The Serpent's Gift: Evolutionary Psychology and Consciousness

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Abstract

As a higher-order cognitive system enabling access to intentional states, and one that few (if any) other species even marginally possess, consciousness or, more appropriately, self-consciousness has likely been both selectively advantageous and the source of adaptive conflict in human evolutionary history. Consciousness was likely advantageous to early human beings because it built on more ancient primate social adaptations. Individuals likely profited by having the capacity to track the intentions of the self and of social others in that consciousness permitted behavioral strategies involving deception and declarative communication. However, consciousness was likely also a source of adaptive conflict in that it interfered with the functioning of more ancient social adaptations, such as infanticide and male sexual coercion of females. Having access to the epistemic states of others meant that knowledge of social transgressions could be rapidly conveyed between parties. For many evolved psychological mechanisms, what was adaptive in human ancestral history suddenly became maladaptive when consciousness appeared.

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Consciousness or, more properly, self-consciousness (or self-awareness) has long been one of the features, along with culture, tool use, and language, that have been used to set human beings apart from other animals (at least in the minds of many *Homo sapiens*). Yet, the erection of a species barrier only serves as a target for others to topple (see, for example, evidence of tool use and cultural transmission in chimpanzees; Whiten et al., 1999), and consciousness is no exception. Although we have our own views about the possible uniqueness of human consciousness (see below), our primary task is this chapter is not a discussion of the *evolution of consciousness* per se as much as it is about the *role of consciousness* in determining particular human adaptations. Of course, we

are concerned with the evolutionary origins of these adaptations, and we do not neglect this topic. Nonetheless, we see human beings as possessing a degree of self-awareness that has no parallel in the animal world and that, once evolved, drastically modified the nature of the beast, comparable to the effect that flight must have had on the biological line that led to birds. Consciousness, however, was a mixed blessing, for it provided not only new opportunities for the species that possessed it but also new challenges, and it required the seemingly rapid acquisition of a suite of cognitive adaptations to deal with this new level of self-awareness. In this chapter, we examine the role of consciousness in human functioning from the perspective of evolutionary psychology. As we demonstrate, evolutionary psychology has had relatively little to say about this role to date, but has the tools to contribute significantly to our understanding of this phenomenon.

As a first step, we feel it necessary to define consciousness in terms that are amenable to empirical science. There will therefore be no zombies joining us at the table nor qualia to occupy our thoughts (cf. Chalmers, 1996) Rather, we define consciousness as *that naturally occurring cognitive representational capacity permitting explicit and reflective accounts of the – mostly causative – contents of mind, contents harbored by the psychological frame of the self and, as a consequence, also the psychological frames of others*. Our view of consciousness is therefore not one of a solely autonoetic (cf. Tulving, 1985) nature, nor does it remove the self from consciousness, but rather seeks to integrate the concept into the empirical tradition of cognitive science by holding it as a system enabling higher-order representations of abstract causes of behaviors.

This definition of consciousness will almost certainly strike some readers as too narrow. Commonly, the topic of consciousness is handled by scholars in the fields of cognitive neuroscience, philosophy, and comparative psychology, and within these areas consciousness is frequently viewed in shades of increasing complexity both within and across species. This is certainly the right

approach for investigations of the anatomical and physiological aspects of consciousness, particularly if the goal of explanation is at, say, the level of sensory experience and motor planning (e.g., Cotterill, 2001; Humphrey, 2000; Jeannerod, 1999; Searle, 2000). But our goal in the current chapter is somewhat different – although we acknowledge the phylogenetic continuity of the biological substrates of consciousness, we believe that there is now sufficient evidence to show that human beings are operating with a mental representational system that can find no analogy in the central nervous systems of other species. Thus, our approach here is to highlight the likely consequences, both the good and the bad, of this evolutionary innovation on the lives of hominid ancestors. We further propose that modern humans have inherited behavioral propensities to act in ways that enabled these ancestors to capitalize on the consequences of this system's presence, and thus also the psychological mechanisms that made these behaviors likely to occur in an adaptive context.

In the sections that follow, we first introduce the reader to the basic concepts of evolutionary psychology. We then provide a brief description of human brain evolution, along with speculations as to how human consciousness emerged. We then examine a related topic; namely, evidence for higher-order cognition in our closest primate relatives, chimpanzees, which serve as imperfect models for what the common ancestor of apes and human beings may have been like. Finally, we discuss the impact that consciousness made on human evolution – an impact that was felt in three ways. First, consciousness, as a domain-general mechanism, provided direct benefits to the species because it expanded on more ancient primate adaptations (e.g., deception, cooperation, reciprocal altruism) that had evolved to cope with living in large social groups but were not necessarily dependent on an awareness of other minds. Second, the emergence of consciousness posed a new series of adaptive challenges because it disrupted fitness-maximizing categories of primate behavior, particularly social behaviors involving the

adaptive exploitation of other members of the species (e.g., sexual coercion and infanticide). These conflicting challenges between more ancient adaptations and the new problems encountered by consciousness created new behavioral algorithms that served to reduce, but not eliminate, the incidence of socially proscribed behaviors in the species. And, third, we propose that human consciousness has been responsible for the evolution of a suite of novel psychological adaptations that are unshared, even in precursory form, with other species (e.g., the psychological mechanisms responsible for suicide).

Evolutionary Psychology

Underlying Assumptions of Evolutionary Psychology

For the past two decades, investigators have been carefully reconstructing the evolutionary history of specific human psychological systems (see e.g., Barkow, Tooby, & Cosmides, 1992; Buss, 1995, 2005; Daily & Wilson, 1988). Based on the central tenets of Darwinian natural selection, evolutionary psychology is a subfield of psychology that seeks to understand the *adaptive function* of the diverse universal cognitive abilities and human behaviors that were selected in the *environment of evolutionary adaptedness*, usually defined as the Pleistocene, the last 2 million years or so when humans emerged as a species. Evolutionary psychology is not concerned with how human beings are similar to or different from other species, but rather with how the human mind was shaped over the course of its recent evolution. Similar to the way evolutionary biologists attempt to explain the emergence and contemporary appearance of morphological structures, such as the human hand or digestive tract, evolutionary psychologists are concerned with the emergence and contemporary appearance of psychological structures, such as those involved in mate-guarding or reciprocal altruism. That is, to what extent did those individuals who possessed psychological traits driving such

behaviors as mate-guarding and reciprocal altruism have greater *inclusive fitness* over those who lacked them? (Inclusive fitness not only refers to producing offspring, as in the case of the more traditional Darwinian concept of reproductive fitness, but also considers the influence that an individual may have in getting other copies of his or her genes into subsequent generations, through grandchildren or nieces and nephews, for example [Hamilton, 1964].)

A central assumption of evolutionary psychology is that the psychological structures that evolved are adaptive, information-processing mechanisms designed to deal with recurrent problems faced by our ancestors. According to evolutionary psychologists, "the causal link between evolution and behavior is made through psychological mechanisms" (Cosmides & Tooby, 1987, p. 277). Individuals who did not possess adaptive psychological traits were unable to reliably engage in behaviors that were adaptive in ancestral environments. As a result, they failed to disperse their genes as much as those who did engage in these adaptive behaviors, and eventually only those individuals whose behaviors were supported by these psychological systems were represented in the population. What get selected, according to this rationale, are not the adaptive behaviors per se, but rather those psychological systems undergirding and enabling these adaptive behaviors (e.g., Buss, 1995; Tooby & Cosmides, 1992).

Moreover, these mechanisms are domain-specific in nature. Human beings (and presumably other animals) did not evolve general learning or information-processing abilities that could be applied to the wide range of problems they encounter as they go about their lives. Instead, what evolved were a host of relatively specific mechanisms, each sculpted by natural selection to deal with relatively specific and recurring problems, such as language, detecting cheaters, or gaining and maintaining mates. As an analogy, the mind is compared to a Swiss Army Knife, with different tools designed for different tasks (Tooby & Cosmides, 1992), rather than a broad ax, which may be powerful but

too wieldy to be useful for many complex problems. Despite claims to the contrary (e.g., Lickliter & Honeycutt, 2003), evolutionary psychology does not advocate a form of genetic determinism, but emphasizes that evolved, adaptive mechanisms are sensitive to environmental context (see Tooby, Cosmides, & Barrett, 2003). This is especially true for human beings, who live in diverse physical and social environments and require a flexible intelligence to survive.

Nevertheless, the plasticity of human thought and behavior is not infinite. Human infants are prepared by evolution for a structured world that includes sights and sounds, a lactating mother, social support, and language, among many other things. There are constraints on what they can process and how they will interpret experience. These *enabling constraints* (Gelman & Williams, 1998) should not be viewed negatively, for they make it easier for children to master the ways of a *human* world, facilitating the acquisition of language, for example, but making it impossible to learn to navigate via echolocation. Over the course of development, children's information-processing biases are modified by experience, but inevitably result in behaviors that are generally well suited to the social environments in which they live.

In an effort to disentangle such complex issues, evolutionary psychologists have established empirical programs with the explicit purpose of identifying and explaining the ultimate function of human thinking in different problem-solving domains, such as those found in the social, physical, and biological environments (see examples in Barkow et al., 1992; Buss, 2005). The unique metatheoretical perspective of evolutionary psychology has also contributed to an understanding of human behavior that goes well beyond that of solely proximate explanations proffered by many social learning theories. Importantly, evolutionary psychology argues that human behavior is motivated not by the conscious interests of people in infinitely malleable social environments, but rather by the genetic interests of human org-

anisms living in complex socioecologies (e.g., Tooby & Cosmides, 1992).

