reported that people in all cultures overestimate the objectivity of thought. One example is that we tend to view matters of taste as having objective validity. Kant (1790/1952) noted that aesthetic subjectivism (the idea that beauty is solely in the eye of the beholder) clashes with common sense. Gardner (1995) elaborated this point:

> Common sense is unequivocal that 'the music is beautiful' means more than, even if it presupposes, 'the music gives me pleasure'. If those two thoughts were the same, one could not regard one's aesthetic judgement as something that another person might take issue with, and in support of which reasons – other than the fact of one's liking it – may be given. But we do think that a judgement that the music is beautiful clashes with the judgement that it is ugly or sentimental: it does so because – as its grammatical form suggests – it aims to say something about the music, not about oneself. (p. 592)

As I will argue in the chapter 7, people also tend to attribute objective validity to their moral judgements, even though no one has yet been able to construct a plausible argument in favour of moral realism (Joyce, 2001; Mackie, 1977; Nozick, 1981). Although targeted empirical evidence is needed, these considerations at least render plausible the notion that we possess an adaptive bias toward assuming the objectivity of our perceptions and other judgements. This supports an evolutionary interpretation of the objective-subjective distinction, which in turn supports the view that the belief in an objective external reality has an evolutionary origin.

Conclusion

Hume (1748/1955) said: "The mind has never anything present to it but the perceptions, and cannot possibly reach any experience of their connection with other objects" (Section XII, Part I, Paragraph 12). But despite the fact that perception alone reveals nothing about the objectivity or mind independence of the world, the common sense assumption for the majority of people is metaphysical realism. Evolutionary considerations and various lines of evidence raise the possibility that this assumption has its origin in innate aspects of the human mind, namely, the capacity to distinguish mental events that have objective referents from those that do not, and the capacity to track the continued existence of objective parts of the world. These capacities plausibly enhanced the inclusive fitness of our ancestors. The ability to distinguish the subjective from the objective may relate to the production of appropriate behavioural responses to subjective versus objective elements of mental experience, and may be associated with an adaptive bias toward assuming the objectivity of our perceptual and other judgements. The conscious understanding that unperceived parts of the world continue to exist may relate to tracking environmental regularities, and may be a necessary ingredient in the generation of novel adaptive behaviour. At this stage, these views are highly speculative, and the arguments and evidence provided certainly do not constitute an unassailable proof. Nonetheless, it is my view that they justify further research and discussion on this topic.

This chapter demonstrates some of the ways that the philosophical literature can contribute to research in evolutionary psychology. First, the subject matter is derived from a philosophical issue. Second, epistemological arguments to the effect that certain beliefs are incapable of empirical verification can be co-opted for use as poverty-of-the-stimulus arguments for the innateness of certain components of our 'folk epistemology'. In the next chapter, I apply the same method to another philosophical issue, and consider the possible evolutionary origin of causal reasoning.

Chapter VI: Silencing Roosters and Skinning Cats: The Evolution of Causal Cognition

'Tis a general maxim in philosophy, that whatever begins to exist, must have a cause of existence. This is commonly taken for granted in all reasonings, without any proof given or demanded.

-David Hume, A Treatise of Human Nature, *1739, Book I, Part III, Section III.*

Whatever happens, where or when, we're prone to wonder who or what's responsible. This leads us to discover explanations that we might not otherwise imagine, and that helps us predict and control not only what happens in the world, but also what happens in our minds.

-Marvin Minsky, The Society of Mind, *1985, p. 232.*

Causal cognition is central to the human understanding of the world. As the philosopher David Hume (1748/1955) wrote: "All reasonings concerning matter of fact seem to be founded on the relation of *cause* and *effect*. By means of that relation alone we can go beyond the evidence of our memory and senses" (Section IV, Part I, Paragraph 4). In this chapter, I consider the possibility that causal cognition has an evolutionary origin, and that certain components of the common sense view of causation can be traced to innate aspects of the human mind. Like the last chapter, one of the guiding assumptions of this exploration is that the philosophical literature on a topic can inform the psychologist trying to understand the origin and nature of human cognition on that topic, and that this is a largely overlooked resource for psychologists. In addition, it is assumed that an evolutionary psychological perspective provides the tools for updating the innate ideas debate in philosophy.

The chapter begins with an outline of the common sense view of causation. It is then argued that certain components of this view originate in innate aspects of the mind. The innate contributions include the concept of *cause*, with its implication that one event precedes and necessitates another; the capacity to abstract regularities from the welter of experience; and the capacity to distinguish between event sequences that are causally connected and those that are not. It is argued that the evolutionary function of causal cognition relates to the efficient generation of novel voluntary behavior designed to control environmental events in the service of evolved goals. Following this, arguments are provided for specific innate contributions to the concept of causation and the capacity for causal cognition. One of these arguments involves taking Hume's famous epistemological observation that our belief in causes is ultimately unjustified, and turning it to the new purpose of showing that the concept could not be derived solely from personal experience. Finally, the possibility is explored that we possess an adaptive bias toward assuming that coincident events are causally connected (*post hoc ergo propter hoc*).

The Intuitive View of Causation

To begin with, I will outline the main components of the common sense conception of causation, as found in adult humans. This will serve as the foundation for the later argument that some of these components have their origin in an evolved capacity for cause-and-effect reasoning. For a start, according to common sense, causes precede their effects in time (Bullock, 1985). On reflection, it may be conceded that causes can be simultaneous with their effects (R. Taylor, 1992). However, the idea that causes *follow* their effects is counterintuitive (although some philosophers and theoretical physicists suggest that it is possible, at least in principle; see, for instance, de

Beauregard, 1977, 1979; Dummett, 1954). Common sense also specifies which types of entities can and cannot enter into causal relationships, that is, which can be the effects of other causes and the causes of other effects. First, physical objects or events can enter into causal relationships. For instance, "it is no accident that an object gets warmer when it moves from shadow to sunlight; the warming happens because the sunlight has an *effect* on the object" (van Inwagen, 1993, pp. 20-21). As well as physical events, mental events can enter into causal relationships. As Jacob (1995) remarked: "Common sense tells us that propositional attitudes have both causal and intentional properties.... Beliefs, in particular, can be causes" (p. 432). In contrast, abstract 'entities', such as numbers, do not possess causal powers or enter into causal relationships (Carruthers, 1992).

Another component of the common sense concept of causation is the notion of *necessitation.* An important question in the philosophical literature is whether causal statements assert only certain observable regularities (for instance, that two events are constantly conjoined with one another), or whether they assert something more than this, namely, that one event *necessitates* the other (Armstrong, 1983; Dretske, 1977; Mackie, 1974; Mill, 1872; Tooley, 1977). (To say that a cause necessitates its effect is not to say that it is necessary for its effect, in the sense that the effect could not occur without that particular cause. The same effect may be necessitated by different causes. However, though a cause is not necessary for its effect, it is sufficient for its effect; Dennett, 2003.) Some philosophers maintain that the notion of necessary connections among events is meaningless, as there is no possible evidence that could demonstrate such a connection (Mackie, 1974; Mill, 1872). On this view, causal relations can be reduced to observable features of reality. This is sometimes known as the Humean approach to causation.[1] The physicist Hans Reichenbach (1951) expressed the position succinctly:

> Since repetition is all that distinguishes the causal law from a mere coincidence, the meaning of causal relation consists in the statement of an exceptionless repetition, and it is unnecessary to assume that it means more. The idea that a cause is connected with its effect by a sort of hidden string, that the effect is forced to follow the cause, is anthropomorphic in its origin and is dispensable; *if – then always* is all that is meant by a causal relation. (p. 158)

Leaving aside the philosophical question of whether 'if – then always' provides an adequate analysis of causal relations, it is certainly not what is *meant* when people assert such relations. As Vollmer (1984) noted, "both layman and scientist feel uneasy about this 'nothing-but' contention.... Does not the night regularly follow the day without being an 'effect' of the day?" (p. 110). Similarly, Löw (1984) pointed out that: "To say that *A* is the cause of *B* does not simply mean that *B* regularly follows *A*. Otherwise, one could say the sun rises because the rooster crows" (p. 217). In short, to common sense, not all regularities are causal regularities. We distinguish between causal and non-causal event sequences, between *post hoc* (*B* after *A*) and *propter hoc* (*B* because *A*) relations among events (Vollmer, 1984). As Carruthers (1992) wrote, the constant conjunction interpretation of causation "falls short of our intuitive concept of cause, which includes the idea that causes somehow necessitate their effects" (p. 57). The relationship between two event types may allow us to *discover* a causal relationship, but, from the standpoint of common sense, it does not *constitute* the relationship of causation. Papineau (1995) affirmed this point when he observed that "the whole Humean approach... is highly counterintuitive" (p. 145).

[1] It is debatable, though, that Hume actually held this view (G. Strawson, 1989; Stroud, 1977; J. P. Wright, 1983).

Finally, various thinkers have suggested that the common sense notion of causality includes the assumption that every event has a cause (Bullock, 1985; Hume, 1739/1978). Van Inwagen (1993) suggested that this assumption, sometimes known as *the principle of universal causation*, is the basis for the First Cause argument for the existence of God,[2] and also underpins all scientific endeavours. More generally, the principle of universal causation appears to underlie our thinking whenever we explain a past event or predict a future one. The Copenhagen Interpretation of quantum phenomena seems strange to us because it contradicts the principle of universal causation, claiming that at the quantum level there are events without causes (Nozick, 2001). Whether accurate or not, the fact that this claim is surprising reveals our intuitions on this issue.

In summary, then, the intuitive view of causation is this: Causes exist prior to (and perhaps sometimes simultaneously with) their effects; objects and minds but not abstractions enter into causal relationships; causes in some sense necessitate their effects; some event sequences are causally connected but others are not; and all events have causes.

The Evolutionary Function of Causal Cognition

The view I will argue for is that the common sense view of causation can be linked to innate aspects of the human mind, although not all components are in fact innate. In this section, I will sketch a speculative outline of the innate contributions to our faculty of causal cognition, and consider the evolutionary pressures that may have shaped this faculty. Before going any further, though, it is necessary to specify what it means to say that causal cognition is innate. It seems unlikely that we are born with an

[2] This argument is roughly as follows: Every event has a cause; the chain of causes cannot stretch infinitely back into the past; therefore, there must be a First Cause, namely God.

understanding of specific causal relationships, and presumably this understanding could not form in the absence of exposure to events. This might seem to imply that causal cognition is a product of learning. However, the tendency to interpret event sequences in terms of cause-and-effect relationships is not an inevitable result of exposure to events. It is easy to imagine that simpler animals could detect regularities among events, but that they do not distinguish between causal and non-causal regularities (Dickinson & Shanks, 1995). So, causal cognition may be innate in the sense that we have an innate disposition to make this distinction and construe the world as a web of cause-and-effect relationships. Experience may be necessary in the formation of causal beliefs, but the fact that experience leads to this *particular* outcome may be explicable in terms of an innate disposition of the mind.

The idea that causal cognition has an innate foundation has precedents in the philosophical literature. Hume believed that it is human nature to construe the world in terms of necessary causal connections, and that this tendency is an instinct found in humans and other animals (Grayling, 1995; Vollmer, 1984). Similarly, according to Kant (1787/1933), the idea that all change is governed by causal law is an *a priori* postulate of thought - an idea that is not derived from experience but which is a prerequisite for any experience. More recently, a number of thinkers have transplanted such speculations into an evolutionary context, thereby providing a naturalistic account of the origin of any innate mental content or processes related to causation. For instance, Lorenz (1941/1982, 1977) contended that the concept of causation is an innate feature of perception, and the product of natural selection. Likewise, Ruse (1989) suggested that our tendency to construe the world in terms of causal connections is the product of epigenetic rules.

If causal cognition does indeed have an evolutionary origin, we can immediately say certain very general things about its evolutionary history. For a start, each step in the evolution of this mental capacity must have been more adaptively useful than other variants available at that time. From an inclusive fitness perspective, this means that, on average, each step must have contributed more than available variants to the survival and reproductive success of the individuals bearing it, and/or to the survival and reproductive success of their kin (Hamilton, 1964/1996). Rumbaugh, Beran, and Hillix (2000) speculated about the more specific course of the evolution of human cognitive abilities:

> The evolution of organisms as causality detectors can be seen as an evolution toward the ideal causality detector. That evolution involves an increase in length of memory, an ability to analyze a multiplicity of probabilistic relationships and identify those that indicate causal relationships, and an ability to mold the relationships discovered. (p. 223)

What selection pressures might have driven the evolution of this ability to detect causal relationships? Three of the major goals of science are understanding, prediction, and control. It may be instructive to consider the evolutionary function of causal cognition in light of each of these three goals - that is, to consider the possibility that the fitness benefits of this faculty lie in the fact that it helps us to understand the world, and to predict and control events. In considering these possibilities, it must be remembered that the evolutionary function of any evolved component of mind must relate to the influence it has on behaviour. A component of mind could only evolve if it had behavioural consequences that, averaged across the population, contributed to the inclusive fitness of the organism (Buss, 1999). With this stipulation in mind, let's first consider causal cognition in light of the goal of understanding. Clearly, the capacity to understand the causal structure of the world is not an end in itself in evolutionary terms. Nonetheless, it may indirectly contribute to adaptive behaviour in several ways. First, it may enable us to predict probable future events from present patterns of experience. If we understand that *A* causes *B*, we know that the presence of *A* predicts the occurrence of *B* (in the right context, at any rate). Now in itself, prediction is no more relevant in evolutionary terms than is understanding. However, prediction may have fitness implications to the extent that it enables us to modify our behaviour in ways that enhance inclusive fitness, allowing us to position ourselves appropriately with respect to impending events. In particular, the ability to represent probable future events allows us to avoid impending harm (Dennett, 2003).

If we only consider prediction, though, we would not have a satisfactory answer to the question of the evolutionary function of causal cognition, and specifically of our tendency to distinguish causal and non-causal event sequences. After all, statistical co-variation alone is sufficient for predicting events, at least in a simple sense. As Vollmer (1984) observed: "should it not suffice to expect certain successions of events? Would not our ratiomorphous apparatus meet all the requirements of our mesocosm by taking into account regular *post hoc* events without feigning *propter hoc* relations?" (p. 111).[3] In order to understand why we distinguish between causal and non-causal regularities, we must look to the third goal of science: controlling events (or, more precisely, influencing them). Non-causal regularities may help us to predict events, but they do not help us to control them. If we know that the rooster crows before the sun rises, we can predict when the sun will rise. However, we would not be able to use this information to control events. For instance, we could not prevent the sun from rising by silencing the rooster. In contrast, causal principles allow us to predict *and* control events. As Löw

[3] The mesocosm is the range of environmental circumstances to which the human mind is adapted.

(1984) noted: "Knowing the *cause A* of a phenomenon *B* makes it possible for us to bring about *B* by doing *A* – thus, a possibility for action is opened to us" (p. 215).

So, causal regularities afford the possibility of exerting some control over events, whereas other regularities do not, and this difference may account for our tendency to distinguish between causal and non-causal event sequences.[4] In Chapter 4, it was suggested that the brain qualitatively tags certain elements of experience as *self* (Melzack, 1992), and in Chapter 5, that the brain tags certain elements of sensory experience as *objective* or *veridical*. The sense that one event *necessitates* another may be the brain's way of tagging some event sequences as causally related, which may signal an opportunity to exert control over events. This relates the notion of necessitation to the need to cause or prevent effects in the world. By focussing our efforts at controlling the environment in the places where they are most likely to be useful, we avoid wasting time engaging in misguided efforts to intervene in events, such as silencing roosters to prevent the sun from rising. Of course, people do not always get it right; indeed, I argue later that people tend to err on the side of assuming causal relatedness over non-relatedness. However, by recognizing that *some* regularities are not causal regularities, we at least avoid some misguided efforts. A similar function may be served by the intuition that causation works from past to future, rather than future to past. Without this understanding, people might engage in futile efforts to change the past by manipulating present causes. Because we understand that causation works from past to future, we avoid wasting our biological resources in this way. (See the discussion on our understanding of time in Chapter 8.)

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[4] This thesis must be distinguished from the manipulability approach to causation in the philosophy literature (Collingwood, 1940; Gasking, 1955; Menzies & Price, 1993; Pearl, 2000; von Wright, 1971). There is no claim here that causation can be *defined* in terms of manipulability; it is merely claimed that the ability to detect causal relations was selected in part because it allows us to manipulate events.

According to this argument, then, the concept of causal necessitation, the capacity to distinguish between causal and non-causal event sequences, and the understanding that causation works from past to future all originate in selective pressures for the organism to control its environment in ways that enhance inclusive fitness. However, there is still one ingredient missing. Consider the following quotation from Dickinson and Shanks (1995):

> The capacity for goal-directed instrumental action is the most basic behavioural marker of causal cognition.... It was the enhanced fitness, endowed by the capacity to control rather than just react to the environment that provided the genetic impetus for the evolution of a mind and nervous system capable of representing causality. (p. 23)

In this passage, the authors pit controlling the environment against reacting to the environment, and argue that causal cognition makes the former possible. This may not be the best way to construe things, however. After all, simple animals with relatively fixed behaviour patterns, such as ants and termites, exert causal control over their environments. Admittedly, their behaviour is not novel or mediated by complex cognition, and in that sense they simply react to the environment. However, their non-cognitive, non-creative reactions do involve exerting causal control over the environment. This suggests that control and reaction cannot be pitted against one another as mutually exclusive options. It may be more useful to think in terms of behavioural fixity versus behavioural flexibility in controlling environmental events. (Of course, fixity and flexibility are not really dichotomous terms, but rather endpoints on a continuum.) My contention is this: The ability to understand causal relationships does not relate merely to the control of the environment, for much simpler animals exert some causal control over their environments too. It relates to *behavioural flexibility* in the control of the environment.

An abstract understanding of causal relationships is only relevant to a species with a high level of behavioural flexibility. If natural selection endows an organism with one way to skin a cat, that organism need not understand the general causal principles that its method exploits. But we are not this type of organism. For humans, there is more than one way to skin a cat. Rather than innate behaviour patterns, we have a capacity to devise new ways of achieving our goals (Tooby & DeVore, 1987). In order to devise new behavioural plans, it is necessary to possess a general understanding of some relevant causal principles. Such an understanding allows us to derive a variety of different ways of achieving our aims. Of course, novel behavior can also be generated through trial-and-error learning, and this would not require any understanding of underlying causal principles. However, possessing such an understanding presumably increases the efficiency with which such behavior can be generated. Of the three goals of science, understanding seems the most distant from behavior. Nonetheless, it may be the most important component of causal cognition, as it opens up the possibility of the efficient generation of novel voluntary behavior aimed at controlling events. Along with the concept of *self* and the assumption of a mind-independent external world, the capacity to understand causal regularities and principles may be an important ingredient in the production of human behavioural flexibility.

Given the importance of a generalized understanding of the causal makeup of the world, it is worth looking more closely at what an organism capable of representing a causal relationship can understand. According to a prominent approach in philosophy, causal laws can be expressed in terms of conditionals, for example, if *A* then *B* (Lewis, 1973, 1986). Various implications follow logically from a causal judgement with this abstract form, and these are implications that an organism capable of representing a causal relationship can potentially exploit. The most important implications concern the presence or absence of the cause (*A*). (1) The clearest implication of the statement 'if *A* then *B*' is that the presence of *A* implies the occurrence of *B*. As mentioned, this allows us to predict *B* from *A*, and to bring about or maintain *B* by bringing about or maintaining *A*. (2) A second set of implications concerns the *absence* of the cause. It might be assumed that, if *A* causes *B*, then the absence of *A* predicts the absence of *B*, and preventing *A* will prevent *B*. Kelley (1967) took this position when he defined a cause as "that condition which is present when the effect is present and which is absent when the effect is absent" (p. 154). However, this is not quite true. It is important to make a clear distinction between these two statements:

If *A* then *B*

If *and only if* *A* then *B*

The latter statement would indeed imply that if *A* were absent, then *B* would not occur. However, the former statement does not have this implication, and it is the former that better represents the implications of a causal law. After all, the same effect might be produced by another cause (Armstrong, 1999). The fact that drinking hemlock causes death does not mean that not drinking hemlock results in eternal life.[5] So, if *A* is removed, *B* may or may not occur. Although there is no certainty, this is still a potentially useful implication. First, assume that *B* is evolutionarily undesirable (i.e., damaging to inclusive fitness). Although avoiding *A* does not guarantee that *B* will be prevented (you might escape from a lion only to be struck by lightning), it is at least a

[5] Not only might the same event be produced by another cause, it is possible in principle that a given event could be uncaused (Armstrong, 1999).

better option than doing nothing, in which case *B* is certain to occur. If *A* is avoided, *B* *may* at least be prevented. On the other hand, assume that *B* is desirable. An organism that knows that *A* causes *B* can also know that, if *A* is eliminated, it may be possible to cause *B* through some other means. This tells us that, if one way to skin a cat ceases to be viable, we should not just give up; there may be other ways to achieve the same end.