Self-Consciousness as an Epiphenomenon

Still, the role of self-consciousness, which appears to be a very general mechanism permitting reflective awareness of the self's proximate motivational states, continues to remain very unclear in evolutionary models of human cognition. Many evolutionary psychologists consider consciousness to be an epiphenomenon that shadows the intuitive operations of psychological adaptations and that has played no important role in the evolutionary emergence of these adaptations. To support this position, such theorists cite people's naïve, explicit explanations for the causes of their own adaptive behaviors, explanations that are far removed from plausible selection-based explanations for their actions (French, Kamil, & Ledger, 2001). In addition, similar behaviors that occur under similar ecological conditions in different societies are often interpreted in very different ways (e.g., for an application of this principle to the subject of infanticide, see Daly & Wilson, 1988). This suggests that, although there was selection for cognitive programs that prompt specific types of responses when encountering particular environmental conditions, people's causal interpretations of these identical behaviors may vary considerably. Among those factors contributing to attributional differences between societies and between individuals are cultural traditions, narratives, religious indoctrination, and education.

The key point is that such causal interpretations of behavior matter little in the long run – so long as an adaptive behavior occurs, it makes no difference whether people believe that the gods made it so or that it was triggered by the state of the economy. This informs us that the cognitive systems supporting many human behaviors appeared earlier in evolutionary phylogeny than did the conscious awareness that currently oversees and interprets them. According to this rationale, if self-consciousness were integral

in causing adaptive behaviors, then it is reasonable to expect that all individuals, irrespective of population or individual differences, would provide the same type of causal explanation when interpreting these behaviors. In this light, self-consciousness is rightly considered an epiphenomenon with respect to these strategies, in that it is ostensibly inconsequential to the standard operations of many psychological adaptations. As a general rule of thumb, whenever a behavior can be reliably predicted to arise in response to a definable set of environmental factors, and whenever post-hoc explanations for this identical response vary from person to person or from culture to culture, self-consciousness has served at most a peripheral role in the evolution of the psychological adaptation supporting this behavior. *Homo sapiens*, like any other extant species, has a deep history; in addition, it also has one that is characterized by only a recent split from the other primate clades. We therefore suspect that a significant proportion of human psychological adaptations fit into this category. That is, we believe that much of human behavior is likely governed by unconscious decision-making strategies that led to genetic fitness throughout the course of primate evolution. For such adaptations, self-consciousness principally serves a spectator role, allowing explanatory searches for the causes of adaptive behaviors but not inserting itself into the decision making in any meaningful way.

Research in evolutionary psychology has amassed considerable support for the idea that there exists an underlying genotypic structure in human beings that leads, in interaction with the environment over the course of development, to the phenotypic expression of psychological systems specially designed to solve recurrent environmental problems. Across human societies, and across the human life cycle, individuals encounter the same set of basic challenges in the social and physical environments – challenges that, if gone unmet, would directly threaten the successful propagation of their genes. One important impli-

cation of this fact is that, regardless of both cross-cultural and individualistic differences in how people explain the causes of their own behaviors, what ultimately determines behavior are the implicit, evolved psychological mechanisms that instantiate a given course of action whenever an individual is confronted with a problem that the human mind is designed to solve.

We also suspect, as do others (e.g., Crook, 1980; Donald, 2000; Humphrey, 1976), that this is only part of the picture and that self-consciousness in fact played an enormously important role in the evolution of psychological adaptations that are specific to human beings. This is because self-consciousness seems to have meaningfully disrupted many ancient psychological adaptations that human beings share with other species and to have presented a new series of challenges that our distant human ancestors were never forced to confront. These challenges, we believe, were initially focused in the social realm, with self-consciousness producing individuals who were more keenly aware of their own knowledge and motivations *and* those of others. Such awareness could have provided great advantages, but with it great problems. With an onslaught of new dynamical problems caused by consciousness, human beings evolved a fundamentally novel suite of adaptive solutions designed to redress these problems.

Along these lines, evolutionary psychology distinguishes the *proximate causes* of human behaviors from their *distal causes*. The proximate level of behavioral causation consists of motivational causes, such as affective, perceptual, and epistemic states that the individual experiences subjectively. In contrast, the ultimate level of behavioral causation consists of the intuitive, domain-driven psychological processes promoting adaptive behavior that are barred from the individual's conscious access. Because any given adaptive behavior has both a proximate cause that must gear the individual toward engaging in a specific course of action, as well as a distal cause that strives to ensure that this course of action is in the best

interests of the individual's genes, these two levels of causation are inseparable. Psychological adaptations are complex, rule-driven processing systems that respond to domain-specific environmental factors.

Adaptations, Byproducts, Noise, and Exaptations

At this point, some comment should be made about evolutionary psychology's adoption of an "adaptationist program." Evolutionary psychology has often falsely been accused of assuming that any species-universal contemporary behavior must be an adaptation. But this is not so. Many features of the modern human mind and behavior are byproducts of other adaptations, or are simply noise. Some may actually be maladaptive, just not so maladaptive as to have caused the elimination of the genes underlying these features from the species' genome. David Buss and his colleagues (Buss, Haselton, Shackelford, Bleske, & Wakefield, 1998) defined *adaptations* as reliably developing, inherited characteristics, produced by natural selection, that served to solve recurrent problems in the environment of evolutionary adaptedness and resulted in greater inclusive fitness. Buss et al. used the umbilical cord as an example of an adaptation, as it solved the problem of how to get nutrients from a mammal mother to her fetus. In contrast, *byproducts* are features that have not been shaped by natural selection and did not solve some recurring problem, but are a consequence of being associated with some adaptation. The belly button would be an example of a byproduct. Finally, *noise* refers to random effects that may be attributed to mutations, changes in the environment, or variations of development, such as the shape of one's belly button. Thus, not all evolved characteristics should be viewed as adaptations. The belly button clearly evolved, but it cannot accurately be viewed as an adaptation. Moreover, some adaptations may have negative side effects (byproducts). For instance, the fetus's large skull is surely an adaptation, housing the large brain that resides within it. Yet, this large head makes birth difficult, due to limits on how broad a woman's hips can be and still afford bipedality. As a result, many women and infants have died in childbirth. However, the cognitive benefits of a large brain must have been greater than the cost in maternal and neonatal mortality; otherwise selective factors would have worked against such costly anatomical constraints and alternative fitness-conferring mechanisms would likely have evolved.

A related concept popular with many evolutionary biologists (e.g., Tattersall, 1998) is that of *exaptation*, defined as "a feature, now useful to an organism, that did not arise as an adaptation for its present role, but was subsequently co-opted for its current function." Further, exaptations are "features that now enhance fitness, but were not built by natural selection for their current role" (Gould, 1991, p. 47). The classic example of an exaptation is the case of avian feathers, which evolved initially to serve a thermoregulatory function but were co-opted to facilitate flight in birds.

Although the concept of exaptations has not generally been accepted by evolutionary psychologists (Buss et al., 1998), we believe that the basic idea is solid – many of the products of evolution arose based on byproducts of other adaptations or features that, initially, had no inherent function for an organism. This is likely to be especially true for brain evolution, with parts of the brain being co-opted for functions they were not originally selected to perform. Yet, once co-opted, any new function must pass through the sieve of natural selection. For instance, although feathers may not have initially evolved for flight, they became necessary for birds to fly, making them an adaptation. Likewise, even if many human cognitive abilities are the products of the co-opting of brain tissue originally used for other purposes, it is reasonable to ask what new problems (if any) these abilities solved and if they, too, may be adaptations (albeit co-opted ones). We thus treat exaptations as special cases of adaptations. Because natural selection is not forward looking but serves only to adapt organisms to their local

environments, it is likely that many contemporary and ancient adaptations may have been co-opted from other seemingly unrelated functions. This perspective may be of special importance to human intelligence and for functions associated with the expanding neocortex that characterized members of the hominid line over the past 5 million years. Consciousness may be the product of our big brain, but we can only guess at the selection pressures, if any, that generated this ability.

The Evolution of the Human Brain

Changes in Brain Size over Hominid Evolution

Human beings are noted for their big brains relative to their body size. Primates, in general, have large brain-to-body size ratios, but this trend is exaggerated in human beings (Jerrison, 1973; Rilling & Insel, 1999). Jerrison (1973) developed the *encephalization quotient* (EQ) to evaluate the expected brain weight/body weight ratio for animals within a family. For instance, given the typical pattern of changes in brain and body weight in mammals, brain weight should increase at a certain rate relative to increases in body weight. If a species' brain is smaller than that expected for its body weight, the encephalization quotient will be less than 1.0, and it will be greater than 1.0 if its brain is larger than expected for its body weight. Most primates have encephalization quotients greater than 1.0, with chimpanzees being 2.3, meaning their brains are, on average, more than twice the size expected for a mammal of their size. This impressive brain/body ratio is dwarfed by that of human beings, however, which is more than three times greater still (EQ = 7.6, Jerrison, 1973; Rilling & Insel, 1999).

Of course, human beings did not evolve from chimpanzees, but last shared a common ancestor with modern chimps between 5 and 7 million years ago. In between our chimp-like common ancestor[1] and contemporary people, paleoanthropologists describe a series of species, some of which were surely our ancestors and others of which likely lead to evolutionary dead ends. Figure 22.1 presents one possible phylogeny for human evolution, dating back about 5 million years. These species differed in many physical characteristics (we can only guess at what their behavior might have been based on brain size and some artifacts), perhaps most prominently being brain size in relation to body size. Figure 22.2 presents the encephalization quotients for contemporary chimpanzees (*Pan troglodytes*), modern human beings (*Homo sapiens*), and three species believed to be ancestral to *Homo sapiens: Australopithecus afarensis*, which roamed Africa about 3 million years before present; *Homo habilis*, the first member of the *Homo* genus that first appears in the fossil record about 2.5 million years ago; and *Homo erectus*, who left Africa to populate Asia and Europe about 1.5 million years ago. As can be seen, the encephalization quotient of *Australopithecus afarensis* was only slightly greater than that of modern chimpanzees, with this value increasing sharply over the next 3 million years in the genetic line that presumably led to *Homo sapiens* (Tobias, 1987). The modern human brain, then, is a reflection of a more general pattern shown in primates and particularly in hominids, those big-brained, bipedal animals of which *Homo sapiens* is the only extant species.

Building bigger brains, at least in primates, seems to be the result of extending the time the brain can grow; delaying the offset of brain growth results in the production of more neurons (Finlay & Darlington, 1995; Finlay, Darlington, & Nicastro, 2001) and greater dendritic and synaptic growth. However, in human beings, the brain can only get so large before the skull that confines it becomes too big to fit through the birth canal. As a result, human infants are born prematurely, and much of brain development occurs postnatally. Were human gestation to correspond to what would be expected for their brain and body size, women would be pregnant between 18 and 24 months (Gould, 1977).
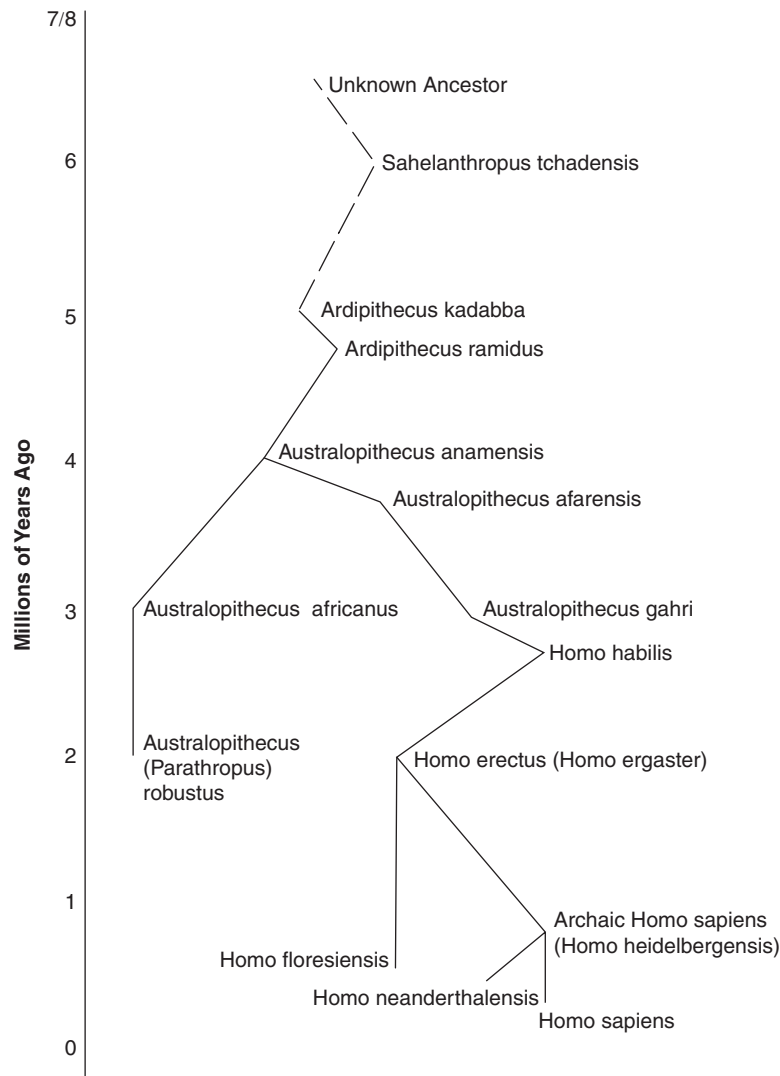
Figure 22.1. One possible phylogenetic tree of human evolution.

Although the canonical perspective of evolutionary psychology is that adaptive mechanisms are domain-specific in nature, a more parsimonious interpretation, we believe, is that increased brain size afforded greater general information-processing capacity that may have permitted the evolution or execution of more domain-specific mechanisms, particularly in the social realm (see Bjorklund & Harnishfeger, 1995; Bjorklund & Kipp, 2001; Bjorklund & Pellegrini, 2002; Geary, 2005). Consistent with this domain-general perspective is the claim that most of the increase in brain size over mam-

malian evolution can be attributed to delaying "neuronal birthdays" (when precursor nerve cells stop dividing symmetrically and begin their migration within the neural tube), and not to changes in specific areas of the brain associated with particular functions, which would be indicative of domain-specific selection pressures (Finlay et al., 2001). This is similar to claims made by Gould (1991), who argued that many aspects of modern human intelligence do not represent domain-specific evolved psychological mechanisms, but rather are the byproducts of an enlarged brain (see also Finlay
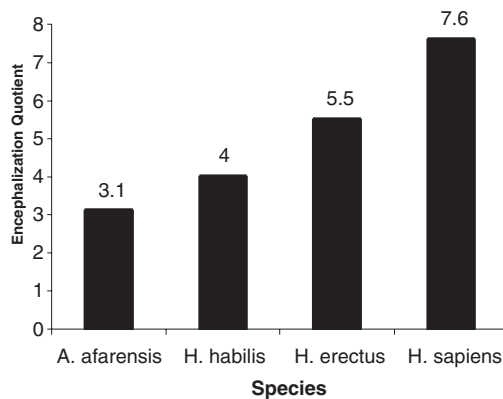
Figure 22.2. Encephalization quotients for several hominid species (from Tobias, 1987). Reprinted with permission.

et al., 2001). Although this argument suggests that not all features of the human brain and mind were specifically targeted for selection (see Geary, 2005; Geary & Huffman, 2002), it does not mean that differences between chimpanzees and human beings, for example, are due only to differences in the total volume of brain tissue between these species. There are many differences in the microcircuitry of many parts of the brains of monkeys, chimpanzees, and human beings, for example, suggesting that specific brain areas and cognitive functions have indeed undergone selective pressure (Preuss, 2001). This implies that, even if much of brain evolution within the hominid line can be attributed to a general mechanism associated with the delay of neuronal birthdays, subsequent specialization of brain and cognitive functions, which are relatively domain-specific in their application, could still have taken place (Geary, 2001).

Big Brains, Slow Development, and Social Complexity

What are big brains for? For one thing, large brains are greatly beneficial for learning. A species that lives in varied environments or requires sophisticated memory abilities to navigate its environment or to remember the location of hidden caches of food cannot achieve these feats with a brain that is barely large enough to control its basic bod-

ily functions. But if an animal is going to invest the time necessary to learn important aspects of its environment, it should be relatively long-lived. Brains are metabolically expensive (Aiello & Wheeler, 1995), and an animal whose existence on this earth is measured in weeks or months, rather than years or decades, would be better off investing its time and caloric resources in pursuits that do not require substantial learning. And the more an animal has to learn to achieve inclusive fitness, the longer its prereproductive period needs to be. Human beings, of course, fit this bill well, not reaching reproductive maturity until the teen years, with some anthropologists suggesting that this was likely closer to 20 years of age for our ancestors (e.g., Bogin, 1999; Kaplan, Hill, Lancaster, & Hurtado, 2000).

In particular, we, and others, have argued that big brains and slow development evolved in primates to deal with the complexity of their social group (e.g., Alexander, 1989; Bjorklund & Bering, 2003a; Bjorklund & Harnishfeger, 1995; Byrne & Whiten, 1988; Dunbar, 1992, 2001; Geary & Flinn, 2001; Humphrey, 1976). Our remarkable technological and abstract reasoning skills have been co-opted from the "intelligence" evolved to deal with cooperating, competing, and understanding conspecifics, and this is a trend observed in primates in general. This trend is seen in research by Dunbar (1992, 1995, 2001), who reported a significant relation between measures of brain size and social complexity among primates (correlation between size of neocortex and group size = .76). Moreover, larger brain size is also negatively associated with length of the juvenile period (Bonner, 1988), suggesting that both brain size and delayed development are important interdependent factors that are related to success in complex societies. This triadic relationship was empirically demonstrated by Joffe (1997), who reported that the proportion of the lifespan spent as a juvenile among 27 different species of primates was positively correlated with group size *and* the relative size of the nonvisual neocortex. We make no claims that any one of these factors is the

cause for another; surely, brain size, length of juvenile period, and social complexity interacted synergistically, with large brains and an extended juvenile period being necessary for mastering the ways of one's group, and social complexity in turn exerting selection pressures for increased brain size and an extension of the juvenile period.

As suggested above, the increasing brain volume over the course of primate and hominid evolution likely is the result of constraints in neural development (e.g., Finlay et al., 2001). Yet, it seems that the increased computing power that larger brains afforded was put to good use, specifically to deal with the complexity of primate social groups. It also suggests that consciousness is not *necessary* for life in a complex primate social group. However, we believe that when neural organization produced consciousness, it did so in a context in which it could be put to good use, specifically in social cognition.

Precursors to Consciousness: The Comparative Psychology of Consciousness

If the common ancestor of human beings and contemporary members of the *Pan* genus were anything like extant chimpanzees, they lived a highly complex social life. For example, chimpanzees in the wild have been shown to possess at least crude culture, as reflected by the transmission from one generation to the next of complex behaviors involved in grooming, nut cracking, and termite fishing, for example (Whiten et al., 1999). Many of these behaviors are unique to a particular chimpanzee troop and so cannot be attributed to species-universal behavioral features. Human beings and chimpanzees also show considerable overlap when it comes to social behaviors, such as, among many others, status striving, coalition formation, reconciliation, and tit-for-tat strategies (e.g., de Waal, 1982, 1986; Goodall, 1986). But do chimpanzees achieve these complex social feats using higher-order cognition involving consciousness, or can their accomplishments be explained otherwise?