There are two further implications. These relate to the presence or absence of the effect (*B*). (3) If we know that *B* has not occurred, we can know that *A* did not occur. (4) On the other hand, if we know that *B has* occurred, we cannot be certain that *A* did occur. It may have, but *B* might instead have been produced by another cause. However, we know at least that it is possible that *A* occurred. As soon as an organism forms a representation of a causal regularity, these various implications become available for informing and guiding novel behaviour aimed at controlling the environment. The behaviours themselves are not innate; however, the capacity for causal cognition that underlies these behaviours may have an innate origin.

Arguments and Evidence For and Against Innateness

At the very least, the innateness of the faculty of causal cognition would make good evolutionary sense. In this section, I will consider arguments and evidence for and against the innateness hypothesis. According to many evolutionary psychologists, a necessary precondition for the innateness of a complex trait is its cross-cultural universality (Pinker, 1994). The first question, then, is whether the concept of past-to-future causation is a universal feature of human mental life. Some thinkers hint that it is not. According to van Inwagen (1993), for instance, the idea that the objects of the universe exert causal influence on one another is part of what he calls the Common Western Metaphysic. The implication is that this idea is an element of Western culture rather than of human nature. In contrast, others argue that causal cognition is a species-typical feature of human cognition. For example, Ruse (1986) claimed that people in all cultures refuse "to take coincidences as coincidences, preferring rather to look for underlying unifying causes" (p. 164).

To begin unravelling this issue, consider a possible objection to the universality hypothesis. This relates to the widespread use of teleological reasoning. Teleological reasoning involves explaining behaviour and events in terms of future goals and purposes (Mayr, 1974/1982). For example, Aristotle (350 BCE/1970) explained the growth of plants and animals in teleological terms, as being directed toward a final end state (or final cause). At first glance, this appears to be the reverse of the form of causal reasoning under discussion, which involves explanation in terms of past conditions. It might be argued that teleological reasoning is much more common than past-to-future causal reasoning, and that the latter is largely unique to modern Western science (which explains organic growth in terms of biochemical antecedents and the evolutionary history of ancestral organisms, rather than in terms of final causes). If past-to-future causal reasoning were indeed uncommon, this would appear to challenge the view that causal reasoning is an innate component of human cognition.

However, even if non-teleological explanations were unique to Western science (which is doubtful), it would not be fatal to the innateness hypothesis. This is because, on closer inspection, teleological reasoning appears to assume past-to-future causation. Consider an everyday example of a teleological explanation: the idea that people engage in a particular behaviour in order to bring about a future goal. This is not the same as backward causation in time. Prior to enacting the behaviour, people presumably desire the goal and believe that their actions will bring it about. If they did not possess the desire or the belief, would they still engage in the same behaviour? Presumably they would not. This suggests that, even in teleological reasoning, we think in terms of the effects of past causes, such as beliefs and desires. These beliefs and desires do refer to future goals, but they exist prior to the actions that bring about the goals. A similar argument can be made in regard to Aristotelian philosophy. Although Aristotle explained the growth of life forms in terms of their final causes, he also held that, from the start, these life forms possessed the *potential* to grow in these ways, and it was this potential that caused their subsequent growth. When teleological reasoning is applied outside the domain of goal pursuing, purposeful animals, it amounts to an anthropomorphic or animistic version of past-to-future causal reasoning. (For instance, the idea that the universe as a whole has a purpose is anthropomorphic (or animistic), because the universe as a whole presumably does not have a purpose or goal; only humans (and some other animals) have purposes and goals.) Nonetheless, it is past-to-future reasoning.

In any case, various arguments support the conclusion that non-teleological causal explanation is universal among human cultures. Humans are often characterized as the tool-using animal (Gusdorf & Tiles, 1997), and it is difficult to imagine that we could invent tools or use them in novel ways without an understanding that certain actions can cause certain outcomes. As Pinker (1997) pointed out: "Tool manufacture and use is the application of knowledge about causes and effects among objects in the effort to bring about goals" (p. 190). Also, it is commonly observed that all cultures have beliefs about the origin of the universe, humans, and life in general (Ayala, 1997). If this is an accurate observation, it suggests that people in all cultures ask questions about the causes of events. Admittedly, the types of causal attributions people make for events differ somewhat across cultures. For instance, the tendency to attribute behaviour to personal dispositions rather than situational influences is apparently more common in individualist cultures than in collectivist cultures (Morris & Peng, 1994). Nonetheless, in both types of culture, people make causal judgements that can be understood in terms of the same primary dimensions (for example, person versus situation, controllable versus uncontrollable, and stable versus transient; Schuster, Forsterling, & Weiner, 1989). Although people in different cultures have different patterns of causal attributions, the capacity for causal cognition may be universal.

As Locke (1689/1959) argued, though, universality alone is insufficient grounds to infer the innateness of mental content. It is *consistent* with the innateness hypothesis, but does not actively support it. However, not only does the concept of causation appear to be universal across cultures, it is also difficult to see how it could be derived from experience alone (Armstrong, 1983; Carruthers, 1992; Laurence & Margolis, 2002). An argument to this effect can be derived from the philosophical literature on causation. David Hume (1739/1978, 1748/1955) argued persuasively that our belief that some events cause others is not rationally justified. Although his goal was epistemological rather than psychological, the same argument can also be used as a poverty-of-the-stimulus argument to the effect that there is an innate contribution to the concept of causation. Prior to Hume, it had been assumed that causes possess inherent powers that necessitate their effects (Papineau, 1995; Russell, 1948). However, Hume pointed out that the senses provide no evidence for this assumption.

> It appears that in single instances of the operations of bodies we never can, by our utmost scrutiny, discover anything but one event following another, without being able to comprehend any force or power by which the cause operates or any connection between it and its supposed effect. The same difficulty occurs in contemplating the operations of mind on body, where we observe the motion of the latter to follow upon the volition of the former, but are not able to observe or conceive the tie which binds together the motion and volition.... All events seem

> entirely loose and separate. One event follows another, but we never can observe any tie between them. They seem *conjoined*, but never *connected*. (Hume, 1748/1955, Section VII, Part II, Paragraph 1)

We do not directly perceive one event causing another; all that we actually learn through our senses is that two events consistently go together. For instance, if one billiard ball strikes another, the second always moves. That and that alone is what the senses reveal to us. The idea that the first ball *caused* the motion in the second goes beyond any evidence we possess now, or could ever acquire. Our senses tell us that "one object or event has followed another, not that one was produced by the other" (Hume, 1748/1955, Section VIII, Part I, Paragraph 5). If the common sense concept of causation were merely a matter of a certain relationship among observable events (for example, a constant conjunction between two events), it could be derived from experience. I have already argued, though, that our understanding of causation goes beyond any observable relationship, and incorporates the notion that one event produces or necessitates the other. But if sensory experience reveals only the contingencies among events, from where does the additional content come? The evidence available to the individual underdetermines the concept. Nonetheless, reasoning in terms of causes appears to be universal across human cultures and ages. Taken together, these points provide reason to conclude that there is an innate contribution to the concept of cause.

In addition to this poverty-of-the-stimulus argument, there is empirical evidence supporting the innateness hypothesis, and in particular, the innateness of the capacity to distinguish causally connected events from those that are not causally connected. This includes evidence from developmental psychology. According to evolutionary psychologists, activities and capabilities that the brain is specialized to perform tend to develop early and easily, without explicit or prolonged instruction (Geary, 1995; Pinker, 1994). So when does causal cognition make its appearance? According to early Piagetian thought, infants do not acquire the understanding of objects interacting causally until around the end of the second year (Piaget, 1955). More recent research suggests, however, that infants are able to distinguish causal from non-causal event sequences much younger than this. For instance, a classic study by Leslie and Keeble (1987) provided suggestive evidence that infants make this discrimination from as young as 27 weeks of age (see also Cohen & Amsel, 1998; Oakes, 1994). Of course, the infants in this study already had 27 weeks of experience outside the womb, and thus the early development of this capacity is not conclusive proof that this capacity is innate rather than a product of learning (see, for example, Cohen, Amsel, Redford, & Casasola, 1998). However, the younger these capabilities can be found, the less plausible it becomes that they could be derived solely from experience, and the more plausible it becomes that there is an innate contribution.

There is also evidence that causal cognition is not confined to our species (Heyes & Huber, 2000). Not surprisingly, the most persuasive evidence concerns our closest living relatives. David Premack (1976) has demonstrated that chimpanzees are able to identify the probable causes of certain sequences of events. For instance, shown a whole apple followed by an apple sliced in half, chimpanzees will choose from an array the tool most likely to have caused this change (a knife). As Kaspar (1984) suggested: "The ability of a chimpanzee to use tools includes the ability to understand simple causal connections. One must 'know' that the same causes will have the same effects" (p. 55). When it comes to causal cognition in more distantly related species, such as monkeys, the evidence is mixed (Dunbar, 2000; Zuberbuehler, 2000). Even so, the fact that causal cognition appears to be present in at least some non-human animals bolsters the view that this form of cognition has an evolutionary origin in humans.

A final line of support for the evolutionary explanation is that it makes sense of a number of existing empirical findings related to causal cognition. This includes findings related to the circumstances in which we are most likely to make attributions about the causes of events. People do not strive to find causal explanations for every event they encounter. Among the events we do attempt to explain are those that surprise us, upset us, or otherwise attract our attention (Hastie, 1984; Wong & Weiner, 1981). An evolutionary perspective can illuminate this finding: The events that we have evolved to find surprising, upsetting, or interesting are presumably those with probable implications for inclusive fitness, and it is these events that it is most important to understand, predict, and control. Another finding in the psychological literature on attributions is that we are most likely to make causal attributions for people's actions rather than for any other kind of event (Zajonc, 1980). This also makes good evolutionary sense; other people are the most evolutionarily significant parts of the environment of a highly social species such as our own (Dunbar, 1996; Humphrey, 1988).

In addition, there is evidence consistent with the view that the evolutionary function of causal cognition relates primarily to the behavioural control of events. Psychologists have concluded that among the most important dimensions of people's causal attributions is whether the cause is controllable (Weiner, 1982). Furthermore, the ability of humans and other large brained animals to understand and manipulate causes begins with "the recognition of their own ability to bring about consequences through their actions" (Rumbaugh et al., 2000, p. 236). Consistent with this analysis, as early as three months of age, human babies learn that their actions can create effects (Gopnik, Meltzoff, & Kuhl, 1999). Taken together, the pattern of evidence points to an innate contribution to the faculty of causal cognition.

Universal Causation: An Implicit Idea?

The discussion so far has linked various common sense assumptions about causation to evolutionary considerations. One assumption that has not yet been considered is the idea that all events have causes, or the principle of universal causation. Is this principle an innate aspect of human understanding? In this case, there is a plausible alternative hypothesis, namely, that the principle is merely implicit in processes of reasoning that have an innate origin, but is not an idea that most people literally possess. The implicit idea hypothesis would work like this: Until and unless we reflect on the issue, we do not believe that every event has a cause. This is not to say we believe that some events do *not* have causes; we simply have no belief on the matter. Logically, all learning may be premised on "assumptions about the lawfulness of [the] world" (D. T. Campbell, 1974/1982, p. 87). Psychologically, though, such assumptions may not be made, at either a conscious or an unconscious level. Instead, they are simply implicit in an evolved tendency to postulate causes for any occurrence that attracts our attention.

There are a number of hurdles that this hypothesis must overcome before it can be accepted. For one thing, when and if we come to reflect on the issue, the idea that all events have causes may immediately seem more plausible to us than the idea that some do and some do not. For instance, the idea that there are uncaused events at the quantum level may immediately strike us as counterintuitive. Furthermore, it might not be subjectively obvious to us that we did not previously hold the belief that all events have causes. If we did not genuinely possess this belief, how can we account for these data?

One possibility is that, when we first turn our attention to the question of whether all events are caused, we notice that, for any event we think about, we immediately assume that that event has a cause. ("Whatever happens, where or when, we're prone to wonder who or what's responsible"; Minsky, 1985, p. 232.) Thus, our pattern of reasoning about specific events is *consistent* with the idea that we believe every event has a cause. Observing this in our past reasoning, we may infer that we held this general belief all along.[6] However, it may only be when we first contemplate the issue that this belief is embodied in the brain. The inference that we held this belief previously may be an error, similar to that of attributing a generalized urge to survive to most animals. Without good reason to suppose that there is an innate origin for the principle of universal causation, there is no barrier to supposing that it is simply implicit, and considerations of parsimony would urge that we do so. Thus, we reach this somewhat surprising conclusion: With the exception of the more philosophically minded, people treat every event as if it has a cause, without in fact knowing that every event has a cause. But although the principle of universal causation is not innate, there are good reasons to think that the faculty of causal cognition is.

Assuming Causation Over Coincidence: An Adaptive Bias?

In the last chapter, it was suggested that we possess an adaptive bias toward assuming the objectivity of our perceptual experience. In this section, I will argue that we also possess an adaptive bias in the domain of causal cognition. Specifically, in conditions of uncertainty, our default assumption is to assume causation rather than coincidence. Evidence that we possess such a bias comes from a number of sources. To begin with, philosophers have a technical term for the fallacy of assuming causation from mere correlation (*post hoc ergo propter hoc*), but not for the reverse error. Similarly, teachers of psychology repeatedly stress to their students that 'correlation does not imply causation,' but apparently feel little need to caution them against

[6] See Bem (1972) for a discussion of the tendency to infer one's own beliefs and attitudes from behaviour.

overlooking the possibility that correlated variables may in fact be causally related. Even young children assume that events are caused, and have difficulty understanding the idea of random phenomena (Gelman, Coley, & Gottfried, 1994). These points provide preliminary evidence that our default position is to assume causation rather than coincidence.

There are also good evolutionary reasons to expect such a tendency. Imagine that someone receives an alleged treatment for an illness, and experiences a subsequent improvement in health. This improvement is not necessarily attributable to the treatment; it is possible that it would have occurred anyway in the natural course of the illness. However, as long as the putative treatment has no undesirable consequences, it is better to err on the side of assuming that it was indeed the cause of the change. If this assumption is correct, the individual will receive the benefits of the treatment; if, on the other hand, the assumption is false, the individual is likely to lose little. The cost-benefit analysis differs for the alternative assumption that the treatment is ineffective. If *this* assumption is false, the individual does not receive the benefits of the treatment, but if it is true, the individual gains little. Overall, then, it is better to assume that any improvement in health is caused by the treatment.

For a similar reason, it is better to err on the side of assuming that an undesirable event was caused by an event that preceded it. The rationale for this can be illustrated by considering the phenomenon of conditioned taste aversions (CTAs). CTAs involve a learned revulsion to any novel food item that was ingested prior to the experience of strong nausea (Garcia & Koelling, 1966; Logue, 1988). These responses are not mediated by conscious cognition (Stewart-Williams & Podd, 2004); however, they lead the animal to act *as if* it assumes the food caused the nausea. Often, the food in question was not the real cause at all (Seligman & Hager, 1990). Therefore, the animal effectively has a bias toward assuming that the food and the nausea are causally related. The evolutionary rationale for this bias is that it is less costly to avoid eating a harmless food than it is to eat a harmful one. The same type of selection pressures may have led to the parallel phenomenon in causal cognition. That is, it may generally be adaptive to err on the side of assuming that an undesirable occurrence was caused by an event that preceded it than to assume otherwise.

The adaptive bias hypothesis helps to explain certain aspects of human psychology, such as our proneness to superstitious beliefs. By decreasing the threshold for judging that a conjunction of events reflects a lawful causal relationship, people are less likely to reject true causal beliefs. As signal detection theory informs us, however, this inevitably increases the likelihood that they will accept *false* causal beliefs (Green & Swets, 1966). Consequently, an offshoot of the tendency to assume causation over coincidence is that humans are prone to superstitions and taboos, for instance, magical beliefs that we can control the weather with spell or prayer. These beliefs are the functional equivalents of acquiring CTAs to foods that are only coincidentally associated with nausea. This analysis raises an important point: Given that the cost of assuming causation over coincidence is an increase in superstitious causal beliefs, if this assumption has an evolutionary origin, the average fitness costs of holding superstitious causal beliefs must have been outweighed by the average benefits of holding true causal beliefs.

Conclusion

There are good reasons to think that the capacity for causal cognition has an evolutionary origin. First, the proposal makes good evolutionary sense. Understanding causal relationships among events may underpin the human capacity to rapidly generate novel voluntary behaviors aimed at controlling events to satisfy evolved motivations. Further support for the innateness hypothesis includes a poverty-of-the-stimulus argument, and developmental and comparative research. The idea that every event has a cause is unlikely to be innate, although it is implicit in the activity of the innate faculty of causal cognition. Evolutionary theory leads to the prediction that we tend to assume causation over coincidence, and provides a framework for understanding existing data on human causal cognition, including the conditions in which we are most likely to make causal attributions and our proneness to superstitious beliefs. In this chapter, we have seen again that evolutionary psychology and philosophy can inform one another. First, an evolutionary approach to psychology updates the traditional innate ideas debate in philosophy. In addition, the philosophical literature can contribute to speculations in evolutionary psychology, by suggesting subject matter and by providing poverty-of-the-stimulus arguments for the innate origin of certain mental content. In the next chapter, I look at the possibility of innate mental content related to topics in moral philosophy.

Chapter VII: Selfish Genes and Moral Animals: Morality as an Adaptation

We believe that we should love our neighbour as ourselves, because it is in our biological interests to do so.

-Michael Ruse, Philosophy of Biology Today, *1988, p. 74.*

Morality is the device of an animal of exceptional cognitive complexity, pursuing its interests in an exceptionally complex universe.

-Martin Daly & Margo Wilson, Homicide, *1988, p. 254.*

The focus of this chapter is human morality, and the possibility that some elements of this phenomenon have an evolutionary origin. After considering general issues related to the possible evolution of a moral instinct, I first explore the idea that certain requisite concepts involved in moral reasoning, in particular the concepts of moral right and wrong, are part of an innate endowment. Support for this conclusion includes a poverty-of-the-stimulus argument derived from G. E. Moore's (1903) famous argument that the good cannot be defined in terms of any other property. Following this, I turn to the question of whether we possess any innate moral predilections. Evolutionary considerations render plausible the view that we possess certain evolved affective responses related to evolutionarily significant moral issues. These exert an important influence on our formalized moral systems, although they are only one influence among many.

In the next section, I discuss specific examples of evolved components of human morality. First, an evolutionary perspective helps to explain altruistic behaviour in our species, including the atypically high level of altruism found among non-relatives.

Furthermore, we may possess innate moral predilections related to such issues as incest and the value placed on human versus non-human life. Finally, I consider the meta-ethical issue of moral objectivism versus nihilism. The most intuitively plausible position for most people appears to be that moral judgements have objective validity. Arguments for and against the evolutionary origin of this intuition are considered. Like previous chapters, this one aims to show the productive interchange that can take place between psychology and philosophy. Again, the subject matter and some arguments are derived from the philosophical literature, and again an evolutionary psychological perspective updates the innate ideas debate in philosophy.

Moral Philosophy and the Evolution of the Moral Instinct

Ethics is a major branch of philosophy. An important distinction can be drawn between normative ethics and descriptive ethics. Normative ethics is the centre of the discipline. Whereas science and metaphysics attempt to answer questions about what *is*, normative ethics deals with the question of what should be. Which actions or intentions are right and which are wrong? Which principles should guide our actions? Descriptive ethics, on the other hand, looks at which ethical beliefs people actually hold and why they hold them. The present chapter is an exercise in descriptive ethics. The focus is what people *do* believe, rather than what they *should* believe. By maintaining this focus, the chapter sidesteps two of the most common pitfalls of evolutionary approaches to ethics: the is-ought fallacy (deriving evaluative conclusions from purely factual premises; Hume, 1739/1978), and the naturalistic fallacy (identifying the good with aspects of the natural world, such as the production of pleasure or happiness; Moore, 1903).