Higher-order cognition in great apes has been an area of great contention, with some scientists arguing that chimpanzees are "almost human," possessing, in rudimentary form, nearly all the intellectual abilities seen in *Homo sapiens* (e.g., Fouts, 1997; Goodall, 1986; de Waal, 1986); whereas others contend that chimpanzees are merely clever "behaviorists," able to accomplish feats of social and technological complexity without the need for abstract (i.e., self-conscious) cognition (e.g., Povinelli, 2000; Povinelli & Bering, 2002). Although a detailed discussion of this literature is beyond the scope of the present chapter (see Bjorklund & Pellegrini, 2002; Suddendorf & Whiten, 2001; Tomasello & Call, 1997, for reviews), we now present briefly some of the evidence for and against higher-order cognition in chimpanzees and the implications it may have for the evolution of human consciousness.

Mirror-Self-Recognition

Many comparative psychologists have argued that evidence of mirror "self-recognition" in great apes is diagnostic of self-consciousness, and this, in turn, has led them to infer that such species must have empathic social cognition as well (Gallup, 1982, 1985; Jolly, 1991). This position was initially advanced by Gallup (1979), whose original mirror self-recognition procedure of placing a dye mark on a hidden portion of an animal's body and then recording its responses to the mark when confronted with a mirror has become the litmus test for self-awareness in other species. If the animal reaches up to touch the mark, then it is said to understand that the mirror image is a representation of itself. If it does something else, however, such as touch the surface of the mirror or threaten its own image, then it is said to have "failed" the mark test and have shown no understanding of its own subjective existence.

To date, other than human beings, who show mirror self-recognition at about 18 months of age (see Brooks-Gunn & Lewis, 1984), only chimpanzees, orangutans, and a few gorillas have "passed" the mark test

(see Suddendorf & Whiten, 2001; Swartz, Sarauw, & Evans, 1999), although variants of the test that have been devised for use with the anatomical constraints of dolphins (Reiss, & Marino, 2001) suggest that this species may demonstrate mirror self-recognition as well. Interpretation of these findings vary widely, however, with some researchers arguing that such mirror-contingent behaviors are clear evidence of self-consciousness and others arguing that they demand only an ability to learn how certain kinesthetic-proprioceptive experiences map onto a mirror image (for a review of this complex debate, see Parker, Mitchell, & Boccia, 2006).

Social Learning

The impressive social learning of chimpanzees, on the surface, would seem to involve an appreciation on the part of the observer of the goal, or intent, of the model, a form of secondary representation and seemingly a characteristic of conscious creatures. But not all social learning requires such mental representation. For instance, Tomasello and his colleagues (e.g., Tomasello, 1996, 2000; Tomasello, Kruger, & Ratner, 1993) have proposed that only *true imitation* requires an understanding of the goals, or intentions, of the model, in addition to replication of important aspects of the model's behavior. Such imitation requires the ability to take the perspective of another, apparently requiring conscious awareness. Although great apes often master complicated tasks after watching a model perform similar problems, such learning usually occurs over multiple trials and involves significant trial-and-error learning (e.g., Whiten, 1998; Whiten, Custance, Gömez, Teixidor, & Bard, 1996); in general, there is little evidence for true imitation of actions on objects in chimpanzees (e.g., Tomasello, Savage-Rumbaugh, & Kruger, 1993). The exception seems to be for great apes that have been enculturated by human caregivers (e.g., Bering, Bjorklund, & Ragan, 2000; Bjorklund, Yunger, Bering, & Ragan, 2002; Tomasello, Savage-Rumbaugh,

& Kruger 1993). However, it is still unclear whether such atypical rearing experiences endow these animals with an understanding of intentionality or whether they simply become more sensitive to human behavioral contingencies that co-occur with specific intentional states (Bering, 2004a; Bjorklund & Bering, 2003b; Bjorklund & Rosenberg, 2005; Call & Carpenter, 2003).

Boesch (1991, 1993) has argued that one phenomenon that would seemingly require conscious cognition is explicit teaching. He reasons that teaching requires the understanding of others as not possessing information, and thus behaviors that appear designed to change the epistemic content of others' minds would (in principle) be evidence of the instructor's metarepresentational capacities. There have been several observations of female chimpanzees in the wild teaching their young offspring how to crack nuts (e.g., Boesch, 1991, 1993; Greenfield, Maynard, Boehm, & Schmidtling, 2000). For example, mother chimps were observed to position the anvil and hammer rocks and the nut in such a way that all an infant had to do was strike the nut to open it. At other times, the female would move especially slowly in the presence of her infant. Although these are impressive demonstrations and consistent with the interpretation that mother chimpanzees actively teach their offspring complex technological skills, they have been observed only rarely and do not seem to be a common way in which "cultural" information is transmitted (see Tomasello et al., 1993).

Understanding the Perspective of Others

In other research, subordinate chimpanzees seem to realize when and when not a dominant chimp can see a valued food item and will only "compete" for the food when it is out of the dominant animal's sight (Hare, Call, Agentta, & Tomasello, 2000; Hare, Call, & Tomasello, 2001). This behavior implies that chimpanzees understand that "sight implies knowledge," a seemingly rudimentary (but valuable) ability in social cognition. Yet, research by Povinelli and his

colleagues (e.g., Povinelli & Eddy, 1996a; Reaux, Theall, & Povinelli, 1999) questions this interpretation. In Povinelli's research, chimpanzees face two experimenters, one with her eyes open and the other with her eyes somehow occluded (e.g., her eyes are closed or she's wearing a mask). When given the opportunity to make a reaching response to either of the experimenters to get food located between them, the chimpanzees respond randomly. Unlike the apes in the food-competition studies of Hare and his colleagues (2000, 2001), they seem not to appreciate that the eyes are a source of knowledge.

With respect to complex social behavior, chimpanzees do occasionally seem to engage in deception; for example, females occasionally place a hand over a subordinate male's mouth during furtive mating, serving to prevent the male's screams from reaching the ears of a dominant male and alerting him to the behavior (see Whiten & Byrne, 1988, for other examples). Yet such deception does not necessarily require that an animal knows what another animal is thinking, but could have been acquired via processes of trial-and-error learning. In related research, when chimpanzees are given false-belief tasks under laboratory control, so that the only way to solve the problem is to appreciate what another individual knows, they fail (Call & Tomasello, 1999). Taken together, these findings and others from a variety of controlled investigations lend support to the idea that chimpanzees have, at best, a vastly impoverished understanding of intentionality (Bering & Povinelli, 2003; Povinelli & Bering, 2002; Tomasello & Call, 1997). They have failed to distinguish between ignorant and knowledgeable social partners (e.g., Call & Tomasello, 1999), to understand *seeing* as a psychological state (e.g., Povinelli & Eddy, 1996a), to distinguish between intentional and accidental actions (e.g., Povinelli, Perriloux, Reaux, & Bierschwale, 1998), to instruct a naïve conspecific on how to go about a novel task that requires cooperative effort (e.g., Povinelli & O'Neill, 2000), and to understand the psychological state of *attention* (e.g., Povinelli & Eddy, 1996b,c).

We cannot say that the primate literature paints an easily interpretable picture of higher-cognitive abilities in great apes. It seems that chimpanzee social cognition is, in many ways, very much like that of human beings. Yet, the understanding they demonstrate of the knowledge of others – perhaps *the* critical component in human social cognition and one for which self-consciousness is required – is limited at best. We feel comfortable saying that chimpanzees and the other great apes do not experience a sense of self-awareness and do not possess an understanding of belief/desire reasoning comparable to the degree characterizing nearly every normal 5-year-old human child. But the roots of such awareness may be visible, and in the absence of controlled conditions, one can easily misinterpret the actions of these animals as being based on an understanding of the knowledge and motivations of others (as we often do with our pets). Assuming that our common ancestor had a social organization and social learning abilities similar to those of extant chimpanzees, when consciousness did first appear, it was in a species and context that would readily capitalize on its attributes.

Evolutionary Psychology and Consciousness

Adaptive Information-Processing Mechanisms: The Assumption of Implicit Cognition

For the most part, when evolutionary psychologists talk about information-processing mechanisms or strategies used to solve specific problems (e.g., mate-selection strategies), they do so in the same way that evolutionary biologists speak of physiological mechanisms or behavioral strategies. Such "strategies" do not imply self-awareness. For example, the mating strategy of a smaller-than-average male fish to mingle among the females and mate inconspicuously with them is quite different from the strategy used by a larger, more dominant fish. Neither strategy, of course, is conscious. Neither animal has reflected upon the best

way to get its genes into the next generation and chosen, after careful deliberation, which course to take. These are unconscious, implicit strategies and of the same sort that evolutionary psychologists propose underlie human behavior. Such an approach affords great explanatory benefits, for it permits psychologists to explain the actions of human beings in the same way that the actions of non-human animals are explained. No special pleading for the uniqueness of humans is necessary.

As a result, higher-order cognition, such as that requiring consciousness, is not a required topic for evolutionary-minded psychologists. This is reflected by examining the indexes of popular books on evolutionary psychology. For example, the term "consciousness" is not found in the indexes of Barkow, Tooby, and Cosmides's (1992) seminal edited volume *The Adapted Mind*, Buss's (1999) textbook *Evolutionary Psychology*, Cartwright's (2000) textbook *Evolution and Human Behavior*, or in Pinker's deservedly popular books *The Language Instinct* (1994) and *The Blank Slate* (2002). Yet the topic of consciousness receives considerable attention in other evolutionary psychology texts (e.g., Gaulin & McBurney, 2001; Palmer & Palmer, 2002) and in popular books such as Pinker's (1997) *How the Mind Works*, reflecting, we think, the recognition by some evolutionary psychologists of the central role consciousness plays in what it means to be human. But, in general, consciousness has been out of the mainstream of evolutionary psychology, and certainly conscious cognition is not necessary to explain adaptive behavior.