One of the aims of descriptive ethics is to shed light on the origin of moral reasoning and people's moral beliefs. This project has a long history. The Stoics of Ancient Greece taught that certain common moral beliefs are innate, as did the rationalist philosophers of the seventeenth century (Scott, 1995). On the other side of the issue, John Locke (1689/1959) and other naturalistically inclined philosophers denied that any moral knowledge has an innate origin. The unveiling of the theory of evolution brought with it the potential to breathe new life into this long-standing debate. Starting with Darwin (1871, 1987), various thinkers have attempted to explain moral behaviour and belief in terms of evolutionary theory, an enterprise known as *evolutionary ethics* (Alexander, 1987; Krebs, 1998; Maienschein & Ruse, 1999; Nitecki & Nitecki, 1993; Trivers, 1985). From this perspective, morality is a biological phenomenon. Like any other feature of the biosphere, it is a product of evolutionary processes. E. O. Wilson (1975) has argued for the necessity of such an approach to morality:

> The emotional control centers in the hypothalamus and limbic system of the brain... flood our consciousness with all the emotions – hate, love, guilt, fear, and others – that are consulted by ethical philosophers who wish to intuit the standards of good and evil. What, we are then compelled to ask, made the hypothalamus and limbic system? They evolved by natural selection. That simple biological statement must be pursued to explain ethics and ethical philosophers, if not epistemology and epistemologists, at all depths. (p. 3)

Of course, neurologically, there is much more to human emotions than the hypothalamus and limbic system. However, *whichever* neural structures are involved, Wilson's basic point remains: Human morality is informed by emotions and preferences that have their origin in our evolutionary history.

A modern evolutionary perspective updates the rationalist philosophers' suggestion that we possess innate moral ideas. From a Neo-Darwinian vantage point, to say that a component of mental life is innate is to say that its specific content does not derive purely from personal experience, but is constructed from the materials of the developmental process, in particular the genes. These materials are shaped by the process of natural selection (random variation and non-random retention of the most successful variants). Natural selection provides a plausible naturalistic explanation for the origin of any innate mental content related to morals and morality.

An evolutionary perspective also tells us something about the selective pressures that shaped any innate contributions to our faculty of moral reasoning. According to the inclusive fitness/selfish gene perspective, any such contributions were not designed specifically for the good of the group or species, or even for individual advantage. Instead, they were designed for the 'good' of the genes giving rise to them.[1] This can generally be taken as equivalent to the view that they are designed to enhance the inclusive fitness of the organisms in which they are found (i.e., the survival and reproductive success of that organism and, to a lesser extent, its kin; Dawkins, 1982; Hamilton, 1964/1996). The innate contributions to our faculty of moral reasoning may or may not advantage the individual, the group, the species, or other species, and may or may not bring happiness or justice. In the following sections, I consider some possible innate contributions to human morality, including moral concepts and intuitions.

Moral Concepts

First, I will consider the capacity for morality in general, and more specifically, the concepts of moral right and wrong. The extent to which moral standards or

[1] As E. O. Wilson, 1975, p. 3, put it, "the hypothalamus and limbic system are engineered to perpetuate DNA".

principles differ across cultures is fiercely debated. However, anthropologists tend to agree that, in all cultures, people possess *some* moral sentiments and norms (D. E. Brown, 1991). As such, even if there are no universal moral principles, moral reasoning may be universal in our species. Any example of normative moral reasoning demonstrates the application of the fundamental concepts of moral *right* and *wrong*. Some things ought to be done; they are good or right. Other things ought not to be done. According to D. Premack and A. J. Premack (1994), the concepts of right and wrong (as well as various other moral concepts) have an innate origin. Nozick (2001) made essentially the same point when he suggested that, in the course of our evolutionary history, there may have been "selection for a normativity operator within our cognitive and emotional apparatus, an operator that attaches an internal 'ought' to certain behavior or patterns of behavior" (p. 271).

What evidence is there that the human mind is innately disposed to think in terms of oughts and ought-nots, rights and wrongs, moral goods and evils? To begin with, this conceptual distinction is thought to be a human universal (D. E. Brown, 1991). This in itself is not compelling evidence for innateness; however, further support comes from combining this observation with a poverty-of-the-stimulus argument. This takes as its starting point a famous philosophical argument provided by G. E. Moore (1903), but turns it to a new purpose. According to Moore, moral terms, such as the concept *good*, cannot be defined in terms of any aspect of our experience, for it is always possible to ask: But *is* that really good? This simple observation shows that the concept *good* and the aspect of experience are not equivalent. To illustrate, suppose we wish to claim that the good can be identified with pleasure, as did the early utilitarian philosophers (Bentham, 1789/1973). If the concept of good and the concept of pleasure were equivalent, then asking 'is pleasure really good?' would be equivalent to asking 'is pleasure really pleasure?' However, whereas the former is a reasonable question, a question worth debating, the latter is not. This suggests that the concept of pleasure does not completely capture the meaning of the word *good*. This argument can be applied to any attempt to define the good in terms of other properties.

The same conclusion is urged by the observation that, if we attempt to define the good in this way, the term loses its natural language function of commending particular actions or intentions (Hare, 1952). Say, for example, we wish to claim that the good can be identified with maximizing happiness. If this claim were true, then to say 'you should maximize happiness because maximizing happiness is good' would mean 'you should maximize happiness because maximizing happiness is maximizing happiness'. But these statements are not equivalent; the latter does not capture the meaning of the former. This suggests that the translation is not accurate, and provides further support for Moore's (1903) conclusion that the good cannot be defined in terms of any property other than itself. In arguing for this conclusion, Moore's goal was to undermine naturalistic systems of ethics, such as utilitarianism and Social Darwinism, which defined the good in terms of natural properties (e.g., pleasure, happiness, or evolutionary fitness). However, his argument also has an unintended consequence. If the concept of *moral good* cannot be defined in terms of any natural property or aspect of our experience, how can it be derived from experience in the first place? This supports the view that the concept has an innate basis.

The next question is: What might be the evolutionary function of the tendency to judge some actions right and others wrong, of the tendency to attach an internal ought to some patterns of behaviour but not others? In general terms, the sense that a particular act is morally wrong may be similar to pain in that its evolutionary function is to dissuade people from engaging in that act. Likewise, the sense that an act is morally right might have the function of encouraging that act. However, to understand why such dissuasion and encouragement might be evolutionarily useful, the question of whether we possess any innate moral predilections must be addressed. This is the task of the next section.

Innate Contributions to the Content of Moral Thought

Even if it is accepted that the basic concepts necessary for moral reasoning have an innate basis, it remains an open question whether any of the specific content of our moral beliefs has its origin in innate components of mind. That is, do we have any innate dispositions to hold particular moral views? D. Premack and A. J. Premack (1994) argued that we do not. In their view, the capacity for moral reasoning is innate, but the content of our moral thought is not. This can be compared to the idea that we are innately disposed to process information about faces, but do not have innate knowledge of any particular faces. Specific moral beliefs are learned from the surrounding culture. To some extent, these beliefs may embody the accumulated wisdom of the culture and subcultures concerning beneficial or harmful courses of action. Of course, not all moral beliefs are wise; some proscribe harmless or advantageous behaviour, and others encourage pointless or harmful behaviour (Anders, 1994). However, as long as the average costs of non-useful moral beliefs did not outweigh the average benefits of useful moral beliefs over our evolutionary history, a capacity to learn local moral standards could have been favoured by natural selection, independently of any specific content. (Another possibility is that the capacity to acquire local moral beliefs is an evolved system for identifying ingroup members, as has been proposed for the capacity to acquire accents; Barrett, Dunbar, & Lycett, 2002.)

The apparent variation in moral beliefs and behaviour across cultures and subcultures appears to support the view that we do not possess any evolved moral predilections, as does the fact that moral codes sometimes change relatively rapidly, both within individuals and within societies. (Take, for instance, the change in expressed sexual attitudes in the West in the second half of the twentieth century.) Furthermore, if there were a universal human moral code, there would presumably be little debate about ethical issues, which is manifestly not the case. However, without denying the variation in moral codes, an evolutionary perspective renders plausible the view that there are some universal moral predilections concerning behaviours that were evolutionarily significant to our pre-modern ancestors (Ruse & E. O. Wilson, 1986), and as we will see, there is some empirical support for this position (Petrinovich, O'Neill, & Jorgensen, 1993). The key ingredients for evolutionary fitness are survival and reproductive success. This being the case, the most likely areas in which any innate moral predilections would be found are those closely related to survival and reproduction. So, for instance, sexual behaviours with important evolutionary implications, such as incest, cuckoldry, and sexual infidelity, are likely to be the focus of moral injunctions in many or most of the ethical systems of the world. Furthermore, where sex and reproduction are concerned, there may be average sex differences in people's moral predilections. This is because of the different selection pressures on genes in males versus females (Trivers, 1972/2002).

At this point, it is important to draw a distinction between formalized moral principles and our native moral psychology, our morally relevant affective tendencies. As C. Wilson (2000) wrote:

> The biological centre of morality contains no verbal formulas at all. It is a set of species-specific inhibitions and dispositions, somewhat variable from individual to individual and population to

> population, evolved in the early adaptive environment of the species and dependent for performance on immediate contextual cues and on the animal's mood. Food sharing and grooming, for example, are elements of the biological core and will be performed when animals give each other the right signals and feel like doing so. Incest with conspecifics recognizable by their shape, smell, or voice as close kin will be avoided when alternatives are available, insofar as it leads to a concentration of deleterious genes... and murderous aggression expressing itself against close companions has presumably been selected against. But morality cannot be identified with this central core, but with a set of centrifugal extensions and generalizations. (p. 233)

So, according to this view, mothers and fathers have an innate inclination to care for their children.[2] However, the notion that there is a *duty* to do this is an extension. More generally, our evolved inclinations may guide and shape our moral judgements and formal moral codes. However, these morally relevant affective propensities are only one influence among many, and thus formalized morality does not simply embody individual moral psychology. Some parts of formalized morality may, for instance, emerge as the net result of 'negotiations' among people with differing interests over many generations. For this reason, our moral codes may sometimes clash with our evolved predilections. Nonetheless, an evolutionary perspective predicts cross-cultural trends in moral belief in areas of evolutionary significance.

At the same time, though, it is exceedingly unlikely from this perspective that we possess any innate content related to ethical matters that were *not* of evolutionary significance to our ancestors. Therefore, we should not expect an evolutionary approach to explain every facet of human morality. (This is not a criticism of evolutionary ethics; it is an *implication* of evolutionary ethics.) Sober (1994) made this point vividly:

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[2] This tendency is thought to be stronger in mothers than fathers, on average, as a result of such factors as paternity uncertainty (Buss, 1999; Maier, 1998).

> In many parts of the world, capital punishment is now less popular than it was a hundred years ago. Why did this transition occur? In contrast, consider the fact that all (or virtually all) human societies have regarded the killing of one's children as a much more serious matter than the killing of a chicken. Why is this so? Perhaps historians have more to tell us than evolutionists about the first question, but the reverse is true with respect to the second. (p. 97)

Overall, then, an evolutionary approach provides a framework for explaining and predicting both similarities and differences among the formalized moral systems of the world. A useful way to summarize the position presented here is to draw a comparison with food preferences. Evolutionary psychologists suggest that, in addition to a universal tendency to learn local food preferences, there are certain universal food preferences (e.g., a preference for sweet food; Gaulin & McBurney, 2001). Similarly, in addition to a universal tendency to learn local moral principles, there may be universal trends in moral thought. Some of these are considered in the following sections.

Universal Trends in Human Moral Behaviour and Belief

There are at least three candidates for facets of human morality that plausibly have their origin in our evolutionary history. These are: altruism, incest abhorrence, and the tendency to value human life over non-human life.

Altruism

Contrary to the early idea that natural selection would give rise only to purely selfish creatures, most evolutionary psychologists now believe that the capacity for altruism is part of our evolutionary legacy (Axelrod & Hamilton, 1981). A great deal has been written about the possible evolutionary origin of altruistic behaviour. Here, I merely summarize this work, note some recent developments in the area, and highlight an evolutionary approach to altruism that has been overlooked: what I will call the extended phenotype approach. Darwin (1871) was among the first to argue that we are biologically disposed to be altruistic. His view was that altruism is a product of group selection: Groups of altruists typically fare better than groups of selfish organisms, and thus altruism comes to predominate in the species as a whole. Group selectionist explanations fell out of favour with the rise of the gene-centred view of evolution (Dawkins, 1982; Hamilton, 1964/1996; G. C. Williams, 1966). Since then, the main evolutionary approaches to explaining altruism have been kin selection theory (Chapters 1 and 2), and the theory of reciprocal altruism (Chapter 2).

According to kin selection theory, genes that 'contribute' to the survival and reproductive success of kin can be selected, as a result of the fact that kin – especially close kin - are likely to possess the same genes (Dawkins, 1979; Hamilton, 1964/1996). So, a gene in one body can increase its representation in the gene pool of a species by contributing to the reproductive success of another body, as long as that body belongs to a close relative (this is, of course, not an conscious or intentional process). Accumulating evidence from human samples is consistent with predictions from kin selection theory. For example, it has been found that non-reciprocated helping is more common among kin than among friends, and that people are more likely to help close kin than distant kin (Burnstein et al., 1994; Essock-Vitale & McGuire, 1985; Hames, 1988). The kin selection explanation of kin altruism highlights the importance of maintaining a clear distinction between morally relevant affective tendencies and formalized moral precepts. Although many manifestations of kin altruism are judged morally desirable (e.g., providing parental care for offspring), modern Western ethical systems tend to frown upon various other manifestations of kin favouritism, which receive the pejorative label of *nepotism.* This suggests that, though our ethical systems sometimes reflect our evolved preferences, they do not always.

Kin selection helps to explain biological altruism among relatives. But how can evolutionary theorists account for altruism among non-relatives? According to Triver's (1971/2002, 1985) theory of reciprocal altruism, many fundamental elements of human moral psychology evolved to facilitate mutually cooperative relationships among non-relatives, while also defending against the problem of cheating (people accepting help but not returning the favour). As noted in Chapter 2, for instance, liking facilitates the establishment and maintenance of reciprocal relationships, as we help those we like and like those who help us; gratitude motivates us to return good for good; and anger motivates us to withdraw help from people who take more than they give (Boyd & Richerson, 1992). Consistent with Trivers's theory, many common moral principles reflect the reciprocity principle (e.g., one good turn deserves another; an eye for an eye). This is not always the case, though. For instance, the ethical precept that we should 'turn the other cheek' may go against our untrained inclinations. This demonstrates again that innate moral psychology must be distinguished from formalized morality.

Recently, evolutionary theorists have considered other explanations for altruism among non-relatives (McAndrew, 2002). These supplement the kin selection and reciprocal altruism explanations, rather than replacing them. One promising approach claims that, to some degree, altruistic behaviour is a product of sexual selection (G. F. Miller, 2000). On this view, altruism and generosity can be understood as a costly display, with the same biological function as the peacock's tail. In addition, some thinkers have taken another look at group selection as a partial explanation for our altruistic tendencies (D. S. Wilson, 2003; D. S. Wilson & Sober, 1994). Finally, I propose that there is another, overlooked approach to altruism. This draws on Dawkins's (1982) extended phenotype perspective, which alerts us to the fact that an organism's behaviour may in some cases be an extended phenotypic effect of 'selfish' genes in *another* organism. If one organism evolved the capacity to manipulate others into unreciprocated altruistic behaviour, this behaviour would not benefit the altruist but could nonetheless be viewed as a product of natural selection. This provides a very different type of evolutionary explanation for altruism. Taken together with the more traditional explanations, evolutionary theory provides a rich array of tools to explain at least some of the altruistic behaviour in our species.

Incest

Although altruism has received the lion's share of evolutionists' attention, it is not the only features of human moral behaviour that invites an evolutionary explanation. Among the most important areas in which evolved moral predilections are likely to be found is incest (Lieberman et al., 2003; Westermarck, 1921). Incestuous mating is generally a bad move in evolutionary terms. If a gene that is potentially detrimental to inclusive fitness also happens to be recessive, it may not be selected out of the gene pool. Recessive genes only find phenotypic expression when both parents contribute the same gene. This is unlikely when the parents are unrelated. However, close relatives share many genes, and thus the offspring of incestuous liaisons are almost certain to have paired recessives. These offspring will have a reduced chance of surviving and reproducing, and thus, from an evolutionary perspective, would represent a poor investment of the parents' time and energy. For this reason, any psychological trait that decreases the likelihood of incestuous mating would be selected.[3] (This provides another reason that a capacity to distinguish kin from non-kin would be selected; see Chapter 4.)

[3] Of course, some incest does occur. However, this does not challenge the notion that we have adaptations for incest avoidance, any more than the fact that we sometimes end up as meals for other animals challenges the notion that we have adaptations for predator avoidance. Selection does not produce perfection.

So, based on evolutionary considerations, it would be predicted that the idea that incest is morally wrong is an intuitive moral predilection for *Homo sapiens*. Furthermore, it would be predicted that this would be a stronger tendency among females than among males, as a result of the differing selection pressure on genes when they are in male bodies than when they are in female bodies. As noted in Chapter 2, human females invest more on average into offspring than males. To begin with, the minimum obligatory physiological investment in producing a single child is nine months of pregnancy for females, whereas for males, it is "a few minutes of sex and a teaspoon of semen" (Pinker, 1997, p. 468). In addition, males as a group also engage in less parental care (Buss, 1999). Because males invest less on average, they stand to lose less (in evolutionary terms) from any given incestuous liaison than do females. For this reason, I suggest that incest may be more abhorrent to females than to males.

There is support for the view that the abhorrence of incest is an intuitive moral predilection. The idea that incest will trigger all sorts of catastrophes is a common ethical intuition across cultures (Boyer, 2001). In addition, one study found that heterosexual sexual coercion is viewed as a more serious offence the more closely related the victim and perpetrator are, especially when the victim is a female of fertile age (Quinsey, Lalumiere, & Queree, 1999). However, although incest avoidance is thought to be universal, incest taboos are not (Pinker, 1997). This argues again that our evolved moral predilections are merely one among several influences shaping our formalized moral codes.

The Value of Human Life

Another candidate for a cross-culturally universal moral valuation is the tendency for people to value the lives of humans over other animals (Petrinovich, 1995). The belief that humans are superior to animals is common among members of our species. This is reflected, for instance, in the Western philosophical tradition. Descartes (1641/1986) taught that animals were non-conscious automata. Similarly, "Kant, in the tradition of continental rationalism, had a low opinion of the status of animals, denying them consciousness or any capability of reasoned thought" (Ruse, 1986, p. 183). This trend is not limited to traditional Western thought. In Indian philosophy, it is held that, as a result of bad karma accrued in this life, a person will be reincarnated as a 'lower' animal (dung beetles are the archetypal example). Some empirical evidence backs up the idea that people of varying ethnic origins value human lives over the lives of other animals. Petrinovich and colleagues (1993) conducted a questionnaire study in which participants were required to respond to hypothetical ethical dilemmas, some of which pitted human against non-human lives. In these dilemmas, "most individuals chose outcomes that benefit the human species" (p. 474). The authors concluded that: "Speciesism could well be a strong universal human tendency" (p. 474). Elsewhere, Petrinovich (1995) has written:

> Even a cursory examination of human behavior and beliefs makes it apparent that human infants are accorded a special status by society and that this status is not accorded to young organisms of other species. This special status is the result of an anthropocentrism that is based on... inclusive fitness, as well as a deep-seated and pervasive tendency toward speciesism. (p. 206)

How might anthropocentrism contribute to inclusive fitness? For one thing, most social animals have inhibitions about severe aggression against conspecifics (Maier, 1998). Perhaps the fact that we value humans over other animals relates to the psychological mechanisms that inhibit intra-species aggression. Our empathy and sympathy does often extend to non-human animals, but perhaps usually to a lesser extent than it does to other humans. One reason for this may be that extending empathy and sympathy to other humans provides the groundwork for the establishment of reciprocally altruistic relationships. This does not apply in the case of other animals, so this selection pressure would not foster the evolution of a tendency to empathize with non-humans. In addition, there might have been active selection *against* such a tendency: Our species has evolved to eat other animals, and empathizing too much with the plight of our prospective meals might interfere with this particular goal. These suggestions are purely speculative at this point. However, the fact that it may seem obvious to us that we would value the lives of humans over non-humans should not blind us to the fact that this is something that requires explanation.

A final comment on the evolutionary origins of specific moral predilections: To many people, it may seem that our typical attitudes on issues such as altruism, incest, and the value of human life could hardly be otherwise, and that there is little need to invoke evolutionary explanations. E. O. Wilson (1996) has speculated that, if the capacity for morality had evolved among termites, they might feel exactly the same way. However, their list of moral imperatives would differ somewhat from our own. Termite morality might emphasize:

> The centrality of colony life amidst a richness of war and trade among colonies; the sanctity of the physiological caste system; the evil of personal reproduction by worker castes; the mystery of deep love for reproductive siblings, which turns to hatred the instant they mate; rejection of the evil of personal rights; the infinite aesthetic pleasures of pheromonal song; the aesthetic pleasure of eating from nestmates' anuses after the shedding of the skin; the joy of cannibalism and surrender of the body for consumption when sick or injured (it is more blessed to be eaten than to eat); and much more. (pp. 97-99)

In light of this thought experiment, human moral beliefs begin to look less like a reflection of timeless moral truths, and more like a set of very specific principles fitting one particular species to its evolved lifestyle.