Although evolutionary psychologists need not postulate conscious cognition when trying to explain the adaptive value of some cognitive mechanisms, they cannot totally ignore it. Cognitive scientists have recognized for some time the complex interplay between consciousness and behavior. In human beings, the relation between higher-order thought and action is a complicated affair. As Cotterill (2001) writes, "We can think without acting, act without thinking, act while thinking about that act, and act while thinking about something

else" (p. 10). Clearly, any behaviors that are directly caused by consciousness can become targeted by natural selection. But a novel twist to this logic, and one we think should be underscored in discussions of human cognitive evolution, is that, in a gossiping society, the inhibition of selfish behaviors would also have become targeted by natural selection (Bering, 2004b; see also Bjorklund & Harnishfeger, 1995; Bjorklund & Kipp, 2001; Dunbar, 1993). That is, *not engaging* in a behavior that has been conditioned by natural selection to occur in response to specific environmental contingencies, but instead overriding this tendency through higher-order cognitive means, may under certain conditions be the more adaptive response. We argue that this is often the case for human beings, an organism whose genetic fitness hinges on social reputation, impression management, and the advertisement of its altruistic traits. The behavioral dispositions that we have inherited from our genetically gratuitous prehominid ancestors, ancestors that did not have to worry about the existence of other minds, must be suppressed very often. This is new psychology shaking hands with old psychology.

We also see an important overlap here between our definition of consciousness as a system permitting metarepresentational thought and the more conventional view of consciousness, and the one often referred to in evolutionary terms as having conferred a selective advantage, as a system that permits simulated outcomes on motoric planning. According to Cotterill (2001), "The adequately endowed system conjures up a simulated probable outcome of the intended motor pattern, and vetoes it if the motion is adverse" (p. 8). Indeed, Jeannerod (1999) presents evidence showing that overt movement and sheer imagery of these actions activate the same brain regions. Povinelli and Cant (1995) have speculated that a large-bodied arboreal primate, such as that envisioned as the common ancestor of humans and great apes, would have profited enormously from symbolic representational abilities enabling such foresight (a wrong move in the tree canopy could prove deadly.) We

would simply extend this line of reasoning by arguing that mental simulations of the probable outcomes of intended actions would have given human beings significant strategic leverage in a variety of both physical *and* social contexts. Social simulations would instantiate alternative psychological construals that included representations not only of others' likely reactions to the self's behaviors but also mental state attributions to these behaviors. Actions can thus be tailored to the unique demands of the social situation. Although it may be the case that other primate species are capable of simulating behavioral outcomes of their actions in social contexts, we argue that only humans can simulate the way that their actions will be interpreted and understood by social others.

As we mentioned earlier, evolutionary psychology deals with both distal and proximate causes of behavior, expressed through adaptive information-processing mechanisms that are responsive to factors in the local environment. Because, in human beings, psychological adaptations occur in conscious agents, these rule-driven processing systems are also tethered to the subjective states of biological organisms. Environmental information that is detected and perceived by the human brain is handled in ways that maximize biological success by either stimulating or inhibiting specific behavioral responses. At least in human beings, however, the perception of these sources of information is often accessible to conscious awareness, and any behaviors occurring in response to environmental input may be closely monitored, if not controlled, by an executive cognitive system.

The Adaptive Benefits and Challenges of Consciousness

On the surface, the benefits of consciousness are self-evident. Self-consciousness and higher-order cognition are so integrated into the fabric of what it means (phenomenologically) to be human that there is no need to look for its benefits. Yet, although it is unquestionable that we'd be a very differ-

ent species than we are today without conscious awareness, that does not preclude the question of what adaptive benefits, if any, consciousness afforded our ancestors. Moreover, consciousness was a mixed blessing, perhaps producing as many problems as it solved. In this section, we look at some of the benefits and challenges brought about by consciousness.

The Benefits of Consciousness

KNOW THYSELF, AND KNOW OTHERS
Perhaps the dominant perspective of the "reason" for the evolution of consciousness was first presented by Nicholas Humphrey (1976), who argued that consciousness played a critical role when dealing with members of our own species. For animals living in complex social groups, the ability to predict, and possibly control, the behavior of others would provide great advantage. Social primates, which surely included our ancient ancestors, already formed coalitions, cooperated and competed with one another, and sometimes used deception to obtain valuable resources or to avoid detection when a social rule was broken. Consciousness arose in this arena and provided an immediate social, and therefore reproductive, advantage to its possessor.

Note that it is implicitly assumed here that the ability to attribute mental states to others is somehow linked to self-consciousness. This requires making the conceptual inference that one's privileged access to one's own proximate causal states feeds an understanding of others' causal states. Specifically, it is assumed that any evolved social algorithms in human beings that necessitate the representation of what others *do* or *do not* know first required the ability to reflect upon the epistemic contents of one's own mind. Indeed, we believe that the ability to detect the intentions of other agents, as well as their emotional, epistemic, and perceptual status, has likely been an enormously influential factor in the evolution of social adaptations in the human species. Such a general representational system, which falls under the rubric of "theory

of mind" in the developmental and comparative psychological literatures, was capable of transforming already existing ancient primate adaptations in the social domain, such as reciprocal altruism and mate-guarding, into more complex adaptations demanding the rapid inferential processing of information dealing with mental states.

From this perspective, self-consciousness was first applied to social cognition and may have permitted the evolution of more domain-specific adaptations devoted to dealing with conspecifics. For example, Baron-Cohen (1995) proposed four separate modules involved with theory of mind. The first module, the *intentionality detector* (ID), permits one to infer that a moving object may have some intent toward the individual (it may be trying to catch me), and the *eye-direction detector* (EDD) interprets eye gaze. These modules develop by around 9 months in infancy and likely do not require full-blown consciousness. The *shared-attention mechanism* (SAD) module is involved in triadic interactions (e.g., person A and person B can each be looking at object C and understand that they see the same thing) and develops at around 18 months in human beings. The *theory-of-mind module* (TOMM) develops around age 4 in children and is similar to *belief-desire reasoning* as described by Wellman (1990), in which children understand that their behaviors are governed by what they believe, or know, and what they want, or desire, and so is the behavior of other people. Such reasoning requires secondary representation and what is conventionally referred to as self-awareness or self-consciousness. Theory of mind has been one of the most investigated topics in cognitive development over the past 20 years, in part because it is at the core of social functioning in any human society.

The most frequently used tasks to assess theory of mind involves children's understanding of false belief. In one version of the task, a child and a confederate watch as a treat is placed in one container (A). The confederate then leaves the room, and the treat is moved to a second container (B) while the child watches. The child is then asked where the confederate will think the treat is hidden. By age 4, most children solve the problem correctly, stating that the confederate will have the false belief that the treat is hidden in the first container. Most children much younger than this age, however, erroneously state that the confederate will believe the treat is hidden in container B. This, indeed, is where the treat is hidden, but this fact is known to the child and not the confederate. Results from experiments using this and other variants of false-belief tasks indicate that young children do not behave as if they possess belief-desire reasoning (see Wellman, Cross, & Watson, 2001). We would not want to declare these children to be unconscious, but they fail to be able to take the perspective of the confederate and to understand that other people have knowledge and desires different from their own that guide their behavior. People in all societies generally behave kindly toward preschool children, so their lack of belief-desire reasoning rarely causes them much trouble. But it is difficult to imagine any adult (or child beyond the age of 7 or 8) who lacks such reasoning functioning well in any human culture, modern or ancient.

CONSCIOUSNESS AND THE DEVELOPMENT OF TECHNOLOGICAL SKILLS

According to Humphrey's hypothesis, consciousness evolved to play a central role in social cognition. But human consciousness extends beyond the social realm into technology (e.g., tool making) and educability. Human beings are not the only tool makers in the animal kingdom, but the tools made by chimpanzees, for instance preparing sticks for use in termite fishing (e.g., McGrew, 1992), are simple, uncomplicated devices compared to the tools made by modern human beings (even those possessing "stone age" technology, see Stout, 2002). Moreover, *Homo sapiens* are the only species that make tools to make tools. Is consciousness required for these accomplishments, and if so, how did it evolve?

Mithen (1996) proposed that, with the advent of language, "social intelligence starts

being invaded by non-social information, the non-social world becomes available for reflexive consciousness to explore" (p. 190). In other words, people are able to represent their thoughts and actions to themselves (or re-representation, following the arguments of Karmiloff-Smith, 1992). For Mithen, with consciousness, general intelligence now serves to integrate the various modules of the mind (e.g., social, technological, natural history) and, with this integration, permits the construction of tools and the transmission of knowledge in a way unprecedented in the animal world. With consciousness, our ancestors could reflect on what they knew, using information acquired in one domain to bring to bear on issues in other domains. Learning can extend beyond the immediate context and be applied to situations only imagined or in one's memory.

The extension of learning is likely an important consequence of consciousness. Self-awareness is, of course, not necessary for complex learning to occur. But much of what makes human beings unique is our educability, our ability to acquire information and procedures for solving problems that our ancestors never encountered (see Bjorklund & Bering, 2000). Relevant here is Geary's (1995) distinction between biologically primary and biologically secondary cognitive abilities. Biologically primary abilities refer to those cognitive mechanisms that have undergone selection pressure over the course of evolution. The abilities themselves and their developmental timetable are species universal, they are acquired via routine interaction with the environment, and children are highly motivated to execute them. Language is a prime example of a biologically primary ability. In contrast, biologically secondary abilities are those a culture "invents" to solve particular recurrent problems. They have not undergone selective pressure and thus are not universal; they are based on biologically primary abilities, but often require substantial practice to achieve, and children may need external motivation to execute them. Reading is a good example of a biologically secondary ability. Most of the cognitive accomplishments associated with culture can be considered to be biologically secondary abilities.