Moral Realism: An Innate Meta-Ethical Predilection?

Finally, I will consider people's intuitive views in regard to a major topic in meta-ethics: whether there are objective moral facts corresponding to our moral beliefs - facts that are not dependent on what anybody believes (Sober, 1994). Moral realists (or objectivists) maintain that there are such facts; moral nihilists (or subjectivists) deny it. There is some agreement that the most intuitively plausible view for most people is moral realism. Boyer (2001) suggested that: "Our moral intuitions specify that behavior is either right or wrong or morally irrelevant" (p. 179) and that "a course of action is in actual fact right or wrong regardless of how the agents themselves explain their behavior" (p. 180). Mackie (1977) claims that our pre-philosophical predilection is to believe – falsely, in his view - that moral statements pertain to objective states of affairs, and thus that they are a matter of knowledge rather than of decision. According to B. Williams (1972), our moral beliefs do not mirror anything in the world, but we feel as if they do; we do not feel that they are invented.

How can we account for the intuition that moral beliefs have objective validity? A number of people have suggested that the disposition toward moral realism has an evolutionary origin. For instance, according to Ruse and E. O. Wilson (1986): "Humans function better if they are deceived by their genes into thinking there is a disinterested objective morality binding upon them, which all should obey" (p.179). Similarly, Joyce (2001) has recently argued that natural selection has programmed us with a sense of *moral inescapability*, a tendency to invest the world with values. What selective pressures might explain the evolution of this tendency? One possible explanation involves tying belief in an objective moral order to Triver's (1971/2002) theory of reciprocal altruism. A principled person can be relied on not to defect on a social arrangement, and therefore is a more desirable partner for mutually beneficial reciprocal relationships. For this reason, it is in people's best interests to convince others that they hold certain relevant moral principles to be true. The best way to convince others of this is to believe it oneself. "This raises the possibility of a sociobiological explanation not of particular patterns of conduct but of the belief in an objective moral order" (Nozick, 1993, p. 11).

On the other hand, there is a great deal of debate about whether we need to posit a specifically evolved tendency toward moral realism. For instance, Waller (1998) challenges Ruse's (1986) assertion that "morality simply does not work (from a biological perspective), unless we believe that it is objective" (p. 253), pointing our that many people – including Ruse himself - reject belief in moral objectivity but continue to accept the value of morality.[4] Admittedly, this is a very sophisticated position, and perhaps a belief in moral objectivity is necessary for most people. Nonetheless, Ruse's position does raise the possibility that moral realism is an intuitive idea, rather than a directly innate idea (see Chapter 3). Alternatively, rather than being a specific product of selection, it may be an offshoot of the general tendency to assume reality over appearance, also exhibited in the belief that perceptual experience reveals an objective external world (see Chapter 5). At this stage, I am unaware of any strong reason to favour any view over any other. As such, I merely raise the issue and leave the question open.

[4] Mackie (1977) and Joyce (2001) advocate the same general position.

Conclusion

In summary, there is reason to believe that certain facets of human morality have an evolutionary origin. In addition to certain fundamental moral concepts, evolutionary theory leads to the prediction that there will be recurring patterns in the ethical systems of the world, and that these can be traced to innate aspects of mind. Some of these aspects of mind, such as those that facilitate kin altruism and incest avoidance, have parallels in other sexually reproducing species. Other aspects may be largely unique to humans. These include moral inclinations that plausibly emerged in order to facilitate the evolution of reciprocal altruism among non-relatives (Trivers, 1971/2002). The tendency to view moral beliefs as objectively valid in the same way that factual beliefs are may also have an evolutionary origin, but at this stage this idea must be considered merely a conjecture. In the following chapter, I look at the possible evolutionary origin of mental content related to miscellaneous other topics in philosophy.

Chapter VIII: Innate Content Related to Other Philosophical Issues

In the course of this investigation it will be found that there are two pure forms of sensible intuition, serving as principles of a priori *knowledge, namely, space and time.*

-Immanuel Kant, Critique of Pure Reason, *2nd ed., 1787, p. 67.*

Darwinian selection guarantees that organisms either know the elements of logic or become posthumous.

-Jerry Fodor, RePresentations, *1981, p. 121.*

In this chapter, I provide an overview of some remaining candidates for innate mental content related to philosophical issues. These include various suggestions for innate ideas stemming from the rationalist philosophers and Kant. Specifically, I examine the claim, often credited to Kant, that the 'categories' of space and time are innate, and the rationalist claim that belief in freewill and knowledge of mathematical logical truths are innate. In addition, I consider the possibility of an innate basis for the capacity for inductive reasoning, and the capacity to track the persisting identity of objects and minds. The implicit ideas hypothesis (Chapter 3) provides important qualifications to the Kantian and rationalist positions. For instance, although certain specialized mechanisms related to spatial and temporal orientation may be innate, the abstract conception of space and time as single 'entities' may simply be implicit in these innate mechanisms. Similarly, specific mathematical and logical truths are unlikely to be innate, but may be implicit in the operation of cognitive capacities that plausibly have an innate origin. The goal of this chapter is not to provide an in-depth discussion of any of the topics under consideration. Instead, it is to round out the discussion of the innate cognitive capacities of humankind, and to point to areas where further research and discussion may be valuable.

Space

To begin with, I consider the possibility of an innate contribution to our understanding of the spatial structure of the world. The view I will argue for is that, although we possess specific adaptations related to space, there is no reason to assume that the generalized understanding of space is a specific product of natural selection. The notion that space is an innate or *a priori* form of perception, rather than an understanding derived from experience, goes back at least as far as Plato. In the *Timaeus*, Plato (360 BCE) wrote:

> Space... is apprehended without the help of sense, by a kind of spurious reason, and is hardly real; which we, beholding as in a dream, say of all existence that it must of necessity be in some place and occupy a space. (cited in Robinson, 1976, p. 61)

The most famous exponent of this view is Immanuel Kant. According to Kant (1787/1933), the human mind is innately structured to construe experience within a three-dimensional, Euclidian spatial framework. A number of modern thinkers have taken up related positions (Shepard, 1987). Hermann von Helmholtz, for instance, proposed that the three-dimensionality of phenomenal space is an innate form of ideation, as opposed to an understanding wrested from experience (Wuketits, 1984b). And, as discussed in Chapter 3, Lorenz (1941/1982) proposed that the Kantian category of space is a product of natural selection. This conjecture makes some sense in evolutionary terms. Spatial representation is relevant to many adaptive tasks. As Dyer (1998) noted:

> The adaptive significance of spatial orientation is obvious: It is easy to imagine why natural selection has equipped animals with mechanisms that enable them to (1) acquire information about their position and orientation relative to fitness-enhancing resources, such as food or mates; and (2) guide movements in search of better conditions. (p. 201)

It is uncontroversial that we possess adaptations related to spatial orientation. This includes the mechanisms involved in spatial localization, and those involved in monitoring the position of the body in space. It is also plausible that there is an innate contribution to our capacity to represent space in three-dimensions. Three-dimensional vision appears to be innate in other species; for example, newborn chicks will stay away from a visual cliff, despite having no prior visual experience. However, for present purposes, the more relevant question is this: Is there an innate contribution to the understanding of space-as-a-whole, the understanding of space as a single entity or container for objects and events posited by Kant? Certainly, the unitary conception of space appears to be intuitively compelling for most people. When reflecting on the issue, we do not see different areas of space as different independent examples of the phenomenon of space; they are parts of one space in which all exists (Kant, 1787/1933; Quinton, 1993). "We think of the world as containing objective particulars in a single spatio-temporal system" (P. F. Strawson, 1959, p. 15). The question is whether this intuition has an innate origin.

There are a number of hints scattered throughout the literature related to the possible evolutionary function of the conception of a unified space, distinct from specific spatial relationships. Any animal whose behaviour stems from a complex understanding of the environment, as opposed to simple reflexes, may require a unified conception of space. This conception would be available to the mechanisms involved in various specialized adaptive tasks.

> Food foraging models and ephemeris learning models and many, many other models require spatial representation. Keeping a constantly updated representation of where one is is crucial for success at many life-maintaining tasks. The device that represents space, and that learns where things are, is thus more generally applied than the device that sets foraging policy. (Gallistel, A. L. Brown, Carey, Gelman, & Keil, 1991, p. 32)

Such considerations appear to lend credence to the idea that a unified conception of space has an evolutionary origin. There is another possibility, however: The abstract conception of space-as-a-whole may not be a directly innate aspect of cognition, but may be merely *implicit* in the activity of various specialized adaptations, such as those involved in spatial localization or food foraging. We might even contemplate the idea that many people go through their entire lives without ever conceiving of space as a single, underlying medium for the 'furniture of the world'. They may think in terms of specific distances and heights, and of relationships such as *on* and *beside*, but not necessarily possess a generalized conception of space that contains all of these relationships. A less extreme view would be that most people do form this generalized notion, but that this is not an outcome that was specifically selected.

To assess the implicit idea hypothesis, I will begin by considering an argument for the opposite conclusion: that the understanding of space-as-a-whole is innate. This takes the form of a poverty-of-the-stimulus argument. Like those considered in previous chapters, it is drawn from the philosophical literature, in this case, the work of Kant. According to Kant (1787/1933), it would not be possible for us to make sense of our sensory input unless we had a pre-existing, pre-experiential understanding of space. His view was that such an understanding is *presupposed* in our ability to understand spatial relationships, and cannot be derived from experience. We cannot derive the concept of space from perceiving different spatial relationships (such as *on* or *beside*), because to perceive spatial relationships we must already possess an underlying concept of three-dimensional space. This observation might be employed as an argument in favour of the innateness of the concept of space. If we cannot experience specific spatial relationships without a pre-existing understanding of space, this understanding could not be derived from experience and must be innate. (This, at least, is one possible interpretation of Kant.)

In my view, this argument is problematic. It could just as well be argued that, in order to understand three-dimensional space, we must first possess an underlying concept of a medium with a certain number of dimensions, and then, in order to understand *this* concept, we must first understand some other, yet more inclusive concept. The argument appears to result in an infinite regress. The brain is finite, so we must draw the line somewhere. If we are prepared to accept that we need not possess the concept of a medium with a certain number of dimensions in order to understand the concept of three-dimensional space (which seems reasonable), why not accept that we need not possess the concept of three-dimensional space in order to make specific spatial judgements? Of course, many people do acquire an explicit concept of space. However, this may not be *necessary* in order to make specific spatial judgements, and therefore we do not need to assume that those who do *not* have an explicit, consciously accessible concept of space have an unconscious one. They may simply not possess the concept at all. The argument does nothing to establish that the concept of space is innate.

Another reason to accept the possibility that our understanding of space need only be implicit comes from a consideration of the concept of *object*. As a matter of definition, objects occupy regions of space. Logically, then, the concept of object presupposes the concept of space (Spelke, 1990). As mentioned in Chapters 4 and 5, even infants have some grasp of the nature of objects. It seems highly unlikely, though, that, before an infant can assemble the concrete concept of object, it must first grasp the highly abstract concept of space. As such, we must assume that this concept is implicit in the workings of those mechanisms that process information about objects, rather than an actual concept that the infant possesses. But if we can accept this for infants, why assume that adults *must* possess a generalized conception of space in order to process information with spatial content?

Cosmides and Tooby (1994) suggested that people "organize patterns on their two dimensional retinal array under the assumption that the world is three-dimensional" (p. 103). However, in light of the present discussion, it is important to specify that this 'assumption' is probably not one we make in a literal sense. It may simply be implicit in the operation of the brain mechanisms involved in vision. Similarly, the principles of Euclidian geometry may be implicit in the activity of certain brain mechanisms, such as those involved in the creation and use of mental maps (Cheng & Gallistel, 1984; Gallistel, 1990). Although we possess specific adaptations related to space, it seems unnecessary to assume that the generalized understanding of space is something that was specifically selected. In reflecting on the issue, the idea that space is singular, three-dimensional, and Euclidian may seem intuitively appealing to most people. However, this may just be because it is consistent with their behaviour and their specific spatial judgements.

Time

According to Kant (1787/1933), not only is the human mind innately structured to construe experience in terms of three-dimensional space, it is also innately structured to construe experience within the framework of one-dimensional time. In this section, I consider this possibility from an evolutionary perspective. Again, I conclude that, although we possess adaptations related to temporality, the abstract understanding of time as an entity abstracted from particular temporal relationships is unlikely to be directly innate.

Seitelberger (1984) provided a vivid description of the time sense found in adult humans:

> [The time sense] comprises not only timing and co-ordination of movements, a very old capacity which appears early in individual life, but also the realization of events in time as coming before and after in correct sequence and the faculty of measuring and estimating the time length of events. In the inner sense of time we are aware of the irreversible course of time from the past into the future through the subjective present.... In experiencing time as duration we perceive the limited extension of our individual existence and the certainty of death. (p. 144)

If the capacity to represent temporal relations, sequence, and duration has an evolutionary origin, its adaptive function presumably relates to behavioural planning. The ability to make long-term plans requires an ability to represent time, and in particular possible futures. Ashby (1960, 1963) described animals as machines that take in information from their present environments and use it to meet the future. For most non-human animals, this may not be a conscious or deliberate process. In nonconscious conditioned learning, for instance, an animal's behaviour is shaped by past experience in ways that typically lead to more adaptive behaviour in the future, but without any understanding that this is taking place. However, the same selection pressures that shaped the nonconscious process in other animals may also have shaped the conscious capacity found in humans to use the past to meet the future. We are not necessarily the only terrestrial animals that represent temporal relations and duration in this way. However, we have a greater capacity for long-term, flexible planning than any other animal, and thus our understanding of time is presumably much greater than that of any other animal (assuming other animals have any understanding of time at all).

It is possible to connect certain specific components of our intuitive understanding of time to evolutionary considerations. Common sense divides time into past, present, and future, and recognizes a fundamental asymmetry between the past and the future. The past is fixed; each past event is a permanent and unchangeable fact of the universe. The future, in contrast, is open. Popper (1982) discussed this asymmetry in relation to the doctrine of determinism (the idea that all events are caused):

> It is trivially true that *the past is completely determined by what has happened*. The determinist doctrine – according to which the future is also completely determined by what has happened – wantonly destroys a fundamental asymmetry in the structure of our experience; and it is in striking conflict with common sense. All our lives, all our activities, are occupied by attempts to affect the future. Clearly, we believe that what will happen in the future is largely determined by the past or the present, for all our present rational actions are attempts to influence, or to determine, the future.... But just as clearly, we do look upon the future as not yet completely fixed; in contrast to the past which is closed, as it were, the future is still open to influence; it is not yet completely determined. (pp. 55-56)

The future but not the past can be altered by voluntary behaviour in the present. This may seem so obvious as to be trivial. However, the fact that it seems so obvious to us may indicate that, far from being trivial, it is a particularly deep-seated aspect of the human understanding of the world, and one that requires an explanation. A Darwinian explanation may be appropriate. A working understanding of the past-future asymmetry makes good sense in evolutionary terms, and Popper's quotation demonstrates how it can be linked to voluntary behaviour. If we did not believe that the past is closed (that is, that voluntary behaviour is powerless to influence it), we might engage in a lot of useless activity attempting to influence past events. (See also the discussion in Chapter 6 of our understanding of the direction of causality.) Conversely, if we did not believe that the future was open, we would not engage in efforts to shape the future and bring it into line with our goals – goals that have been shaped in part by evolutionary forces (see Chapter 2). It seems that a conscious understanding of the past-future distinction is necessary for an animal that engages in consciously directed voluntary behaviour, informed by explicit memories of past events and directed toward future goals.

But is there any reason to think that this understanding has an innate basis? If humans have evolved to understand time, then we would expect these ideas to be found in all human cultures. However, the universality of this conception of time is sometimes denied. Such denials often involve reference to the work of Benjamin Whorf. Whorf (1956) suggested that the Hopi Indians of Arizona have a fundamentally different understanding of time than Westerners, or no concept of time at all. Among Whorf's claims were the following: The Hopi have no words or grammatical forms that refer to time, past, or future; their verbs lack tense; they have a concept of psychological time but not a concept of physical time; and they do not use spatial metaphors to talk about time. If this were correct, it would be fatal to the innateness hypothesis.[1]

So, is it correct? Whorf based his conclusions on a limited sample of Hopi language (Pinker, 1994). Later, Ekkehart Malotki (1983) studied Hopi conceptions of

[1] Unless, that is, it were maintained that the innate contribution to the time sense in the Hopi differs from that of other human populations.

time in depth, and concluded that Whorf's conclusions were radically mistaken. The Hopi do have time concepts, including the concepts of past, present, and future. They have units of time, including days, months, seasons, and years, and they aggregate these units. They have a tense system, and they use temporal metaphors (including spatial ones). Therefore, the Hopi example does not undermine the view that time is understood in similar terms across cultures. According to D. E. Brown (1991), the distinction between past, present, and future, as well as the employment of units of time, are human universals. Further, he noted that people in all cultures and linguistic communities try to predict and plan for the future, which is at least consistent with the speculation that the evolutionary function of temporal representation relates to long-term planning.

A poverty-of-the-stimulus argument provides support for the view that there is a specific innate contribution to our understanding of time. Now it might be argued that the concept of time could be abstracted from experience. Of course, we do not directly experience time passing. "What we experience are differences between our present perceptions and our present memories of past perceptions" (Deutsch, 1997, p. 263). Nonetheless, the case could be made that, through comparing present perceptions with memories, we become aware of change and thus time. The problem is that this comparison would require a pre-existing understanding that memories refer to past events. Without the concept of *past*, we could not understand that a given mental experience was a memory. So, we cannot derive an understanding of time from a comparison of present events and memories, because such a comparison already presupposes an understanding of time. If our understanding of time cannot be derived from the experience of change, then, on purely logical grounds, we have reason to suppose that this understanding has an innate origin - that it is an understanding the human mind is in some sense designed to function with.

However, just as a capacity to make individual spatial judgements may be innate but the conception of space as underlying medium merely implicit, it is possible that a capacity to make particular temporal judgements is innate but an abstract conception of time-as-a-whole is implicit. We may have an innate disposition to think in terms of temporal concepts such as past, present, and future, and in terms of temporal relationships such as *before* and *after*. But perhaps most people do not possess an overall conception of time as a single entity or container of events, either consciously or unconsciously; they simply act as if they do. Alternatively, perhaps most people do form this conception, but it is merely an epiphenomenon of a generalized intelligence, rather than a specific adaptation. In any case, the abstract understanding of time as an entity abstracted from particular temporal relationships may not be directly innate, despite the fact that we possess adaptations related to temporality.

Freewill

Closely tied to our understanding of time is the notion of freewill (also known as freedom of the will). The question of whether or not we have freewill is one of the core problems of metaphysics. To say that we have freewill is to say that, for at least some behaviour we undertake, we could have done otherwise. It is also taken to imply that we have ultimate responsibility for our actions (G. Strawson, 1986). To deny that we have freewill, on the other hand, is not to deny that we make our own choices, but rather to claim that these choices are just as determined and mechanical as the motion of the planets around the sun (albeit much more complex). In this section, I ask whether the intuition that we possess freewill can be traced to innate aspects of mind, as opposed to being derived solely from experience or reasoning. My conclusion is that it cannot.

According to Francis Galton (cited in Pearson, 1924), the position of the conscious mind "appears to be that of a helpless spectator of but a minute fraction of a huge amount of brain work" (p. 236). But whether or not this is the case, it is not how it *appears* to the spectator. As Deutsch (1997) wrote:

> The common-sense view is that we have free will: that we are sometimes in a position to affect future events (such as the motion of our own bodies) in any one of several possible ways, and to choose which shall occur; whereas, in contrast, we are never in a position to affect the past at all. (p. 269)

As this quotation indicates, the concept of freewill is intimately connected with the belief discussed in the last section that the past is fixed but the future open. Logically, belief in the openness of the future is a precondition for belief in freewill. At the same time, belief in freewill is itself a logical precondition for various other aspects of human thought. For instance, a belief in freedom appears to underlie our tendency to think in terms of possibilities (modal reasoning). We compare the probable outcomes of different courses of action and decide on a course of action, but this would only make sense if we believed that these different options were genuinely open to us. Belief in freewill also appears to underlie moral reasoning. Morality is premised on such assumptions as that some actions are wrong and others are right; that both are available to us; and that we should choose the actions that are right. If this choice were not genuinely free, if people could not do otherwise, it does not seem that we could justifiably blame or praise people for their actions. We do blame and praise, which suggests that our pre-philosophical intuition is that, for any voluntary action, the actor could have done other than what was actually done. That is, our pre-philosophical intuition is that we have freewill.