As defined, human beings may not be the only species to display biologically secondary abilities; chimpanzees, as we noted previously, pass on unique cultural knowledge from one generation to the next (Whiten et al., 1999), and such accomplishments as nut cracking and termite fishing can be considered to reflect biologically secondary abilities (Bjorklund & Bering, 2003a). But it is human beings who have made the most of culturally acquired cognitions, and this has been achieved, we argue, through consciousness. The acquisition of such skills as reading, arithmetic, navigation, coordinated hunting, and external forms of memory (such as pictures, or even intentionally placed cues designed to prompt memory) all required a degree of self-regulation and secondary representation not available without consciousness. Self-awareness, by itself, may not be sufficient for the successful execution of biologically secondary abilities. Individuals required the ability to sustain attention and to avoid distraction (i.e., to stay "on task") and to have sufficient working memory to achieve many secondary skills. These are abilities that likely evolved with increased brain size (e.g., Bjorklund & Harnishfeger, 1995) and may have been necessary for the emergence of consciousness and higher-order cognition. But the consciousness initially applied to social intelligence was eventually applied to other domains, and the result was an animal that created a complex and rapidly changing culture, which affected its members' inclusive fitness more than its biology.

The Challenges of Consciousness

OTHER MINDS, NEW PROBLEMS
As we have commented earlier, however, possessing consciousness may have its drawbacks. For one thing, if consciousness provides a window to one's own thoughts and educated guesses to the thoughts of others, it is highly likely that those "others" possess the same insight. This makes social intercourse all the more complicated, particularly

for one who may be less proficient at "mind reading" than others. Because intentional states are actually the causes of behavior, any ineffectiveness in taking these states into account when strategically interacting with others who are also able to detect intentionality would be highly detrimental. If other individuals do employ such knowledge effectively (i.e., to adaptive ends) while the self merely represents others' mental states and perseveres with its old unconscious devices, then unavoidably the self's genetic fitness would become reduced significantly. For the successful organism, however, the structured and organized use of intentionality – again, a categorically new brand of social information perhaps undetectable by any other species – may have elaborated these already existing psychological adaptations by applying strategic inferential mechanisms involved in assessing other agents' motives (Haslam, 1997).

COUNTER-INTUITIVE CHALLENGES OF CONSCIOUSNESS

In addition to the problems of dealing with other self-aware conspecifics, there may also be some counter-intuitive detriments of self-consciousness. According to Trivers (1981, 1985), being self-conscious of certain proximate, socially proscribed motivations could put someone at a disadvantage relative to those who were able to mask these intentions through either self-deception or through the targeted loss of conscious access to such motives. In effect, self-consciousness began to interfere with adaptive functioning in the social domain. The ability to represent one's own selfish intentions and motives can seriously disrupt the efficiency of adaptive behaviors because these motives must be well hidden from others for adaptive outcomes to occur. Because emotions are closely tied to intentions, the ability to engage in adaptive social behaviors may be affected negatively by having these selfish intentions "leak" through behavior (Ekman & Friesen, 1975). Social partners may be able to detect ulterior motives through a variety of subtle, affectively induced behavioral cues, such as a higher than normal tone of voice, avoid-

ance of eye contact, and defensive posturing. Because individuals who leaked these cues in the environment of evolutionary adaptedness were less able to deceive others in the interest of their own genetic fitness, individuals who were able to deceive *themselves* about their own selfish motives may have been at a select advantage. These latter individuals possessed a new type of psychological adaptation – self-deception – that essentially militated against the behavioral effects of having knowledge of their own socially maligned intentions. As a consequence, they could deceive others more effectively in the service of their own genes (Nesse & Llloyd, 1992; Trivers, 1981, 1985). Trivers (1981) therefore reasons that "the mind must be structured in a very complex fashion, repeatedly split into public and private portions, with complicated interactions between the subsections" (p. 35).

Interestingly, implicit in this rationale is the suggestion that the "unconscious" of the Freudian variety has a more recent phylogenetic history than does consciousness, essentially emerging to serve as a repository for those self-epistemological states that may seriously hazard people's biological success. In addition to Freud, the existential philosopher Kierkegaard (1946/1849) seemed to capture these ideas when he wrote in *The Sickness Unto Death* that "with every increase in the degree of consciousness, and in proportion to that increase, the intensity of despair increases: the more consciousness, the more intense the despair" (p. 345). For the contemporary evolutionary psychologist, this despair is probably defined in terms of intrusive higher-order thoughts that interfere with an individual's adaptive information processing. Although interpreting correlations is an inherently difficult task, neurobiological findings of shrinkage in hippocampus volume in adult women who experienced childhood sexual abuse *and* who have also been diagnosed with post-traumatic stress disorder may support hypotheses arguing for an adaptive role of unconscious processes (Bremner et al., 1999; but see Gilbertson et al., 2002). Repression of such traumatic experiences so that they

are inaccessible to declarative memory may help sustain brain regions devoted to short-term and autobiographical memory.

In another hypothesis, Burley (1979) has argued that, with the onset of consciousness, women who could detect the physiological cues signaling ovulation in their own bodies might begin consciously regulating their birth cycles. The likely result of this purposeful regulation is fewer pregnancies, which, although satisfying the "egocentric" interests of individual women (e.g., avoiding pain, having a manageable family size, accruing enough resources before having children), would also be necessarily detrimental to the genetic fitness of these same women. Indeed, some women, according to Burley, would fully exploit these physiological indices and avoid pregnancy altogether by continually abstaining from intercourse near the time of ovulation. Natural selection might have therefore concealed ovulation from women's conscious awareness, eliminating estrus and sharply reducing their sensitivity to this critical reproductive period. In fact, evolutionary psychological research indicates that ovulating women, who are not taking oral contraceptives, are more sexually receptive, as reflected by their emotional ratings of the smell of androstenone (e.g., Grammer, 1993) and also their dress and social signals, than are nonovulating women.

What is interesting about these accounts is that consciousness is considered to pose adaptive challenges to human beings, rather than to facilitate their genetic fitness. This argument flies in the face of any theorist who has ever boasted that human consciousness represents the pinnacle of evolutionary achievement. In contrast, in many regards, self-consciousness seems to be a maladaptive trait, providing individuals with access to information that causes them to engage in biologically poor decision making that disrupts their ability to carry out adaptive behaviors. Because self-consciousness tampered with evolutionarily stable behavioral patterns, it is very possible that self-consciousness was an evolutionary byproduct of some other adaptive system or adaptive trend in the human brain, rather

than a trait that evolved directly through natural selection. As we have suggested previously, self-consciousness may, for example, have been an outgrowth of a dramatic expansion of the frontal cortex during hominid evolution, a highly adaptive trend that greatly increased the general intelligence and planning abilities of these species (Banyas, 1999; Luria, 1973). In line with this, self-consciousness may rightly be considered an "all or nothing" phenomenon, rather than appearing in stages and degrees over the course of phylogeny. As Humphrey (1992) puts it, "There must have been a threshold where consciousness quite suddenly appeared – just as there is a threshold that we ourselves cross in going from sleep to wakefulness" (p. 206).

If self-consciousness emerged as an unavoidable byproduct of such a cortical expansion, it may not have been easily "removed" by natural selection because such a reorganization of the brain might have come with costly adaptive tradeoffs. Instead, it may have been more economical for nature to have "allowed" human consciousness by keeping the species' evolved neural organization intact while hammering out a series of constrained, novel psychological adaptations that were specifically designed to handle the new adaptive problems of consciousness.

This approach to consciousness differs substantially from those who have been searching for an adaptive explanation for the presence of such a representational capacity. For instance, in a discussion on the adaptive value of introspection, McGuire and Troisi (1998) note,

> There are good theoretical and empirical reasons for doubting the accuracy of introspections; the workings of most infrastructural systems are not available to awareness despite often heroic efforts to make them so. Nevertheless, it is reasonable to argue that a capacity that can so influence how we think, feel, and act is unlikely to have appeared by chance. Most persons introspect; most give credence to their introspections; and introspections often trigger strong emotions (e.g., shame) (p. 125).

Consciousness as a Double-Edged Sword

As we noted above, consciousness had its advantages, despite its apparently considerable disadvantages. The evolution of consciousness might have been responsible for a fundamentally novel set of psychological adaptations – specialized cognitive systems that went through the sieve of natural selection and that made human beings qualitatively distinct from other closely related species, such as chimpanzees. Once armed with these psychological adaptations that were specially fitted to the problem of consciousness, human beings were poised to become an enormously successful species, ultimately capable of radiating widely across both hemispheres and easily outcompeting competitor species. To this end, consciousness was a "blessing in disguise" because it forced heritable potentialities in individual members of the species that, in concert with consciousness, enabled these organisms to harness fitness advantages that occurred at unprecedented evolutionary rates. That is, once consciousness became "manned" with an ensemble of psychological adaptations that were functionally designed to operate it, the information made accessible by self-consciousness (i.e., the proximate causes of behavior) could be systematically controlled and exploited by the species.

We believe that this interpretation of the evolution of consciousness can go some distance in answering the following important question posed by Pinker (1997, p. 132): "If consciousness is useless – if a creature without it could negotiate the world as well as a creature with it – why would natural selection have favored the conscious one?"

On the Reorganization of More Ancient Primate Adaptations

How Previously Adaptive Social Behaviors Became Socially Maladaptive in Modern Human Beings

We propose that new psychological adaptations emerging in response to the evolution of consciousness were woven into an ancestral tapestry containing more ancient psychological adaptations (Povinelli, Bering, & Giambrone, 2000). It is this synchronic existence of the old and the new that characterizes human behavior and the breakdown of which results in dysfunctional consequences. Failure to adequately defend the self from knowledge of its own biologically oriented intentional states may lead to psychopathy (Becker, 1974; Fábrega, 2002). For instance, human males appear to have inherited ancestral adaptations for female sexual coercion (Thornhill & Palmer, 2000), but these ancient adaptations must peacefully coexist with more recently evolved psychological systems that enable others to infer males' sexual intentions and to rapidly transmit information dealing with socially proscribed behaviors. Under these social conditions, the inhibition of certain ancestrally adaptive behaviors, such as sexual coercion, becomes adaptive, and the evolution of psychological mechanisms (e.g., moral emotions such as guilt and shame) capable of disengaging such phylogenetically older responses becomes essential. This coexistence of ancient primate adaptations with recent human psychological adaptations is not well understood, as demonstrated by the recent statements of primatologist de Waal (2002):

> A major problem with the strategy of singling out rape for evolutionary explanation is that the behavior is shown by only a small minority. The same criticism applies to Daly and Wilson's (1988) well-known work on infanticide by stepparents...If child abuse by stepfathers is evolutionarily explained, why do so many more stepfathers lovingly care for their children than abuse them? And if rape is such an advantageous reproductive strategy, why are there so many more men who do not rape than who do? (p. 189, italics in original).