A handful of thinkers have conjectured that the sense of freedom or belief in freewill has an evolutionary origin (Carruthers, 1992; Ruse, 1986; van Inwagen, 1993). An initial problem with this position is that it is far from obvious how a sense of freedom would enhance inclusive fitness. In fact, it may seem implausible that a sense of freedom is something that was selected over and above the neural mechanisms involved in making choices and thinking in terms of possibilities. What could a decision-making animal achieve with a sense of freedom that it could not achieve without this sense? How would this sense result in the genes that facilitate its development predominating over other available alleles in the gene pool? One attempted explanation ties the evolution of a belief in freewill to decision-making.

> I cannot try to decide whether to do A or B unless I believe that doing A and doing B are both possible for me.... if I never decided what to do, I should not be a very effective human being. In the state of nature, I should no doubt starve.... Belief in one's own free will is therefore something that we can hardly do without. It would seem therefore that it would be an evolutionary necessity – at least for rational beings like ourselves – that we believe in free will. (van Inwagen, 1993, p. 196)

A related suggestion is that the evolutionary value of the sense of freedom relates to the fact that it is necessary for the proper functioning of human morality (Carruthers, 1992; Ruse, 1986). According to Ruse (1986):

> The notions of 'right' and 'wrong' make little sense unless a person has a capacity for choosing between them. Yet, for all the enthusiasm we have for causal necessity, when it comes to making individual choices, there are few doubts perturbing us about being locked into our actions. We have a strong sense of personal freedom.... [O]ur moral capacities clearly demand some sort of phenomenological awareness of freedom. (p. 181)

Neither of these suggestions is particularly satisfying. *Logically*, modal reasoning and moral reasoning may demand belief in freewill. However, there is no reason to think that they are required *psychologically*, and thus no reason to think that such beliefs would necessarily have to evolve in order for modal or moral reasoning to be possible. After all, we usually have little difficulty living without logical consistency. To illustrate: The freewill versus determinism debate stems from the logical tension between our belief in freewill and our belief that events are caused, but this tension does not cause most people the slightest problem in their everyday dealings. Another, more promising suggestion derives from the work of Daniel Wegner (2002). His view is that 'will' is a qualitative feeling, the evolutionary function of which is to tag behaviour as *ours*, as opposed to anyone else's. This account involves relating the sense of will to the adaptive challenge of keeping track of which events in the world are one's own actions. (See the discussion in Chapter 4 of the distinction between self and not-self.) However, Wegner is talking about the sense of *will*, not freewill. To deny that we have freewill is not necessarily to deny that we cause our own behaviour through an effort of will; it is to deny that we could have willed otherwise. Therefore, even if we have a qualitative sense that we will our behaviour, this does not mean that we have a qualitative sense of freedom.

Indeed, a convincing case can be made that, pre-philosophically, people's apparent belief in freewill is merely implicit in the capacity for decision-making and moral reasoning, rather than a belief that most people actually possess. From this perspective, those who come into contact with philosophy learn that maybe they do not have freewill, and in the process are acquainted for the first time with the idea that they *might*. Without contact with philosophy, most people would not think about the issue.

But the fact that they do not think 'I do not have freewill' should not lead philosophers, who may be atypical in thinking about such matters, to conclude that they instead think 'I do have freewill'. Some might, but perhaps many more hold no belief on the matter, at either a conscious or an unconscious level. Granted, people in all cultures may act as if they believe they have freewill. However, according to this line of argument, they *only* act *as if* they hold this belief, which in fact they do not hold at all.

Before we could accept this hypothesis, we would have to account for certain awkward facts. For instance, if and when people first reflect on the issue, the idea that they possess freewill might immediately seem more plausible than its denial, and it might not seem subjectively obvious to them that, prior to contemplating the issue, they held no view either way. Could the implicit idea hypothesis accommodate this data? Imagine people reflecting for the first time on whether or not they have freewill. Their behaviour in the past is consistent with the idea that they do, and is inconsistent with the idea that they do not (this is another way of saying that the belief is implicit in their behaviour). For this reason, belief in the existence of freewill may be the most intuitively compelling option. To reject it would be to concede that one's past behaviour was irrational. It is widely recognized that humans are prone to anthropomorphism, which involves attributing mental states to animals that do not possess these states (D. E. Brown, 1991; Guthrie, 1994). However, it is possible that sometimes we make a similar error when thinking about our own past mental states: We attribute beliefs to ourselves that we did not really possess, but which were simply implicit in our behaviour. The upshot is this: There is no barrier to concluding that the belief in freewill is merely implicit in innate mechanisms, rather than itself an innate product of selection. Furthermore, in the absence of any reason to think that a belief in freewill might enhance inclusive fitness, this is the conclusion that we should draw.

Mathematics

Another suggestion of the classical rationalists was that certain mathematical and logical truths are innate or *a priori*. This view is found in Plato, and is also commonly attributed to such luminaries as Leibniz (1704/1981) and Kant (1787/1933). The position I will consider in this section and the next is *not* that these truths are innate, but that the capacity for mathematical reasoning and logical reasoning is. At any rate, I hope to show that this is not an unreasonable position and that it is one worth examining. I begin with a consideration of the possible innate bases of mathematics. In one sense, it is inarguable that our mathematical abilities have an innate basis. After all, humans are capable of deliberate mathematical reasoning whereas most other animals are not, and presumably even in the most enriched environment imaginable, no other animal would be capable of the level of mathematical prowess that most humans are. But is this made possible by a specific adaptation, or is it derived from a more general cognitive superiority?

Some evolutionary psychologists and others have taken the former position and argued that mathematical reasoning is an activity that the human brain is specialized to perform (Carey & Spelke, 1994; Dehaene, 1997; Gelman, 1991; Katz, 1981). The first question to ask about this view is what evolutionary advantage this capacity might have served within ancestral human populations. Empiricist philosophers have typically maintained that mathematical truths are mere tautologies (Hume, 1739/1978; Russell, 1946). From this perspective, it seems implausible that these truths could be useful from an evolutionary perspective. However, the 'unreasonable effectiveness' of mathematics in the natural sciences argues that the apparently vacuous truths of mathematics are somehow related to reality in a deep and important way (Hamming, 1980; Wigner, 1960). As such, it is reasonable to suggest that an understanding of mathematics could be evolutionarily useful. Reality appears to conform to the 'laws' expressed by mathematics; therefore, in adapting cognitively to the structure of reality, organisms may do so at the abstract level of mathematical truths as well as at more concrete levels. Bringing the discussion down to earth, it is not difficult to imagine circumstances in which basic mathematical competence could enhance inclusive fitness. Ruse (1986) provided a simple example: "Two tigers were seen going into the cave. Only one came out. Is the cave safe?" (p. 162). More generally, the evolutionary significance of mathematics may link to our capacity to represent and understand objects (see Chapters 4 and 5). As Kitcher (1983) noted, "arithmetic describes those structural features of the world in virtue of which we are able to segregate and recombine objects" (p. 108).

The view that the brain is specialized for mathematical understanding faces an immediate objection. According to Chomsky (1988): "It is impossible to believe that it was specifically selected. Cultures still exist today that have not made use of this faculty" (p. 168). If this were so, we would have to conclude that mathematics is a cultural tool, instantiated in a brain not specifically designed for this purpose. However, it is not clear that Chomsky's assertion is correct. The concept of *number* is thought to be a semantic universal, and all languages are thought to contain number terms (D. E. Brown, 1991). It also seems likely that members of any culture would realize that if two tigers enter a cave and only one leaves, there is still one tiger in the cave. This at least opens up the possibility that there is an innate, evolved contribution to our mathematical abilities. Of course, many aspects of mathematics are offshoots of evolved capabilities, rather than abilities that were specifically selected. ("I doubt that knowledge of the properties of prime numbers aided Australopithecines in their journey along the path of evolution"; Ruse, 1986, p. 169.) Nonetheless, it is possible that basic mathematical competency has an evolutionary origin, and that advanced or formalized mathematics is an extension of this basic competency.

A number of thinkers have championed this position (Dehaene, 1997; Ruse, 1986). Geary (1995), for instance, has argued that the innate contributions to mathematical understanding include estimating the quantity of small sets without counting; making estimates of 'greater than' and 'less than'; counting up to three or four; and adding or subtracting small numbers. (See also Carey & Spelke, 1994.) Aspects of mathematics that are *not* adaptations include counting in base ten; adding and subtracting large numbers; and multiplying and dividing (Geary, 1995).

There are various lines of support for the idea that simple mathematics, but not complex mathematics, has an evolutionary origin. Complex mathematics is difficult to master and has no precedent among other animals, whereas the reverse is true of basic mathematics (Geary, 1995; Gelman & Gallistel, 1986; Wynn, 1992). In addition, certain rudimentary aspects of mathematical understanding appear to be present in humans from a very early age. For example, in one series of studies (Wynn, 1992), five-month-old babies were shown a Mickey Mouse doll. A screen was placed in front of the doll, and then, as the baby watched, a second, identical doll was placed behind the screen. For babies in the control condition, the screen was then dropped, revealing two Mickey dolls (as would be expected). For babies in the experimental condition, however, only one Mickey was revealed; the other had been surreptitiously removed. The result was that those in the latter condition stared for longer at the array, indicating that they were surprised to see one doll rather than two. This suggests that infants as young as five months compute the results of simple arithmetic operations. Before acquiring any language or number terms, they apparently have a rudimentary sense of number.

According to Gallistel and Gelman (1992), we share these preverbal mechanisms of counting and arithmetic with species at least as distant as rodents and birds. The least controversial evidence in this regard concerns apes and monkeys, who appear to have a rudimentary grasp of mathematics (Hauser & Carey, 2003; King & Fobes, 1982). Furthermore, in support of the view that mathematics is a specific evolved domain, cases have been reported of individuals with selective impairment or selective sparing of the ability to comprehend and produce numerals (Thioux, Pillon, Samson, de Partz, & Noel, 1998; see also Dehaene, 1997). If nothing else, the idea that the human brain is specialized for basic mathematical understanding is worthy of further consideration.

Logic

Logic is another of the main branches of philosophy. It deals with the principles of valid inference. Philosophers have identified various logical principles. Among these are the law of identity ($x = x$), the law of non-contradiction (not [x and not-x]), and the law of excluded middle (either x or not-x). Some rationalist philosophers suggested that knowledge of these principles is innate or *a priori* (Kant, 1787/1933; Leibniz, 1704/1981), and a number of more recent thinkers have attempted to place such suggestions within an evolutionary psychological framework. W. S. Cooper (2001), for instance, hinted that rationality is an Evolutionarily Stable Strategy: “A fit cogitator will avoid... irrationalities as a primate avoids snakes, and for the same reason: A tolerance of irrationalities, like a tolerance for snakes, is unstable and invadable by less tolerant strategies” (pp. 80-81). Ruse (1986) made a similar point: “The proto-human who had an innate disposition to take seriously the law of excluded middle, and who avoided contradictions, survived and reproduced better than he/she who did not” (p. 162).

A working understanding of the basic principles of logic could provide several selective advantages. First, these principles may allow us to deduce new knowledge about the world from information we already possess. As Papineau (1987) noted, "habits of thought which generate new true beliefs from old ones will be biologically advantageous" (p. 187). Again, Ruse (1986) provided a simple but effective example:

> A tiger is seen entering a cave that you and your family usually use for sleeping. No one has seen the tiger emerge. Should you seek alternative accommodation for this night at least? How else does one achieve a happy end to this story, other than by an application of [the] laws of logic? (p. 162)

Logical principles also appear to underlie our efforts at predicting one another's behaviour. If we know that a person wants *X* and believes that *Y* will bring about *X*, we can infer that the person is likely to do *Y* (Boyer, 1994). Carruthers (1992) provided another illustration of the potential adaptive advantage conferred by a working understanding of logic, specifically, the principles of transitive reasoning.[2] His illustration connects this understanding to the uniquely human talent of long-term behavioural planning:

> It is clear that all human communities, however remote in the past, will have had knowledge of the truths of logic.... Rational planning of a strategy of action would be impossible if one could not rely upon such truths as 'If I will not get A unless I do B, and I cannot do B unless I do C, then I will not get A unless I do C'. (p. 147)

So, a working knowledge of certain basic elements of logic could certainly be biologically advantageous. But what reason is there to think that this has an innate

[2] Transitive reasoning takes the form: If *A* then *B*; if *B* then *C*; therefore, if *A* then *C*.

origin, as opposed to being learned or otherwise acquired? W. S. Cooper (2001) provided a theoretical reason to expect this: "Like snake avoidance... rationality is likely to be largely innate, for there is no need for the intolerance [of irrationality] to be learned anew each generation" (pp. 80-81). Similarly, Ruse (1986) wrote: "We need the law of non-contradiction and *modus ponens* to get through life... so why should they not be part of our biologically informed, innate conceptual apparatus?" (p. 169).[3] In addition, some empirical evidence is consistent with the innateness hypothesis. According to Pinker (1997): "All languages have logical terms like *not*, *and*, *same*, *equivalent*, and *opposite*. Children use *and*, *not*, *or*, and *if* appropriately before they turn three, not only in English but in half a dozen other languages that have been studied" (p. 334). Furthermore, at least some non-human apes have a rudimentary grasp of logic (Cheney & Seyfarth, 1985; King & Fobes, 1982). For example, there is evidence that chimpanzees are capable of some forms of reasoning. They appear to be capable of reasoning by analogy (Gillan, D. Premack, & Woodruff, 1981), and of transitive reasoning (Gillan, 1981).

But what precisely is innate? In his famous attack on the rationalist doctrine of innate ideas, Locke (1689/1959) suggested that the law of identity and the law of non-contradiction are probably among the best contenders for innate or *a priori* ideas. As mentioned in Chapter 3, though, Locke also pointed out that even these principles are not known to most of humankind. As such, it seems unlikely that the abstract principles themselves are innate. Nonetheless, it remains possible that they are implicit in innate psychological mechanisms. Rather than innate knowledge of logical principles, as posited by the rationalist philosophers, what might be innate is a specifically evolved

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[3] *Modus ponens* is a common type of deductive argument. Its abstract form is: 'if p then q; p; therefore q.'

capacity for logical reasoning. This issue is further explored in the following section, which takes a closer look at one particular logical principle.

The Law of Non-Contradiction

One of the most important principles of logic is the law of non-contradiction. Aristotle (350 BCE/1924) believed that this law was the starting point for all reasoning. The principle can be expressed in various ways; for instance, 'it is impossible for something to be and not to be at the same time' (Locke, 1689/1959); 'nothing can at the same time both have a quality and not have it' (Russell, 1912); or 'two contradictory statements cannot both be true'. Why might an abstraction such as the law of non-contradiction be evolutionarily useful? Bertrand Russell (1912) claimed that the law of non-contradiction is not simply a law of thought or principle of good reasoning, but rather "a fact concerning the things in the world" (p. 50). Similarly, Millikan (1984) suggested that the law of non-contradiction is a way of testing that beliefs map onto the world, and that it has this function "because of the ontological structure of the world" (p. 143). A working knowledge of the law of non-contradiction may be evolutionarily advantageous because it coordinates our minds and behaviour with this abstract structural principle, just as our understanding of the behaviour of objects coordinates our minds and behaviour with more concrete features of the world.

As the Millikan quotation indicates, one example of the application of this principle is that it may allow us to refine our beliefs about the world. If two beliefs are logically inconsistent, one or both must be false. This implication is something that an evolved rational animal could take advantage of. As cognitive dissonance theory suggests, contradictions among people's beliefs sometimes prompt belief change (Festinger, 1957; Festinger & Carlsmith, 1959). By refining their beliefs, our ancestors may have been able to achieve their goals more successfully. Another function was suggested by Leibniz's (1704/1981) response to Locke's claim that most people are utterly unaware of principles such as the law of non-contradiction:

> Everyone does... use the principle of contradiction (for instance) all the time, without paying distinct attention to it... the conduct of a liar who contradicts himself will be upsetting to anyone, however uncivilized, if the matter is one which he takes seriously. (pp. 76-77)

With these words, Leibniz may have inadvertently stumbled on one of the evolutionary functions of the law of non-contradiction: Contradictions provide one means of detecting other people's efforts at deception. I suggest that, from an evolutionary perspective, it is probably at least as important to detect contradictions between what people say on different occasions, or between what they say and what might actually be true, as it is to detect contradictions among one's own thoughts. The capacity for deliberate deception appears to be very ancient. There is evidence that other primates, such as chimpanzees and baboons, engage in tactical deception (Byrne & Whiten, 1988; Byrne & Whiten, 1991; Savage-Rumbaugh & McDonald, 1988; Whiten & Byrne, 1988; but see Heyes, 1998). As soon as the ability to engage in deception came into existence among our ancestors, there would have been selection pressure for detecting other people's efforts at deception. It would have been particularly important to detect inter-sex deception concerning such matters as fidelity, commitment, and resources (Buss, 1999). A working knowledge of the law of non-contradiction could be an evolved counter-adaptation to such deception. In addition, it may help us to avoid being detected when using deception ourselves. We know that, in order to deceive another person successfully, we should avoid saying things that are overtly internally inconsistent.

However, it seems unlikely that an abstract understanding of the law of non-contradiction is directly innate. Instead, it is more likely to be implicit in various innate mechanisms. So, for instance, rather than being specialized to understand the law of non-contradiction, the human brain may be specialized to detect contradictions between what people say on one occasion and what they say on another. Similarly, the law of non-contradiction may be implicit in an evolved capacity for elementary deductive reasoning. Logically, deduction rests on the truth of the law of non-contradiction. The first lesson that students of logic learn about deductive arguments is that if the premises of a deductive argument are true and the argument valid, then the conclusion must be true. The grounds for this assertion are simple: If you accept the premises of a valid argument but reject the conclusion, you hold contradictory beliefs. So, the law of non-contradiction underpins deduction. However, the fact that we use deductive reasoning is no reason to assume that we hold a belief in the law of non-contradiction. Most logicians do, of course, but those who have not reflected on the issue may not. As Smart (1989) pointed out, "it is possible to reason correctly without knowing the rules of inference one uses" (p. 197). The more general conclusion is that certain aspects of logical reasoning may be innate, but there is no reason to assume the innateness of the logical principles posited by the rationalists.

Induction

Another suggestion for an innate aspect of cognition is the capacity for inductive reasoning. A number of thinkers have entertained the idea that this capacity has an evolutionary origin (Kornblith, 1993; Ruse, 1986). For instance, Carruthers (1992) suggested that "non-deductive principles of belief formation… are an innately given part of our cognitive apparatus" (p. 165), and Nozick (1993) suggested that we have an evolved tendency to see certain connections (for example, inferences from sample to population) as self-evident. Although there is not a great deal of empirical evidence bearing on this issue, some evidence is at least consistent with the hypothesis. For instance, other apes, in particular chimpanzees, appear to have an untutored grasp of inductive reasoning (Gillan et al., 1981; Ruse, 1986). An innate capacity for inductive reasoning would also make good evolutionary sense. According to Quine (1995): "The survival value of primitive induction is anticipation of something edible, or of some creature by which one might be eaten" (pp. 19-20). Those cousins of our ancestors "who could not learn to generalize from past experience (in a way that was appropriate then) succumbed to dangers that left them fewer descendents" (Nozick, 1993, p. 121).

Persisting Identity

The final candidate for an innate aspect of cognition that I will explore in this chapter relates to the philosophical issue of the persistence of identity. To common sense, physical objects, individuals, and minds retain their identities over time, despite changes in their attributes (Loux, 2002). For instance:

> The tree (this very tree) was here last year, even though it then had a slightly different set of properties from those it has now. (For example, it probably had a different number of leaves then.) But it was the *same* tree. (van Inwagen, 1993, p. 20)

Similarly, despite the physical and mental differences between a newborn and the adult it turns into, we view these as different stages in the history of the same entity. If the belief in the persisting identity of objects, individuals, and minds has an evolutionary origin, it presumably relates to prediction. It may allow us to track evolutionarily important regularities in the environment while ignoring unimportant changes (Riedl, 1984). Beyond this, though, the area in which persisting identity can be most easily linked to evolutionary considerations is the notion of the persisting identity of self and other individuals. As noted, the child and the adult are viewed as different stages in the history of a single person. But this is not the only possible way to construe things. The philosopher Derek Parfit (1984) argued that the present self is no more closely connected to the self in the distant past or distant future than it is to any other individual in the world. As Hirsch (1982) noted: "Someone with this attitude might say 'How terrible, tomorrow a person who is continuous with my present state will be in pain!' rather than 'How terrible, tomorrow I will be in pain!'" (p. 310). Although logically this may be a perfectly legitimate way to construe the data, no one spontaneously adopts the Parfitian attitude. The common sense view is that past, present, and future selves are the same self. Granted, we might say 'I was a different person then'. But notice that we say '*I* was a different person', rather than '*that* was a different person'. We speak as if there is an unchanging self that persists through changes.