In fact, the relative rate of sexual coercion *should* drop off substantially once encroached upon by a representational system capable of tracking the self's intentions and also the intentions of others. In other primate species, such behaviors as forced copulation and infanticide may lead to retaliatory

attacks, sometimes lethal, by offended higher-status parties who have direct perceptual access to such incidents (de Waal, 1982; Goodall, 1986; Kummer, 1971). However, (a) the inability of potential "victims" to perceive the hidden, aggressive intentions of potential "perpetrators"; (b) the inability of perpetrators to track others' knowledge of their behaviors; and (c) the inability of observers to intentionally communicate the occurrence of these transgressions to naïve others who did not witness the event foster a high level of frequency of such behaviors in non-human primates. Indeed, by all accounts, such behaviors almost certainly will occur whenever the conditions are "right" – that is, when dominant animals, or those with connections to dominant animals who may recruit others to the event through various alarm displays, are absent, making retaliation unlikely to occur.

This changes dramatically, however, with a species such as *Homo sapiens*, for whom social information is capable of being transmitted rapidly between parties far removed from the actual behavioral incident (Dunbar, 1993), and individuals (any one of whom is a potential perpetrator) are knowledgeable to this extent. In such cases, retaliation for social transgressions is likely to ensue as a direct consequence of others gaining knowledge of the proscribed behavior. What is defined as a transgression is going to be determined by the various socioecologies of different groups. However, in general such judgments will be made for those behaviors that pose a clear and present danger to the fitness interests of individual members of a community such that group functioning is adversely affected and may not adequately sustain the needs of individuals within the group as long as the behavior is allowed to occur. It is difficult to imagine any human socioecology where rape, homicide, and child abuse would not meet these criteria. But the real confound is the fact that, for human beings, the possibility of retaliation is no longer just a matter of who was physically present at the time of the transgression but also who *else* knows what *Agent A* did to *Agent B*; what these others believe *Agent A's* intentions were in doing

so; whether others know about or what they believe about *Agent A* engaging in similar behavior in the past; whether others believe *Agent B* "deserved" such treatment; whether others believe *Agent B* experienced physical or psychological pain from *Agent A's* behavior; whether others believe *Agent A's* behavior is diagnostic of a stable personality characteristic and is thus likely to occur again; whether *Agent A* knows something of relevance about those who know about the behavior and can use this information strategically; whether others believe *Agent A's* behavior was caused by his own intrinsic traits or was governed by the circumstances surrounding the event; whether others believe *Agent A's* claims about the causes of his own behavior; whether others believe *Agent A's* displays of remorse over or regret about his behavior are sincere; whether others believe *Agent A* possesses specialized knowledge that makes him valuable; and whether *Agent B* might have possessed such knowledge. In contrast, individual members of non-human primate species may have "witnesses" to their social transgressions in the technical sense of the term, but such witnesses pose minimal risks to genetic fitness given their inability to represent the epistemic states of those who did not perceive the proscribed incident.

This functional synchrony between old and new psychological adaptations should not be terribly surprising when considering the species' recent phyletic history. In terms of their general morphological characteristics, human beings seem to have undergone what Mayr (2001) refers to as *mosaic evolution*, which is "evolutionary change that occurs in a taxon at different rates for different structures, organs, or other components of the phenotype" (p. 288). That is, aside from a handful of trademark characteristics, *Homo sapiens* has remained largely unchanged at the level of its structural appearance from the time it last shared a common ancestor with the great apes. Derived traits distinguishing the species from other primates evolved mostly independently of those ancestral traits – the "morphological bulk" – that are responsible for the taxonomic classification of human

beings as primates. Human beings continue to share with the African apes a basic *bauplan*, or body plan, where the only distinctly human characteristics are differences in the proportions of the arms and legs, the mobility of the thumb, amount of body hair, skin pigmentation, the size of the central nervous system and, related to this, the reduction in prognatic facial features (Mayr, 2001). By all accounts, human beings are primates first and hominids second; some scholars have even argued that the molecular differences between human beings and chimpanzees are too minimal to warrant classification as separate genera (Diamond, 1992).

It is unlikely that gross similarities and a small subset of novel derivations are limited to physical characteristics, however. Consciousness-based psychological adaptations in human beings have continued to interact with many of the cognitive programs supporting adaptive behaviors in non-human primates. This explains why human beings share so many behavioral patterns with chimpanzees and the other great apes, as we noted above. According to Povinelli and his colleagues (Bering & Povinelli, 2003; Povinelli, 2000; Povinelli et al., 2000), the ability to represent the underlying intentional states promoting these adaptive behavioral patterns (e.g., those involved in reconciliation, coalition formation) enabled human beings to reinterpret the separable actions comprising them in fundamentally novel ways. This reinterpretation process in turn led human beings to adopt new sets of behaviors that were qualitatively different from the evolved action configurations upon which they were based.

For example, human beings share with chimpanzees a number of gestural displays that are morphologically identical between the two species (see Povinelli, Bering, & Giambrone, 2003). One of these displays is the holding-out-a-hand gesture that is used by chimpanzees to recruit allies, to solicit reconciliation, and to seek physical contact with conspecifics (Bygott, 1979; de Waal, 1982). Without an attending higher-order cognitive system that enables the representation of the intentional states causing such behavior, however, the gesture cannot take on any referential meaning. That is, although it serves adaptive ends (e.g., promoting physical contact such as grooming and consequently allowing subordinate chimpanzees to avoid future conflict with rivals), those chimpanzees receiving this communicative sign will fail to recognize the "aboutness" of the gestural display. This can explain why chimpanzees in the wild have not been observed to engage in referential gesturing (e.g., Plooij, 1978). To understand the referential nature of communicative displays, organisms must first be capable of representing those unobservable causal states that are behind intentional actions (Baldwin, 1991, 1993).

For instance, the holding-out-a-hand gesture that human beings inherited from an ancestral primate species is reinterpreted as being an intentionally communicative display (Povinelli et al., 2003; see also Franco & Butterworth, 1996; Vygotsky, 1962). Adult caregivers, for example, who witness their young infants extending their hand toward an out-of-reach object on the ground will automatically attribute the gesture to the infant's *wanting* the object and will subsequently retrieve it for them. Some theorists have even speculated that indexical pointing naturally emerges in ontogeny because there is a differential extension of this finger in the human hand (Itakura, 1996; Povinelli & Davis, 1994). The index finger is essentially "pulled out" by parental response during the course of early reaching attempts; those reaches that contain more explicit indexical extensions are interpreted more readily by caregivers as communicatively meaningful. Such indexical extensions may then be co-opted to provide a more accurate referential trajectory when engaging in both imperative and declarative communicative attempts using pointing.

Comparative experimental analyses of chimpanzees' and human beings' comprehension of pointing provide support for Povinelli's reinterpretation hypothesis (Povinelli et al., 1998). Chimpanzees that are confronted with a human experimenter who is pointing to the correct location of a hidden food reward fail to understand the communicative intention of this action. Rather,

they choose a location to which the experimenter's hand is physically nearest, even though the pointing gesture clearly references a distal location. In contrast, 2-year-old children easily interpret the referential intent of the experimenter and are able to find the hidden prize in the distal location.

This principle is captured by Dennett's (1987) concept of the *intentional stance*, which essentially describes human beings' intuitive causal reasoning about the underlying reason, or purpose, that the designer of the action had in mind. Specifically, human beings appeal to the mental states of others when attempting to explain their actions. There is an intentionality that underlies all purposeful behavior; this intentionality consists of the range of proximate causes (e.g., emotions, cognitions, perceptions) to which the agent in question has conscious access. Povinelli reasons that, with the evolution of human beings, an awareness of this underlying intentionality engendered a new way of thinking about others' behaviors, where explanatory searches are intuitively launched in pursuit of the proximate causes of behaviors. This explanatory drive is extremely powerful in human beings and seems to extend to the physical domain as well (Baillargeon, 1994; Spelke, Breinlinger, Macomber, & Jacobson, 1992). Gopnik (2000) has argued that the need to understand the causes of events is automatic, compulsive, and affectively based. This argument puts intuitive explanatory theorizing about the causes of events in line with Geary's biologically primary abilities. A biologically secondary ability in this domain might be scientific explanation, which builds on the natural explanatory drive but which is cognitively effortful, requires extensive practice and training, and is mastered by only a subset of the species' population (McCauley, 2000).

The Evolution of Qualitatively Unique Psychological Adaptations in Human Beings

In addition to adding increasing complexity to pre-existing adaptations, metarepresenta-tion seems to have also constructed several fundamentally novel psychological adaptations that are entirely based and dependent upon this competency. For instance, although there are several species, particularly insects, where individual organisms systematically increase their own risk of mortality in the face of threats of inter-species predation to their larger colonies (e.g., Andrade, 1996; Holmes & Bethel, 1972; McAllister, Roitberg, & Weldon, 1990; McAllister & Roitberg, 1987; O'Connor, 1978; Poulin, 1992), human beings seem to be the only species where individual members commit suicide in response to the negative social appraisal of conspecifics. Although suicide is a leading cause of death in human beings, it is completely unheard of in other primate species beyond highly questionable anecdotal accounts. According to some theorists, shame is both the best predictor of suicide and its primary determinant (Lester, 1997). The capacity to experience shame requires self-consciousness in that it is an emotional reaction to negative self-appraisal (Gilbert, 1998; Tangney, 2001). Indeed, Baumeister (1990) has even referred to suicide as "escape from self." In addition, shame assumes metarepresentational abilities because it is a *secondary social emotion*, centering on others' perceptions and knowledge about the self's negative traits (Tangney, 2001).