Assuming for the sake of argument that this tendency of thought has an evolutionary origin, what selection pressures could account for it? A clue may be found in the genes'-eye view of evolution, according to which the evolutionary function of an adaptation is to propagate the genes giving rise to that adaptation (Dawkins, 1982, 1989; Hamilton, 1963/1996; G. C. Williams, 1966). Despite any important differences between past, present, and future selves, these selves are *genetically* identical (for the most part). That is, regardless of what changes occur in the phenotype, the genotype remains the same. As such, if an organism acts in ways that contribute to its future inclusive fitness (or, from a Parfitian perspective, the inclusive fitness of a later organism that is continuous with the present one), the same gene patterns would 'benefit'.

This insight enables us to connect the notion of the persisting identity of self to voluntary behaviour, and specifically to the human ability to formulate novel behaviours aimed at fostering one's long-term interests (or those of kin and other loved ones). The concept of a persisting self incorporates the view that the future self is the same entity as the present self, and has the same interests. Without this notion, people might not do anything that would have a payoff for them in the future but not the present, as they would not view the future self as the same person as the present self. So, one of the reasons this aspect of mind may have been selected in our species may be that it is part-and-parcel of the ability to pursue long-term goals, goals shaped by evolved motivations. Hume (1739/1978) argued that the idea of an unchanging something that persists through changes is an illusion. The Buddha held a similar view. An evolutionary psychological perspective may help to account for this illusion: It tracks a fact of nature that has only recently been uncovered by science: the unchanging pattern in any particular genome.

Conclusion

In this and the last four chapters, I have examined various suggestions for innate aspects of cognition, many of which were derived from the philosophical literature. This includes conceptual distinctions such as that between self and not-self; the concepts of object and mind; belief in an objective and mind-independent world; causal reasoning; and moral reasoning. In this chapter, I have considered various other potentially innate aspects of mind, including innate contributions to our understanding of space and time, mathematics and logic, deduction and induction, and the persisting identity of objects and minds. So far, I have left open the question of whether innate beliefs might represent innate knowledge. This is the issue I address in the next chapter.

Chapter IX: Innate Ideas as a Naturalistic Source of Metaphysical Knowledge

Origins of man now proved. Metaphysics must flourish. He who understands baboon would do more toward metaphysics than Locke.

-Charles Darwin, 1987, Charles Darwin's Notebooks, *D26, M84.*

Our instruments of knowledge – our senses, our brains, our linguistic abilities – were not put in place in order to give us a disinterested picture of reality, but to help us to survive and reproduce.

-Michael Ruse, in N. Rescher, Evolution, Cognition, and Realism, *1990, p. 105.*

In the last five chapters, I have dealt with the epistemological question of the sources of human knowledge, and argued that certain components of our conceptual frameworks and representation of the world have an innate origin. In this final chapter, I turn to another epistemological question, the question of the *justification* of knowledge. The subject matter of this chapter is captured by the following questions: Does the fact that certain tendencies of belief have an evolutionary origin provide any reason to think that these beliefs are accurate? Can evolutionary theory provide a solution to the problem of induction, or justify belief in an external world or in other minds? Can innate mental content related to such metaphysical topics as causation, space, and time tell us anything about these topics? In short, do 'innate ideas' constitute a naturalistic source of metaphysical knowledge? If I had to answer either 'yes' or 'no' to these questions, and was allowed to say no more, I would be tempted to answer 'no'. This would probably be closer to the truth than the affirmative response. In the following pages, however, I will aim at a more nuanced answer, which, although perhaps closer to the negative than the affirmative, does allow some tentative conclusions to be drawn from innate mental content.

The chapter begins with an outline of the argument that evolved innate ideas constitute a source of knowledge, following which I will consider some of the major criticisms of this argument. These include the idea that evolutionary justifications are circular, that evolved mental content is not necessarily accurate, and that, if the evolutionary argument is taken seriously, it has certain improbable consequences. In the course of this analysis, I attempt something that, in light of these important criticisms, might seem somewhat foolhardy: I mount a (very cautious) defence of the notion that, in certain circumstances, it is possible to derive knowledge from the fact that certain tendencies of belief have an innate basis. Criteria are provided for judging when it is appropriate to argue from innateness to approximate truth. Finally, a new method for metaphysics is proposed, a method that involves taking evolved intuitions seriously. The overall conclusion is that evolutionary theory cannot solve the problem of induction, or provide an ultimate justification for any belief, but that in certain cases the theory bolsters our conviction that a given belief is a reasonable first approximation.

Evolutionary Theory and the Justification of Knowledge

Descartes (1641/1986) believed that innate ideas were implanted in the human mind by God, and that they must be accurate for God would not deceive. The question we are examining here is whether a similar argument can be derived from evolutionary theory, by substituting natural selection for God. That is, if we accept that a given example of innate mental content is a product of natural selection, do we then have any assurance that it is accurate? Some evolutionary epistemologists have suggested that we do (e.g., Derksen, 1993). The general position is captured in the dictum: "Natural selection would not have left us with eyes that regularly misled us" (D. T. Campbell, 1987, p. 151).

My first sketch of the evolutionary argument (EA) is as follows (as you notice some of its weaknesses, I would ask for your patience - qualifications are provided later): Any innate mental content is likely to be the product of natural selection. If innate contributions to our representation of the world were not accurate, they would not have been useful and would not have been selected. The fact that they *were* selected gives us some assurance that they are accurate depictions of the world. It indicates that they cannot be too radically mistaken, at least not in any biologically relevant way. Alvin I. Goldman (1975) endorsed this viewpoint when he remarked, "the process of natural selection is presumably a kind of process that will generally produce true beliefs, if it produces beliefs at all" (p. 117).

The empiricists and logical positivists argued that only concepts that had their origin in experience could be considered meaningful (Carnap, 1967; Hume, 1739/1978). However, from an evolutionary psychological perspective, our beliefs are not shaped solely by *sensory* experience. They are also shaped by the 'experience' that constitutes the evolutionary history of the species, via certain innate tendencies of the mind. These innate contributions can be viewed as a naturalistic source of knowledge, alongside the evidence of the senses. There is no reason to think that the evidence of the senses is necessarily any more accurate than that of any innate contributions. Both are means by which information can be encoded in the nervous system. As Donald Campbell (1974/1982) put it:

> In a crude way, instinct development can be seen as involving a trial and error of whole mutant animals, whereas trial-and-error learning involves the much cheaper wastage of responses within the lifetime of a single animal.... The same environment is editing habit and instinct development in

> most cases, the editing process is analogous, and the epistemological status of knowledge, innate or learned, no different. (p. 81)

So, innate mental content can be viewed as a naturalistic source of knowledge. As I have argued in previous chapters, some of this content pertains to topics in metaphysics, including metaphysical realism, the existence of other minds, causation, space, and time. Where this is the case, and assuming the validity of the EA, this content constitutes a naturalistic source of metaphysical knowledge.

If this argument is accepted, it has some very important consequences. First, the EA provides an answer to the radical sceptic, who denies the existence of an external world. In Chapter 5, it was argued that the belief in an objective, mind-independent external world traces to innate aspects of mind. Nothing in our sensory experience contains the idea that there is a mind-independent external world; all that we experience are fleeting and fragmented sensory impressions. But our minds go beyond the evidence, and interpret these impressions as signs of a stable external world. The idea of a mind-independent world is not derived from sensory experience. Instead, it must be a consequence of the innate design of our minds. The fact that any normal mind automatically assumes an objective and mind-independent external world may count as proof that such a world does exist. We evolved a mind/brain that creates a sense of an objective, mind-independent external world because this tendency generally contributed to the persistence of the genetic material that gave rise to the tendency. In what kind of world would this tendency be biologically advantageous? It would be advantageous in a world that genuinely exists beyond our fleeting sensory impressions. The fact that this tendency evolved indicates that it was useful, and the simplest explanation for its usefulness is that it is accurate.

Another application of the EA concerns ontology, the study of the basic categories of existent entities. In Chapter 4, an evolutionary origin was posited for the tendency to divide the world up in certain ways (for instance, into self and not-self, animals and non-animals, humans and non-humans, physical and mental entities). It could be argued that the fact - assuming it is a fact - that a disposition to form certain conceptual distinctions was preserved in the process of our evolution suggests that these distinctions were useful, and the fact that they were useful suggests that they divide nature at the joints, or at any rate, are not too dramatically in error (Kornblith, 1993; Quine, 1960). Therefore, according to this argument, the study of the evolved contributions to our conceptual frameworks can tell us something about the categorical structure of reality.

The capacity for inductive reasoning provides another example. According to Kornblith (1993), inductive reasoning is a native inferential tendency, and is efficacious because the structure of our minds dovetails with the structure of the reality of which our minds are a part. His view is that "our inductive inferences are tailored to the causal structure of the world" (p. 91). The strongest conclusion that might be drawn here is that an evolutionary justification of inductive reasoning solves Hume's problem of induction. If induction did not work, the capacity for inductive inference would not have evolved; it has and therefore it does. A similar argument can be constructed for abductive inference (inference to the best explanation). According to Carruthers (1992):

> If our concept of best explanation has already been shown to be innate, then this gives us good reason to believe that such inferences are generally reliable.... [I]t is hard to see how the inference to the best explanation could have survival value, unless it is indeed reliable. (p. 110)

Many other examples can be provided. In Chapter 6, it was argued that the capacity for causal cognition is a product of natural selection. If causal cognition does indeed have an evolutionary origin, this would argue for the utility of this tendency, and therefore its accuracy. Vollmer (1984) affirmed this point when he noted that causal cognition "is well adapted to this mesocosm. It was checked during millions of years of evolution and has stood the test" (p. 111). Similarly, if the capacity to construe other people as possessing minds (ToM) has an evolutionary origin (Chapter 4), this would argue that the capacity was useful, and its usefulness would in turn argue that it is related to the reality it aims to represent. Thus, an evolutionary perspective provides a solution to the long-standing philosophical problem of justifying a belief in other minds. A further example concerns our understanding of space and time (Chapter 8). As Hahlweg and Hooker (1989a) noted, if "an organism was endowed with a space-time framework which did not lead to a sufficiently truthful representation of the environment, then this organism would not survive and would leave no offspring" (p. 28). Thus, our survival argues for the accuracy of our mental representations of space and time. Finally, if the capacity to understand mathematical and logical propositions has an evolutionary origin (Chapter 8), this would suggest that the capacity must have been biologically useful, which in turn suggests that it must correspond to reality in some way.[1]

In summary, then, according to the EA, an analysis of the innate contributions to our construal of the world is a potential source of knowledge. The basis of this argument is that these contributions were selected in the process of our evolution, and that this vouches

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[1] There is no need to assume a Platonic realm of disembodied mathematical truths here. As Carruthers (1992) pointed out, "all we need to suppose is that mathematical calculation gives us access to whatever structural features of the physical world underlie our success in action" (p. 46).

for their relative accuracy. Furthermore, to the extent that our 'innate ideas' relate to topics in metaphysics, we can view them as a naturalistic source of metaphysical knowledge.

Meeting the Critics

The EA has an initial appeal. However, important criticisms can be levelled at evolutionary approaches to the justification of knowledge. In this section, I will consider three: the EA is circular, innate content is not necessarily accurate, and the EA has certain implausible implications, for instance, supporting the existence of objective moral truths and objective aesthetic truths.

Evolutionary Justifications Are Circular

Many philosophers have argued that appeals to evolution (or science in general) in answering epistemological questions are circular (Bradie, 1986; A. J. Clark, 1987; Putnam, 1983; Stroud, 1985). According to this view, the appeal to evolutionary theory in justifying the accuracy of innate mental content fails because evolutionary theory itself presupposes the very assumptions that it is used to justify. As an example, consider the evolutionary justification of induction. This involves justifying induction with reference to a theory that is itself justified with inductive arguments. Quine (1975) made this point well. He asked why our inductions tend to come out right, and found an answer in Darwin: "Creatures inveterately wrong in their inductions have a pathetic but praiseworthy tendency to die before reproducing their kind" (Quine, 1969, p. 126). This has sometimes been mistaken for an attempted evolutionary justification of induction (see, for example, Stich, 1990). However, Quine did not maintain that the EA could defeat the sceptic.

> I am not appealing to Darwinian biology to justify induction. This would be circular, since biological knowledge depends on induction. Rather, I am granting the efficacy of induction, and then observing that Darwinian biology, if true, helps explain why induction is as efficacious as it is. (Quine, 1975, p. 70)

As this quotation indicates, an evolutionary explanation for the origin of inductive reasoning must be clearly distinguished from an evolutionary solution to the philosophical problem of induction. The former may be viable, but the latter fails because it rests on a circular argument. Thus, Darwin has no answer for Hume. But can he defeat Descartes' demon? As mentioned, the tendency to interpret sensory experience as revealing an external world may be a product of natural selection. According to the EA, the fact that this tendency was selected indicates that it was genetically useful, and the simplest explanation for its usefulness is that it is accurate. However, like the evolutionary solution to the problem of induction, this argument is plagued by circularity. As with science in general, the theory of evolution presupposes the existence of an external world. Ruse (1989) made this point clearly:

> There is something intuitively implausible about a person suggesting that we are the end products of a long and arduous process of struggle and selection all occurring before we got on this earth, and then that person turning right around and suggesting also that none of this history occurred except in the minds of humans. (p. 218)[2]

[2] Curiously, Ruse (1990) nonetheless identifies himself as an anti-realist.

Given that evolutionary theory presupposes the existence of an external world, any proof of the existence of an external world based on evolutionary theory begs the question against the radical sceptic (A. J. Clark, 1987; Rorty, 1979). The upshot of this and the previous argument, according to the critics, is that evolutionary theory cannot defeat scepticism in regard to an external world or inductive justification (O'Hear, 1997). There may be many reasons to accept the reality of an external world and the validity of induction, but the evolutionary account of the origin of induction and metaphysical realism is not among them. "Hence the account is not part of first philosophy; it is part of our current ongoing scientific view" (Nozick, 1993, p. 112).

The EA is weakened by the circularity charge. However, it may not be necessary to reject it outright. The first point to make - a point that is usually overlooked by the critics - is that the circularity criticism does not apply uniformly to evolutionary justifications for all innate content. It would not apply, for instance, to the attempt to justify belief in the existence of other minds with reference to the evolutionary origin of ToM, because evolutionary theory does not presuppose a belief in other minds.[3] In addition, evolutionary theory may not pre-suppose any particular view on the topics of space, time, or causation (although it is presumably inconsistent with some), and thus the circularity criticism would not apply in these domains.

Furthermore, even where the EA does involve circularity (for instance, in the justification of induction and metaphysical realism), this may not always be a vicious circularity (Clendinnen, 1989; A. H. Goldman, 1990; Meyers, 1990; Vollmer, 1987). In some cases, it may be possible to argue that the discovery of innate mental content reveals a

[3] This is demonstrated by the fact that it is possible to imagine evolution taking place without producing any minds.

new layer of coherence in the scientific worldview. If we assume the validity of the metaphysical assumptions of science, such as the assumption of an independently existing external world, we then find confirmation of these assumptions in the evolutionary analysis of our innate or evolved tendencies of belief. This provides some support for the validity of these assumptions by showing that the scientific worldview is at least coherent (that is, that its propositions are logically consistent with one another). Coherence may not be an adequate criterion for truth, but it is at least a precondition for the truth of a worldview. This may not seem like much of a victory, but given that the problem of radical scepticism has haunted Western philosophy for centuries, and that the problem is commonly viewed as intractable, it may be the best that can be expected. The EA does not completely resolve the problem, but this does not mean that it makes no contribution at all.

On the other hand, the coherence argument cannot salvage the evolutionary justification for induction. The reason is simple.

> This view [that inductive reasoning is a product of natural selection] leaves us, as before, with the problem of induction: a certain factual connection held in the past and selection led to our being organisms who see it as a valid basis of inference, but will this factual connection continue to hold now and in the future? (Nozick, 1993, p. 109)

The problem is not that the argument is circular; the problem is that an evolutionary account of the origin of inductive reasoning does not avoid Hume's challenge. Even if the innateness of inductive reasoning implies that induction was useful over the course of our evolution, we have no guarantee that it will continue to be useful in the future. Inductive reasoning exists now purely because it has worked in the past. Thus, an evolutionary approach to psychology cannot solve the problem of induction. According to Ruse (1986), the proper Darwinian response is to concede that inductive reasoning is not ultimately justifiable, and to give up the attempt. Nonetheless, if we follow Quine and grant the efficacy of induction, it may still be possible to apply the EA to other innate tendencies of belief. The conclusions we have reached so far are: (1) that when the application of the EA involves circularity, the best argument that can be made for accepting the truth of an innate tendency of belief is that to do so increases the coherence of our worldview; and (2) that the EA does not always involve circularity.

Innate Content is Not Necessarily Accurate

Another criticism of the EA relates to the accuracy of innate mental content (Stich, 1990). In areas in which science has made good progress, it has become clear that our innate tendencies of belief are often far from accurate. Many facets of modern science are deeply counterintuitive. In particular, many aspects of intuitive physics disagree with those of scientific physics. According to Nozick (2001):

> It is a commonplace that advances in physics have radically overturned our evolutionarily instilled theories and concepts, and our common-sense theories. Space is not Euclidian, simultaneity is not absolute, the world is not deterministic, quantum events stand in (an ill-understood) relation to their being observed, and they also can have nonlocal correlates that are not mediated by intervening processes. (p. 8)

Many concepts that in the past were viewed as so certain that they were classed as metaphysical necessities have since been overturned by physics. Again, Nozick (2001) summarizes:

> *Every event has a cause* – gone with the formulation of quantum mechanics. *Space is Euclidian* – gone with the formulation of consistent non-Euclidian geometries and their adoption in contemporary physics. *Space has constant curvature* – gone with General Relativity…. *For any two events, one temporally proceeds the other, or the other proceeds it, or the two are simultaneous* – modified in Special Relativity…. *The world exists in a definite state independently of our observations* – shaken by quantum mechanics. (p. 133)

In short, it appears that scientific thinking is more accurate but less natural to us than other systems of thought (McCauley, 2000). This raises an important question: Given that many of our intuitive views have been rejected as false, why should we trust evolved intuitions when it comes to other beliefs, such as those in the domain of philosophy?

But before we can accept that our evolved view of the world is often inaccurate, we must be able to explain how an inaccurate view could be maintained in the process of natural selection. The key is to challenge the assumption, implicit in the EA, that biologically useful beliefs must be accurate. Many commentators have pointed out that true or highly accurate beliefs are not always more evolutionarily useful than false beliefs or approximations. Fitness enhancement may result from highly restricted and selective cognitive mechanisms, and from mechanisms that are subject to error or even actively and consistently deceptive (Stich, 1990; Vollmer, 1987). In short, usefulness and truth do not always coincide.[4] The implications for the EA are clear. In regard to the question of inductive reasoning, for instance, R. Campbell and Hunter (2000) observed that: "The Darwinian explanation of induction, however interesting in its own right, appears totally irrelevant to the question of justification posed by Hume, quite apart from its circular nature. Only if one conflates truth with fitness might one think otherwise" (pp. 8-9). The same difficulty faces any knowledge justified by the EA.

Selection for Approximate Truth

One reason to doubt that accuracy and usefulness will coincide is that selection often produces psychological mechanisms that yield approximate truth rather than exact truth. As O'Hear (1997) put it: "Parsimony, and simplification of data… are likely to be involved in the representational systems of an organism evolving in a world of any complexity, as ours undoubtedly is" (p. 61). There are various reasons for this. First, adaptations are often far from optimal. Natural selection does not produce perfection, and therefore might not produce a close fit between the organism and its environment. As such, if certain tendencies of belief are adaptations, "we should expect a gap between [these] beliefs and the physical world comparable to that which we find between animal form and ecological niche" (D. T. Campbell, 1974/1982, p. 172). An evolutionary perspective leads to the expectation that the mind will exhibit design flaws, quirks, and 'bugs'. Of course, people have always realized that the mind is imperfect; an evolutionary approach simply helps to *explain* this fact (Vollmer, 1984). What is significant for present purposes, however, is that "we should beware of inferring from survival to fit between species and environment" (O'Hear, 1997, p. 55).

[4] Of course, according to a pragmatist account of truth, usefulness and truth coincide as a matter of definition. From this perspective, there could be no such thing as an adaptive falsehood (at least not if usefulness were identified with *genetic* usefulness).

Another reason that selection may favour approximations is that a high degree of accuracy is often unnecessary. It has been suggested that the only things that frogs can perceive are shapes in motion (Lettvin, Maturana, McCulloch, & Pitts, 1959), but that this is adequate for adaptive action. This illustrates the point that simplifications may be adaptive, and thus that adaptiveness does not necessarily imply accuracy. We should not expect that selection would craft perfectly accurate beliefs, except where accuracy and simplicity happen to coincide. Mere approximations are often 'true enough' to be useful. In addition, a functionally adequate, fast approximation is likely to be selected over an accurate but cumbersome calculation (O'Hear, 1997).

The intuitive human understanding of the geometry of space provides a suitable illustration. Until the early twentieth century, it was believed that Euclid had assembled a set of self-evident, logically necessary truths about physical space. This tidy picture was shattered by the development of non-Euclidian geometries, and their eventual incorporation into Einstein's general theory of relativity (Nerlich, 1994). The implication of this transition is that "counter-intuitive non-Euclidian geometry is appropriate for the description of reality and even seems to be more adequate" (Vollmer, 1984, p. 106). Nonetheless, Euclidian geometry is more closely allied with our common sense view of space than non-Euclidian geometries, and it is possible that this can be explained in terms of the evolved design of the mind (see Chapter 8). But Euclidian geometry is presumably a close enough approximation for the purposes of inclusive fitness. Furthermore, the neural resources required to represent a more accurate geometry may have made it prohibitively expensive (Nozick, 1993).

Euclidian geometry is a clear example of an intuitively plausible system that now appears to be false, but it opens up the possibility that there are others. Nozick (2001) asked whether, like Euclidian phenomenological space, the concept of *truth* is a product of evolution but is not strictly accurate. It may be a part of a folk epistemology, which is imperfect and may disappear if a better epistemology is devised. Similarly, "Just as Euclidian geometry need only have been 'true enough,' so too the belief in other minds and in an independently existing external world could become fixed (via the Baldwin effect) *without* being strictly speaking true" (Nozick, 1993, p. 123). Like the frog's representation of the world, these beliefs need only be true enough for genetically useful action.

Logic provides another possible example. According to Ruse (1986), the innate logic of human reasoning is the logic of the sentential calculus. However, just as Euclidian geometry does not perfectly represent the geometry of physical space, sentential logic may only approximate the logic that describes the physical world (Thompson, 1988). A similar argument may even be devised in regard to the accuracy of mathematics. It is important to emphasize that, although the *possibility* that our logical, mathematical, and other beliefs are only approximations should be admitted in principle, this should not be taken as a proof that they are in fact only approximately true. Nonetheless, the fact that it can be argued that they even *might* be approximations further erodes our confidence that innate contributions to our mental representation of the world are certain to be accurate.

The overall conclusion is this: "Enhancement of inclusive fitness yields selection for approximate truth rather than strict truth" (Nozick, 1993, p. 113). We cannot safely make inferences from innate cognitive tendencies to the nature of the world.

How might advocates of the EA respond to this conclusion? To begin with, it should be noted that advocates are perfectly willing to concede that any innate contributions to our view of the world are likely to be merely functionally adequate approximations (Lorenz, 1941/1982, 1977; Vollmer, 1987b). Furthermore, it is worth pointing out that there is a danger that the criticism may be used selectively. Critics of the EA argue that the beliefs embodied in our evolved tendencies of knowledge-production are not infallible; however, the evidence of our senses is also not infallible. If fallibility is an adequate reason to reject innate mental content as a source of knowledge, then to be consistent, the critics must also reject sensory information as a source of knowledge. Similarly, the critics argue that our evolved intuitions are likely to be approximations, and therefore false given a strict enough criterion. This certainly seems to be a reasonable assertion, and if advocates of the EA were committed to the belief that innate ideas are *perfectly* accurate, their position would not be salvageable. But this applies equally to all empirical knowledge. If the approximation argument implies that evolved contributions to our knowledge must be rejected, it also implies that all scientific beliefs should be rejected. We cannot reject innate predilections as a source of knowledge on the grounds that they are imperfect approximations, but then retain other sources that are also imperfect. Unless the critics are willing to embrace global scepticism – which presumably most will not – the approximation criticism does not provide adequate grounds to reject evolved contributions as a source of knowledge.

So, what *is* the proper response to the approximation criticism? The criticism may be better viewed as a qualification rather than a refutation. So, for example, belief-desire folk psychology may, strictly speaking, be false. Nonetheless, it may be *more* accurate to say it is true than to say it is false. (Compare: The earth is not perfectly spherical; nonetheless, it is closer to the truth to say that it is spherical than to say it is flat.) Similarly, it might be argued that the common sense notion of causation (the idea that one event is necessitated by an earlier one) stands at least as a good first approximation, as does the concept of *persisting object*. A similar conclusion can be reached in regard to logic. Even if our intuitive logic is a mere approximation, it may be accurate enough for evolutionary purposes. According to Lorenz (1941/1982):

> The realization that all laws of 'pure reason' are based on highly physical or mechanical structures of the human central nervous system which have developed through many eons like any other organ, on the one hand shakes our confidence in the laws of pure reason and on the other substantially raises our confidence in them. Kant's statement that the laws of pure reason have absolute validity, nay, that every imaginable rational being, even if it were an angel, must obey the same laws of thought, appears as an anthropocentric presumption. At the same time, however, the nature of their adaptation shows that the categorical forms of intuition and categories have proved themselves as working hypotheses in the coping of our species with the absolute reality of the environment (in spite of their validity being only approximate and relative). This is clarified by the paradoxical fact that the laws of 'pure reason' which break down at every step in modern theoretical science, nonetheless have stood (and still stand) the test in the practical biological matters of the struggle for the preservation of the species. (pp. 127-128)

The Parochial Nature of Human Knowledge

There is another problem, though. Even if any innate contributions to our picture of the world can in some cases be viewed as approximations, their approximate accuracy may hold only within a certain narrow range of circumstances. Newtonian physics is accurate enough to describe our everyday world, but breaks down in extreme conditions, such as in a strong gravitational field or when travelling close to the speed of light (d'Inverno, 1992; E. F. Taylor & Wheeler, 1992). Similarly, our innate concepts and beliefs may be accurate enough for adaptive action in a terrestrial environment, but break down in extreme conditions (extreme, that is, relative to the conditions in which we evolved). Capek (1975) put the point like this:

> Our mental structure mirrors only a certain sector of reality to which it is adjusted. It is a very wide segment – the zone of the middle dimensions and of low velocities – which until the recent explosive technological development was the only zone biologically important for man.... [O]ur classical intellectual habits lose their applicability outside the limits of the region to which they were originally adjusted. (pp. 95-96)

Any innate contributions to our view of the world were shaped in a particular range of environmental circumstances, that of our hunter-gatherer ancestors or pre-human ancestors.[5] Consequently, they may not be reliable outside that range, or outside the sphere of what is biologically relevant (Hahlweg & Hooker, 1989a). "To take a simple example, humans are notoriously inefficient at judging sizes underwater" (Papineau, 1993, p. 100). More broadly, it might be argued that, when it comes to the abstruse questions dealt with by philosophers and physicists, our intuitions should probably be given little weight. As Nozick (2001) pointed out:

> Intuitions grounded in finite numbers do not extend to the infinite; for instance, no finite set can be placed into a 1-1 correspondence with a proper subset of itself, with nothing left over, yet an infinite set can be. So, too, might not our intuitions about what is possible for the universe as a whole, intuitions that are grounded in experience of only small parts of the universe, be inaccurate and unreliable? (p. 162)

For example, even if it is granted that the capacity for inductive reasoning is a product of natural selection and tends to enhance the inclusive fitness of members of our

[5] Thus, an epistemological implication of evolutionary psychology is that our view of the world is to some extent a view of the world in the past.

species, there is no guarantee "that such reasoning continues to be a reliable guide to discovering the truth in circumstances where the discovery of the truth is no longer correlated with enhanced fitness" (R. Campbell & Hunter, 2000, pp. 8-9). Causal cognition is another example. It is probably reasonable to think that causal cognition is appropriate within the conditions and circumstances for which it evolved. In this range of conditions, it may be a close enough approximation to be biologically useful. However, outside this range, it may simply be inapplicable. Indeed, intuitive causal cognition appears not to work at the micro level described by quantum mechanics. At this level, the idea that every event has a cause appears not to hold. Similarly, the intuition that causes precede effects may not hold "in very exotic situations, such as very close to the Big Bang or inside black holes" (Deutsch, 1997, p. 286).

In addition, it is entirely conceivable that causal cognition is not applicable to philosophical questions far removed from the evolutionary needs of our hunter-gatherer ancestors in the African Savannah. Take, for example, the question of why there is something rather than nothing. Just as causal cognition is apparently not applicable at the quantum level, it may not be applicable to questions such as this. That is, we should be extremely cautious about accepting that there must be a causal answer to the question of why there is something rather than nothing. One popular answer to this question is to posit God as First Cause. But we cannot rely on the intuition that there must be an ultimate cause for the universe as a whole. Thus, an important philosophical implication of evolutionary psychology is that it weakens the First Cause argument for the existence of God.[6]

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[6] I am not arguing that, as a result of our evolutionary origin, humans are constitutionally unable to answer questions such as why there is something rather than nothing (although maybe we are). All I am arguing is that our intuitive categories may be inadequate for this task. Rather than ruling out the possibility of answering these questions, this realization may be a necessary step *toward* answering them.

Like intuitive causal cognition, intuitive physics is only applicable to mid-size physical entities and processes (Carey & Spelke, 1994). Our intuitions about the physical world do not extend to the very fast (special relativity), the very large (general relativity), or the very small (quantum physics). Lorenz (1941/1982) wrote, "the reproductions of the world by our forms of intuition and categories break down as soon as they are required to give a somewhat closer representation of their objects" (p. 128). Quantum mechanics is a perhaps the archetypal example. We understand the apparently rational workings of the human-scale world fairly well. However, Niels Bohr, one of the key players in the quantum revolution, suggested that the human mind is simply not equipped to understand the quantum world (O'Hear, 1997). Bohr famously suggested that: "Anyone who is not shocked by quantum mechanics hasn't understood it." This quotation captures the fact that quantum mechanics does not square with intuitive physics. According to an early interpretation of quantum phenomena, there is discontinuity in the motion of subatomic entities (A. A. Miller, 1987), contrary to the common sense intuition that motion is continuous (Spelke, 1990). In addition, quantum phenomena apparently clash with intuitive principles of logic. For instance, Heisenberg's uncertainty principle implies that, at least at the quantum level, the law of the excluded middle may not hold true (Ruse, 1989). As Lorenz (1941/1982) dryly noted: "It is as though the 'measure of all things' was simply too coarse and too approximate for these finer spheres of measurement" (p. 134).

The strangeness (to us) of quantum physics, and of relativity theory, is consistent with an evolutionary origin for specific components of our intuitive view of matter, space, time, and gravity. Indeed, the fact that these theories seem strange to us is *explained*, at least to some extent, by an evolutionary approach to the mind (Vollmer, 1984). However, an evolutionary approach is inconsistent with the view that innate ideas are even approximately true outside the range of circumstances associated with our cognitive evolution. Based on considerations such as these, Hahlweg and Hooker (1989a) reached the following conclusion:

> Bioepistemology provides philosophers with a tool for criticism. The message is: Don't trust your perceptual and conceptual structures once you leave the safe grounds of everyday experience; criticize even the most basic presupposition such as our concepts of causation, of induction, our space-time framework, and even our logic. Therefore the main function of bioepistemology is to assist us in freeing ourselves from anthropocentric preconceptions of which we may not be aware. (p. 29)

Can the EA be salvaged? Again, the criticism that innate content is only locally applicable may be best viewed not as a refutation of the EA, but instead as a refinement. We have no reason to assume the accuracy of innate tendencies of thought in matters beyond the sphere of everyday life. However, within the range of their applicability, the EA might yet work. So, for example, if we wish to justify our concept of causation on the grounds that it has an evolutionary origin, our conclusion must be restricted to the sphere and scale of reality relevant to human cognitive evolution. Just as our understanding of causation breaks down at the quantum level, our understanding of induction, the external world, and logical necessity may break down at this level too. But this is not to deny that our understanding in these domains represents a valid approximation at the macroscopic level. The most accurate view of the universe may come from maintaining our evolved concepts and tendencies of belief, but keeping in mind the limited range of their application. This may be a better approach than either rejecting them altogether or accepting them without the proviso.

Evolutionary Justifications Have Implausible Consequences

A third criticism of the evolutionary approach to the justification of knowledge is that, if taken to its natural conclusion, it has certain highly implausible consequences. The EA appears to amount to the assertion that we should accept our intuitions as local approximations, as long as it can be shown that they have their origin in the evolved design of the mind. This produces plausible results in some cases. For instance, if causal cognition were not at least somewhat accurate, it is difficult to see how it could have been crafted by natural selection. However, in other cases, the EA is not so plausible. An example relates to the philosophical issue of the relationship of mind to brain. Mind-brain dualism appears to be more intuitively plausible for most people than monistic approaches such as identity theory or functionalism (see Chapter 4). "The claim that conscious experiences or states of conscious awareness are identical with physical states of the human organism seems incredible to many people. The two things just seem so very different!" (Nozick, 2001, p. 219). This intuition may trace to the evolved nature of the mind/brain. Various commentators have proposed that we have separate cognitive specializations for thinking about physical bodies and for thinking about minds (e.g., Leslie, 1994). This may help explain the initial plausibility and perennial popularity of dualism, and why physicalist theories seem so implausible. But if the EA implies that our intuitive predilection for mind-brain dualism provides support for dualism, then the EA is on shaky ground. After all, many modern philosophers reject mind-brain dualism (Dennett, 1991), and this is particularly so among evolutionary epistemologists (Hahlweg & Hooker, 1989).

It seems that in some cases the EA furnishes reasonable conclusions, but in others it does not. This casts doubt on its reliability. The argument must be rejected – unless, that is, we can find a principled reason to reject our philosophical predilections related to issues such as the mind-brain relationship, but retain those related to issues such as causation. The key to doing this may be found in the fact that the capacity for causal cognition is plausibly innate, whereas our intuitive stand on the mind-brain issue is an intuitive idea - related to the innate design of the mind but not itself innate (see Chapter 3). This is an important distinction. If it is accepted that causal cognition is an adaptation, we have some reason to think that it is accurate; after all, if it were not, it would not have been selected. In contrast, if our 'Cartesian intuitions' are a selectively neutral artefact of the functional specialization of the human brain, there is no reason to think that they need to be useful or accurate. We must add yet another stipulation to the EA: It applies only to innate content crafted by natural selection, and not to intuitive ideas.

However, even if we restrict our attention to innate content, the EA still has some implausible consequences. As Chapter 7 noted, evolutionary psychologists maintain that some components of moral psychology and of our moral beliefs have an evolutionary origin (Alexander, 1987; Krebs, 1998; Trivers, 1971/2002). But would we want to argue that this provides any assurance that our moral beliefs are literally true, or that an analysis of the innate contribution to these beliefs would provide us with knowledge of objective moral truths? Many thinkers would find this position unpalatable. After all, moral beliefs are a good candidate for beliefs that confer an evolutionary advantage but are false. As Joyce (2001) argued:

> The innateness of moral judgements undermines these judgements being true for the simple reason that if we have evolved to make these judgements irrespective of their being true, then one could not

> hold that the judgements are *justified.* And if they are unjustified, then although they *could* be true, their truth is in doubt. (p. 159)

Similarly, Ruse (1995) concluded that morality is a "collective illusion of the genes…. We need to believe in morality, and so, thanks to our biology, we do believe in morality. There is no foundation 'out there' beyond human nature" (p. 250). So, given that many thinkers doubt the very existence of objective moral truths, the fact that the EA implies that any innate moral beliefs are objectively true must lead us to question whether the EA is valid. And if one is not too troubled by the notion of objective moral values, consider aesthetic tastes instead. As noted in Chapter 3, some standards of physical beauty used in mate choice appear to have an evolutionary origin (Buss, 1989; Gangestad & Thornhill, 1997; Jones, 1996; Shackelford & Larsen, 1997, 1999), as do landscape preferences (S. Kaplan, 1992; Orians & Heerwagen, 1992; Thornhill, 1998; Ulrich, 1984; E. O. Wilson, 1993). The evolutionary function of these preferences is not related to any objective facts about what is beautiful, and indeed there is no reason to think that there are such facts. However, if the evolutionary origin of, say, the belief in other minds counts as proof of the objectivity of other minds, then presumably the evolutionary origin of our aesthetic preferences must count as proof of the objectivity of our aesthetic preferences. Again, when pressed, the EA has implausible consequences. These consequences of the EA seem to show, by *reductio ad absurdum*, that the argument is false.

With some further qualifications, however, it may once again be possible to salvage the argument. The key is a consideration of the purposes for which different components of our psychology evolved. In the case of innate content related to causation, space, time, and the existence of an external world and other minds, the evolutionary advantage presumably relates to the accuracy of our understanding of the world. The evolutionary advantages of moral beliefs and aesthetic preferences are unrelated to their objective truth or falsity. The evolutionary explanation of innate influences on moral beliefs, for example, revolves wholly around the effects that these have on the way we treat one another. From an evolutionary perspective, it does not matter how much or how little our moral beliefs correspond to any objective moral truths, even if such truths existed. This type of functional analysis provides a principled approach to distinguishing which aspects of our innate psychology can provide knowledge of the external world, and which cannot. We can ask this question: If the objective facts were different, would natural selection still favour the same tendency of belief? If the answer is 'no,' we have some reason to think that the belief in question is at least approximately true. On the other hand, if the answer is 'yes,' then an evolutionary psychological perspective offers no reason to think that the belief is true. In principle, it may be, but the mere fact that we have an inherited tendency to think it true is no proof that it actually is true.

A New Method for Metaphysics

Where does this leave us? Many of the ideas emerging from metaphysics challenge our intuitive views, as do the ideas emerging from modern science. Given that science contradicts our intuitions in the scientific realm, what reason do we have to trust our intuitions in the realm of metaphysics? This may sound like a rhetorical question, but in this section I will attempt to formulate an answer. To begin with, although science and metaphysics both make counterintuitive claims, there is an important difference between the two areas. Whereas in science there is at least some consensus about the progress we have made and the direction we are headed, metaphysics is notorious for its lack of established findings (Loux, 2002; Stich, 1975; van Inwagen, 1993). If metaphysicians were able to resolve controversies and reach consensus through the methods they presently use, then we would probably be wise to bow to their expertise, regardless of whether their conclusions squared with our evolved intuitions. It is not clear, though, that such progress has been made. Given this state of affairs, it seems reasonable to propose a new method for metaphysics, a method that involves taking evolved intuitions seriously.

For the reasons already discussed, this method should only be applied when dealing with innate content, and should only be applied when the evolutionary function of this innate content is plausibly dependent on its (approximate) correspondence with the external world. Whenever these demands are met, we must next ask whether the application of the EA to a given aspect of innate mental content is circular. If it is, then the best that can be achieved is to employ the coherence argument: We can tentatively assume the accuracy of the content in question because doing so increases the coherence of our worldview. If, on the other hand, there is no circularity, move on to the following steps.

First Approximations and Last Approximations

The first step is simply to adopt the working hypothesis that innate content represents a reasonable first approximation. Earlier it was noted that the message of evolutionary epistemology is: "Don't trust your perceptual and conceptual structures once you leave the safe grounds of everyday experience; criticize even the most basic presupposition" (Hahlweg & Hooker, 1989a, p. 29). Even the most intuitively compelling theory of common sense may be wrong. The problem is that, beyond this conclusion, we are left with little guidance in choosing among philosophical theories. Without evidence to guide a change in belief, we would have no idea in which direction we should change it.

Although we can expect our intuitions to be wrong, not just any counterintuitive theory is correct. We cannot simply choose counterintuitive theories over intuitive ones, because there are in principle infinitely many counterintuitive theories. Even if we agree that an intuitive theory is likely to be inaccurate, this does not imply that a counterintuitive theory will be *more* accurate. Our beliefs may be closer to the truth if we hold an intuitive false belief than if we hold a counterintuitive false belief. In matters where science has not progressed beyond evolved intuitions, our evolved knowledge may at least provide a good first approximation. And where science *cannot* speak, it may also have to serve as a last approximation.

As an example, consider the epistemological question of whether non-human animals possess conscious mental states such as desires and beliefs. People are less likely to extend ToM to non-humans than we are to members of our own species. This is why many more people have been able to take seriously Descartes' view that animals are nonconscious automata than have ever been able to take solipsism seriously, and why the question 'are other animals conscious?' attracts a lot more philosophical attention than the question 'are other humans conscious?' Nonetheless, people do commonly extend ToM to other animals, and this tendency may have an evolutionary origin. It has been suggested that ToM was not selected only for understanding other humans, but was also useful in understanding some non-human animals, including predators and prey (Mithen, 1996). This may have implications for the question of mental states in other animals. If it is accepted that attributing mind, beliefs, and desires to non-humans, in particular closely related ones, was useful in our evolutionary history, this in turn suggests that it may be closer to the truth to assume that these animals possess these mental states than to assume that they do not. That is, it is a good first approximation. (And remember that ToM may not be perfectly accurate even when applied to humans.) This is an issue that science may not be able to resolve, and thus this first approximation may also have to serve as a last approximation.

Reject Counterintuitive Theories That Cannot Account For Our Intuitions

Although innate ideas are not necessarily accurate, the refinements made to them tend to leave room to understand how the initial version was a useful first approximation. As such, we should be dubious about philosophical theories that, rather than refining our intuitions, directly and completely contradict them. We should not reject these intuitions until and unless we have a theory that can account for the appearance that they are true. But we should reject any theory that strongly conflicts with an evolved aspect of our mental representation of the world, unless that theory can account for the fact that this mental content is an evolutionarily useful first approximation.

There is no doubt that science has reached many counterintuitive conclusions. However, our intuitive predilections tend to make sense in light of these conclusions, and it is generally apparent how the unrefined intuition could be an adequate approximation. For instance, Newton's first law of motion (which states that objects continue in their state of motion or rest unless acted on by a force) contradicts the intuition that the natural state of an object is to be at rest, and that motion requires the ongoing application of force (Resnick, 1994) However, the usefulness of the intuition makes sense in light of the scientific understanding of friction. The Aristotelian conception of the physical universe is a more accurate description of our phenomenological world than is Newton's conception, as a result of the pervasive influence of friction (Stewart & Cohen, 1997). Another example: Science has reached the counterintuitive conclusion that matter consists mainly of empty space, and that we perceive "a continuous flux of forces and events in terms of stable and enduring material objects" (O'Hear, 1997, p. 57). However, our intuitive conception of matter is perfectly consistent with the way matter appears to us at the macrocosmic level: as solid, stable, and continuous.

The lesson is that we should be suspicious of any theory that contradicts our evolved intuitions, unless it can be explained how these intuitions could be genetically useful approximations. For instance, before we accept any theory that maintains that time is not real (e.g., McTaggart, 1908/1993), we should be able to account for the appearance that it is. As Chapter 8 noted, our intuitive conception of time may be related to aspects of the mind that are products of evolution. Before accepting the view that time does not exist, we need to know how such mechanisms could be evolutionarily useful despite producing a false image of reality. Until then, we are justified in accepting the reality of time, despite knowing that our intuitive predilections are not guaranteed to be correct, and indeed are *probably* wrong. This is because, though probably wrong (in the absolute sense), they are likely to be more accurate than any theory that is unable to account for their usefulness.

This is not to say that we cannot fine-tune our evolved intuitions. Assume for the sake of argument that people have an evolved tendency to believe that if *A* causes *B*, then removing or withholding *A* will prevent *B*. Philosophers might refine this view of causation by pointing out that it commits the fallacy of denying the antecedent. That *A* causes *B* does not mean that the absence of *A* implies the absence of *B* (Armstrong, 1999). But although this refinement is a modification of our intuitive view of causation, it does not ride roughshod over that view. Compare this with the sceptical conclusion that there simply are no causes, or that there is no real distinction between causal and non-causal connections. This view is completely inconsistent with our intuitions, and leaves us with no understanding of why, if our intuitive view of causation is so radically mistaken, it could still be biologically useful.

In some cases, this approach will not recommend particular philosophical theories, but rather eliminate from consideration (or at least de-prioritise) any theories that directly contradict our innate ideas and leave them inexplicable. The approach will tend to support all vaguely realist theories against all theories that completely eliminate the possibility that there is any truth in our evolved intuitions. In such cases, an evolutionary approach reduces the range of theories to be given serious consideration, rather than bringing us to any definite and specific conclusions. It does not locate the problems in the arguments for counterintuitive conclusions, but suggests that we should scrutinize these arguments for such problems. In this way, it helps set the agenda for philosophy. An evolutionary approach points us toward where our philosophical efforts are best placed.

Going Beyond Evolved Intuitions

The next matter to consider is how we might proceed beyond our evolved intuitions. The development of atomic physics in the first third of the twentieth century provides a good example of a successful transition from intuitive starting points to a highly counterintuitive theory. A. A. Miller (1987) pointed out that Rutherford's initial model of the atom as a miniature solar system was based on intuitions such as object permanence - intuitions that plausibly have an evolutionary origin (see Chapter 5). Bohr's 1913 model was less intuitive: Although still visualizable, it included the counterintuitive notion of electrons making quantum leaps, which defies the intuitive principle that objects occupy linked regions of space and time (Spelke, 1990). It was not until 1925 that Heisenberg finally dropped the notion of visualizable solar system atoms (A. A. Miller, 1987). This provides a good model for how to proceed from intuitive to counterintuitive judgements: cautiously and only if the evidence genuinely seems to demands it.

A promising method of progressing beyond intuitive starting points involves linking innate mental content to current scientific knowledge. Research on disgust has revealed that, when an object classed as a contaminant touches another object, people typically view the latter object as contaminated also. The degree of contamination is independent of the length of contact; even the slightest touch transmits it completely. This ancient adaptation matches a fact about the world that is invisible to us and was only recently discovered: the fact that germs multiply and therefore that even the slightest contact can soon result in complete contamination (Boyer, 2000). This is an example of how parts of our construal of the world that were previously inexplicable can make sense as science uncovers aspects of nature that natural selection has been fitting our minds to, but which we had not dreamed existed. It would be naïve to assume that any innate content simply depicts reality as it is. However, it may be reasonable to make the weaker assumption that such content corresponds to *something* in reality. We might look to science for suggestions as to what that something might be. Once again, consider causal cognition.

> If there is some innate inclination to causal interpretations shouldn't there be some real-world structure corresponding to this propensity? Is there, in fact, contrary to Hume and Kant and their critics, an ontological difference between regular post hoc and causal propter hoc that is relevant not only epistemologically but even empirically and for evolution? (Vollmer, 1984, p. 111)

To what feature of reality might causal cognition be adapted? A number of evolutionary epistemologists have suggested that the answer to this question is *energy transfer* (Lorenz, 1941/1982; Vollmer, 1984). As Lorenz (1941/1982) put it: "The essence of 'propter hoc' which alone differentiates it qualitatively from a 'uniform post hoc' lies in the fact that cause and effect are successive links in the infinite chain of phenomenal forms that energy assumes in the course of its everlasting existence" (p. 138). So, for instance, we would say that the collision of one billiard ball with another *causes* the second ball to move, because this sequence of events involves a transfer of energy (in particular, kinetic energy). In contrast, we would not say that the rooster crowing causes the sun to rise, because this sequence does not involve energy transfer. I am not suggesting that this interpretation of causation is necessarily correct; it is not clear, for example, that mental causation can be understood in terms of energy transfer. However, the example does illustrate a potentially useful approach to going beyond evolved intuitions.

Limitations

There is at least one criticism of the EA that I have not dealt with. I have argued that innateness is no indication of perfect truth, but that, given the various stipulations outlined in this chapter, innateness may at least argue for approximate truth. However, not only may a useful belief be a crude approximation, it may be an adaptive falsehood. As Clendinnen (1989) wrote: "In most cases the beliefs we act on need to be true to contribute to Darwinian fitness. But we must note that sometimes false beliefs can play this role" (p. 464). For instance, romantic infatuation has a biological function that relies on distorted views of the object of one's affection. A similar process of infatuation may be involved in the parent-child bond. In addition, a recurring theme in the previous chapters was that selection sometimes favours adaptive biases. We may err on the side of assuming animate over inanimate; reality over appearance; the objectivity of our mental states over subjectivity; causation over coincidence; and design over accident. Given that innate content could be directly false and yet still adaptive, what confidence can we have in the

EA? At this point, my only response to this argument is to point out that it is not sufficient for critics to claim that any particular instance of innate content *may* be an adaptive falsehood; they must provide an account of how a given element of mental life could be false but still be favoured by selection. Nonetheless, advocates of the EA should remember that any example of innate content could in principle be an adaptive falsehood, and they should be suitably circumspect in the conclusions they draw concerning the accuracy of that content.

Future Directions

There are various directions that future work concerning the implications of innateness for epistemology might profitably take. First, cross-species research may provide further data concerning whether any given example of innate mental content accurately depicts the world. As Lorenz (1941/1982) suggested, "different adaptations to one and the same lawfulness strengthen our belief in its reality" (p. 135). The more widespread any innate mental content is in the animal kingdom, the better a candidate it is for knowledge rather than mere belief. For example, even if the concept of God has an evolutionary origin in humans (which I am not suggesting is the case), it is presumably only found in members of our species. As such, we would have less confidence that this aspect of mind relates to an objective reality than we would have in the case of a more widespread innate tendency, such as the tendency to construe the world in terms of objects situated in three-dimensional space.

Cross-species commonalities in innate mental content may be a product of a common origin or of convergent evolution. The products of convergent evolution would be more convincing candidates for genuine innate knowledge. An analogy can be drawn between convergent evolution and convergence as a criterion for truth in science. Where there is convergence in scientific research and theory, we can be more confident that our theories are zeroing in on an accurate view of some part of reality. Similarly, if it could be shown that some aspect of the cognitive systems of various different species was a product of convergent evolution, this would provide stronger evidence that this aspect corresponds to reality than would innateness in a group of species that inherited it from a common ancestor.

Another principle that could be exploited in future research is this: The more ancient a cognitive adaptation is, the more accurate it is likely to be. This is because longer standing adaptations have, in a manner of speaking, resisted falsification for longer. Many animals appear to have cognitive adaptations related to physical objects (Wynne, 2001), which suggests that adaptations that mesh with the physical world are very ancient. They have been subjected to a longer period of selection than more recent cognitive adaptations, such as ToM, which may mean that they have been honed to a greater degree and are more reliable. This may help to explain why the physical sciences are better established and more advanced than the psychological sciences.[7] Finally, the development of mass society is too recent to be associated with any complex psychological adaptations. As Boyer (2001) remarked: "Sedentary settlements, large tribes, kingdoms and other such modern institutions are so recent in evolutionary time that we have not yet developed reliable intuitions about them" (p. 250). Consequently, humans may tend to be poor intuitive sociologists.

[7] On the other hand, this could simply be because the physical level of analysis happens to be simpler and more predictable than the psychological.

Conclusion

There are an unlimited number of possible theories, most of which are wrong, and although any evolved contributions to our view of the world are also likely to be wrong, we may get *closer* to the truth by accepting these contributions as first approximations than by simply rejecting them, at least in the absence of absolutely compelling reasons to do so. Furthermore, where science cannot speak, our first approximations may also have to stand as last approximations. This logic can only be applied in the case of innate content that is dependent on its approximate correspondence with the external world, and only within the sphere in which cognitive evolution took place. Although evolutionary theory does not solve the problem of induction, it may contribute to a number of other philosophical problems. An evolutionary account of belief in an external world provides some support for the existence of such a world, by increasing the coherence of the scientific worldview. The EA also provides a partial solution to the problem of other minds, and suggests that innate content related to space, time, and causation may serve as good first approximations, at least within the range of circumstances of our cognitive evolution. Although the EA must be very carefully qualified, it seems reasonable to think that, in some circumstances, innate ideas can be viewed as a naturalistic source of metaphysical knowledge.

Discussion

Here we have an epistemological issue of no small weight that is resolved by modern science.

-Henry Plotkin, Darwin Machines and the Nature of Knowledge, *1993, p. 237.*

The innate ideas debate is one of the great debates in the history of philosophy. The position I have aimed to support in the preceding nine chapters is that, through a careful consideration of the relevant literatures in philosophy and evolutionary psychology, this debate can be greatly advanced. First, I have argued that evolutionary psychology has various philosophical implications. It provides a naturalistic explanation for the origin of any innate mental content and necessitates a reworking of the epistemological doctrines of empiricism and rationalism. An evolutionary psychological perspective also has important epistemological implications, suggesting that in some very limited circumstances, innate mental content can be accepted as a naturalistic source of knowledge. Second, I have argued that philosophy can inform evolutionary psychology. Various suggestions for innate mental content can be drawn from the philosophical literature. Furthermore, this literature provides arguments that can be used as poverty-of-the-stimulus arguments for the innateness of certain components of mind. This includes arguments for the innateness of the capacity to represent objects, as well as belief in other minds and an external world, and the concepts of *cause* and *moral good.*

A large proportion of the thesis was devoted to the task of postulating various innate concepts and processing abilities. Drawing together these varied suggestions, an outline can be provided of the intuitive human worldview. According to common sense:

> There is an external world independent of our perceptual experience. This consists of objects situated in three-dimensional space, which are linked together in a web of cause-and-effect relationships. Objects are continuous in space and time; they are solid and thus cannot pass through one another; and they continue to exist when beyond the reach of our senses. Among these objects, important distinctions can be drawn between self and not self, life and non-life, and humans and nonhumans. Furthermore, a distinction can be drawn between mental and physical entities. Each living human being (and perhaps members of some other species) has a mind, and has beliefs, desires, and intentions. Whereas physical objects have dimensions in both space and time, mental entities have dimensions only in time. The past is fixed, but the future is open and can be shaped by voluntary behaviour in the present. Voluntary behaviour can be judged in terms of whether it is morally good, bad, or neutral.

To round out this work, I will draw together some of the threads of the preceding chapters. One recurring theme was the idea that the evolutionary perspective can account for various qualitative aspects of human phenomenology. In Chapter 4, I argued that the brain has an innate disposition to tag certain sensations with a qualitative sense that they are parts of the self. In Chapter 5, I argued that we possess a sense that our perceptions are veridical, which reflects the operation of an evolved mechanism designed to distinguish experiences that have objective referents from those that do not. In Chapter 6, I argued that the sense that one event necessitates another is the brain's way of tagging event sequences as causally related, which signals a possible opportunity for controlling events. Finally, in Chapter 7, I suggested that some behaviour is tagged with a qualitative sense of moral rightness, and some with a sense that it is morally wrong. Like pleasure and pain, the sense of rightness and wrongness may encourage or dissuade people from certain actions.

Another common thread throughout the thesis was the idea that any innate mental content must have behavioural implications. For example, in Chapter 5, I argued that the ability to distinguish the subjective from the objective relates to the production of appropriate behavioural responses to subjective versus objective aspects of mental experience, respectively. Similarly, in Chapter 8, I argued that our understanding of time has important links with behaviour through such intuitions as that behaviour can influence the future but not the past. In several places, I argued that aspects of our conscious representation of the world contribute to our capacity to generate novel voluntary behaviour in the pursuit of evolved goals. For instance, in Chapter 6, I argued that the evolutionary function of causal cognition relates to the fact that it underpins our ability to generate novel behaviour aimed at controlling events. Other examples include the self-other distinction and the capacity to represent unperceived parts of the world. Like causal cognition, these aspects of cognition are important ingredients in the creation of novel yet adaptive behaviour, aimed at attaining evolved goals.

In Chapter 3, I outlined two alternatives to the conclusion that a suggested innate idea was in fact innate. The first was that it is implicit in innate aspects of mind. The implicit idea hypothesis was evident throughout the thesis. In Chapter 6, I argued that Hume's principle of universal causation (the idea that every event has a cause) is unlikely to be innate, but that it is instead implicit in the activity of an innate faculty of causal cognition. Other suggestions for implicit ideas include the generalized conceptions of space and time as 'entities' separate from objects and events, the belief in freewill, and the logical law of non-contradiction (Chapter 8). The second alternative to the innateness hypothesis was that a proposed innate idea, although not innate, was nonetheless intuitively compelling as an indirect result of the innate design of the mind. Most of the implicit ideas come under the category of intuitive ideas as well. In addition, it was suggested that the concept of God and mind-brain dualism are intuitive ideas (see Chapters 3 and 4, respectively).

A final theme concerns the implications of evolutionary theory for the issues of epistemological certainty and scepticism. The rationalists believed that innate ideas were a source of perfect truths. An evolutionary perspective undermines this position. Innate ideas are fallible, and even our most certain beliefs, such as the truths of logic and mathematics may in principle be approximations or true only under certain conditions. These possibilities reaffirm the lack of faith in the possibility of obtaining certain knowledge that characterizes modern epistemology. However, the evolutionary analysis of innate influences on thought also boosts our confidence from the level found among sceptics. For instance, it increases our confidence in the existence of an external world and in the existence of other minds. We can never be absolutely certain of anything, but we have stronger grounds to reject scepticism after Darwin than we did before.

My Contributions

This thesis makes a number of novel contributions. One contribution is to organize the rationalists' suggestions for innate ideas into a taxonomic structure, dividing them into implicit, innate, and intuitive ideas. Another contribution is to put a Darwinian spin on the issue of innate ideas, and to derive evolutionary psychological hypotheses from the philosophical literature. In some cases, only scattered references exist in the literature hinting at an evolutionary origin for the aspects of mind considered in this thesis. I have attempted to make an explicit case for such hypotheses, drawing on various lines of evidence and argumentation. A further contribution is the argument presented in Chapter 9, which proposed that that, in some circumstances, innate tendencies of belief can tell us something about the world and can be viewed as a naturalistic source of metaphysical knowledge. I am not the first to suggest that innate contributions to our view of the world can be taken as knowledge; however, the naturalistic form of this position has not previously been developed in much detail, and qualified in light of the very good criticisms that have been raised against it.

Various testable predictions have emerged in the course of this investigation. Many of these relate to adaptive biases. I have argued that we possess a bias toward assuming animate over inanimate, assuming the objectivity of our perceptions and other judgements, and assuming causation rather than coincidence, and we may also err on the side of assuming human over non-human causation. These suggestions mark potentially fruitful areas for research within an evolutionary psychological framework. Another fertile area for hypothesis generation is the issue of evolved moral intuitions (Chapter 7). For instance, based on evolutionary considerations, it was predicted that that the idea that incest is morally wrong is an intuitive predilection for *Homo sapiens*. Furthermore, based on average differences in parental investment among members of our species during the period of our evolution, it was predicted that, on average, incest would be more abhorrent to females than to males. These hypotheses are amenable to empirical investigation, and mark potentially valuable areas for future research.

Limitations

One of the main foci of this thesis was to argue that certain aspects of mental content are innate. However, there are several difficulties associated with this task. First, the concept of innateness is problematic (Griffiths, 2002). Although I have made an effort to explicate this concept, no doubt there is still much more that needs to be said. Second, the arguments I have provided in support of the innateness hypothesis are far from watertight. The evidence in most cases is somewhat flimsy, which makes it impossible to justify any strong conclusions in this area. At best, I have shown that the innateness hypothesis is not unreasonable, and that it deserves further consideration. In addition, some areas of exploration are better developed than are others. The ideas outlined in Chapter 7 (Selfish Genes and Moral Animals), for instance, seem weaker than those presented in some other chapters. Third, my analysis was focused almost completely at the psychological level. An important area for future research would be to try to shed light on the brain structures and processes underlying the innate aspects of mind I have posited. Fourth, I have not speculated about the developmental processes that might produce these innate tendencies, nor how flexible or inevitable these developmental outcomes might be. Fifth, I have not speculated about the specific sequence of events that constitutes the evolutionary history of these innate aspects of mind. Finally, because of the broad focus of the thesis, I have covered a lot of ground in a relatively short space. Consequently, some areas would benefit from a more thorough analysis. In particular, Chapters 4 and 8 argue for so many innate aspects of mind that the case I make can only be considered preliminary. For instance, I have not devoted a great deal of space to outlining and defending the poverty-of-the-stimulus arguments. As such, these must be seen as merely suggestive, rather than conclusive.

Conclusion

According to Bertrand Russell (1912), "through the greatness of the universe which philosophy contemplates, the mind also is rendered great, and becomes capable of that union with the universe which constitutes its highest good" (p. 94). Evolutionary theory helps to explain how this is possible for us - how clumps of matter come to be organized in such a way that they are able to contemplate the universe, and how they come to perceive and understand little pieces of the world and even know general truths about the universe. In this thesis, I have assumed that the mind is ultimately a product of evolutionary processes, and have attempted to provide an overview of the innate contributions to our understanding of the world. I have argued that there is an innate contribution to concepts such as *self*, *object*, *external world*, *causality*, *space*, and *time*, and that these components of our worldview are not so much discoveries of individuals or cultures, as 'discoveries' of natural selection. Finally, I have argued that, in studying these innate contributions to our representation of the world, we do not merely learn about ourselves; we also learn about the world that shaped these aspects of mind in the first place.

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Appendix A: "Darwin and Descartes' Demon" Publication

Stewart-Williams, S. (2003). Darwin and Descartes' demon: On the possible evolutionary origin of belief in an external world. *Evolution and Cognition, 9*, 123-130.