These factors are interesting in light of the current discussion because suicide has been implicated as a probable adaptation facilitating inclusive fitness. In his "mathematical model of self-destruction," de Catanazaro (1986, 1987, 1991, 1992; see also Brown, Dehlen, Mils, Rick, & Biblarz, 1999) has shown that suicide is positively correlated with genetic burdensomeness to close kin; individuals whose lives negatively affect the reproductive opportunities of family members are significantly more likely to commit suicide than others. Adaptations subserving inclusive fitness are fairly common among various species (Hamilton, 1964); however, psychological adaptations involving human suicide promote inclusive fitness in a qualitatively different manner because they are

dependent on access to the informational reservoir of intentionality. Human beings seem to be unusual among other primates in that the representation of another conspecific's mere thoughts, or the misperception of their thoughts, can engender affective reactions in the self that are translated into actual behavior. One such behavior is suicide, and it is therefore difficult to reason that consciousness serves only the role of an epiphenomenon in this case.

The Evolutionary Significance of the Mechanism of Consciousness

To state that the mechanism of consciousness is responsible for certain psychological adaptations is to say that, without having the means to access the type of information we are calling intentionality, many human behavioral patterns could simply not have evolved. This is the position that we endorse and also one that, we believe, most evolutionary psychologists would accept as well. However, we make no claims that people's explanations for their own behaviors must be correct (i.e., biologically relevant) for self-consciousness to have been a meaningful component of natural selection. Because there is overwhelming evidence that people do not understand the biological relevance of their own adaptive behaviors (see Buss, 1999; French et al., 2001), evolutionary psychologists rightly reject this notion of *propositional veracity*. This is typically what evolutionary psychologists are referring to when they state that self-consciousness has had little to do with the evolution of adaptive human behaviors. People do not need to know why they do what they do in order to behave adaptively (e.g., "I find my wife sexually attractive because she possesses features that indicate our mutual offspring will likely be resistant to parasites"). The *capacity* to ascribe intentions and beliefs to the self and to others, however, is something altogether different from this use of the term "consciousness" and *is* a pivotal element that is required for many adaptive human behaviors to occur (e.g., "I don't think Kevin is sincere about his intentions to marry my sister,

so I'm going to discourage her from seeing him again").

Although there is disagreement over the precise developmental mechanisms by which children come to understand the existence of other minds (e.g., Wellman, 1990), it seems reasonable to assume that gaining access to the type of information provided by self-consciousness (i.e., the self's own intentions), at the very least, would *facilitate* an understanding that others' behaviors are caused by similar means. It seems implausible to us that an ensemble of adaptive heuristics concerning various relationships between other people's behaviors and the causal states generating them could be adequately developed by an organism that does not first have the intellectual device required to conceptualize the general category of causal states (i.e., intentionality) in question. Theories are only as useful as the concepts that they contain; without an ability to conceptualize those mental constructs that are correlated to specific types of behaviors (e.g., "Jakob opened the cabinet because he *thought* that's where the bananas were"), such theories, whether wrong or right, simply could not be constructed.

Children's conceptual knowledge about mental states might become progressively enriched through language (see Tomasello & Bates, 2001) and also through personal experience involving intuitive hypothesis testing (Gopnik & Meltzoff, 1997), but such elaboration can only build on a basic capacity to represent such states to begin with. As Bloom (1998) writes, "Language is a tool for the expression and storage of ideas, but not a mechanism that could give rise to the capacity to generate and appreciate these ideas" (p. 215). This is supported by strong evidence of preverbal infants' abilities to attribute goals and intentions (Carpenter, Akhtar, & Tomasello, 1998; Meltzoff, 1995; but see Huang, Heyes, & Charman, 2001). By 9 to 12 months of age, human beings seem to be sensitive to the fact that intentional agents engage in goal-directed actions, that their behavior is teleological, and that their actions are self-generated. Throughout early ontogeny, children's understanding of

intentionality becomes increasingly enriched, so that by the age of 4 years, they are able to represent the beliefs and knowledge states of other individuals and predict and explain their behavior on these grounds (see Wellman et al., 2001). Although slight differences may exist among societies in the relative rate of acquisition of such social cognitive skills, as well as the emphasis that is placed on the types of mental state attributions that are made, the development of this "theory of mind" system runs a standard epigenetic track across human societies (Tardif & Wellman, 2000; Wellman et al., 2001; see also Lillard, 1998).

To help illustrate, consider a case where, unlike mental states, the ability to naturally detect adaptively relevant information is an impossibility for human beings. The human sensory system is unable to detect dangerous levels of carbon monoxide, an odorless, colorless, tasteless gas that results from the incomplete combustion of hydrocarbon fuels. Carbon monoxide binds with hemoglobin with an affinity about 250 times that of oxygen, interfering with oxygen transport, delivery, and utilization. At high levels of exposure, carbon monoxide can lead to loss of consciousness, coma, and death.

From an evolutionary perspective, hydrocarbon fuels are apparently too recent an innovation for human beings to have evolved sensory capabilities designed to detect high levels of carbon monoxide. As a result, victims receive no obvious sensory warning that dangerous levels are present in the environment. If such information were accessible (e.g., through olfaction) and also present in ancestral conditions, natural selection would have likely favored those individuals who responded to the presence of carbon monoxide in adaptive fashion. Without such ability, however, no adaptive mechanisms associated with such toxic environmental conditions have evolved, and contemporary individuals are seriously threatened by this poisonous gas.

Fortunately, human beings have developed fairly effective strategies of detecting high levels of carbon monoxide by artificial means. Electrochemical devices, for instance, contain platinum electrodes embedded in an electrolyte solution, the combination of which creates a sensor that is designed to react with carbon monoxide molecules and to sound an auditory alarm when the gas is present. There is also, of course, the proverbial canary in the coal mine, whose odd behavior or death in poorly ventilated mining shafts serves to alert workers of dangerous levels of carbon monoxide.

To some extent, self-consciousness is similar to this canary in the coal mine, in that it provides us with conceptual access to a hidden source of information that has consequences for our genetic fitness. The canary provides us with access to information (carbon monoxide) in the external environment (the coal mine), whereas self-consciousness provides us with access to information (proximate causal states) in the internal environment (the mind). What is adaptive is not simply having access to these types of information, however, but rather how that information is translated into the production of actual behavioral responses. Merely "being" self-conscious without having functional psychological adaptations designed to respond to and control the flow of information dealing with the self's proximate causal states is like ignoring the dead canary in the coal mine. Information is only as useful as the psychological adaptations that are designed to harness and exploit it (for complementary accounts of consciousness, see Damasio, 2002; Frank, 1988).

The analogy falls short, however, in that self-consciousness provides human beings with access to information without requiring an artificial means of detection. The detection mechanism is naturally entrenched in the human cognitive system and does not rely on metaphors or external devices. Rather, the same concepts that are used to construct adaptive theories about other peoples' behaviors are also the ones represented through first-order psychological experiences.

The Serpent's Gift

"But the serpent said to the woman, 'You will not die. For God knows that when you eat

of it your eyes will be opened, and you will be like God, knowing good and evil.' So . . . she took of its fruit and ate; and she also gave some to her husband, and he ate. Then the eyes of both were opened, and they knew they were naked" (Genesis 3: 4–7, Revised Standard Version).

The serpent's gift was self-knowledge, and with it the knowledge of others and the ability to acquire a knowledge of right and wrong. Nature is amoral. We may shudder at the way chimpanzees tear apart a colobus monkey they have caught or feel revulsion that a male lion kills the cubs sired by another when it acquires a new mate. But those emotions are uniquely human, and we do not judge as immoral the chimpanzee or the lion for acting in its own best genetic interest. With consciousness, however, comes social proscriptions. Actions can now be right or wrong, moral or immoral, even if they are executed in, what in ancient times, would have been our own best interest. Stepfathers still murder their stepchildren at rates many times greater than that of biological fathers (see Daly & Wilson, 1988), something the male lion might understand (if he were conscious). But with the advent of consciousness this behavior is now wrong, and because it is not socially sanctioned, it is rare in an absolute sense. Theft, adultery, assault, and murder still happen with high frequency in all societies (although rates differ considerably among societies), and most societies have proscriptions against them and punishment for transgressors who are "caught in the act." Although most of us believe that there are some universal human rights, a look at the variety of behaviors that are judged as moral and immoral, legal and illegal, in cultures around the world suggests that this may not be so. For example, although modern Westerners are aghast by infanticide, it is expected, under some circumstances, in some cultures (see Hrdy, 1999); the treatment of women varies considerably across cultures and history, each culture believing that its view is the morally correct one. (According to Genesis, it was woman who first ate of the tree of knowledge, and this has influenced her status in many cultures over the past two millennia.)

So consciousness did not provide a moral code, but it did provide the ability to see things from another's perspective, and with it the knowledge of good and evil, at least as defined within a particular society.

Consciousness also provided a view of the mind of the gods. With consciousness comes the need for explanation. We look for causes, for intentionality, not only in the actions of others but also in the events that surround us. If Homer's behavior is motivated by his knowledge or his wishes, might not the behavior of lightning or rain be motivated similarly? There is a reason for everything, our consciousness tells us, and in prescientific days it was the gods or spirits that made things happen – gods or spirits we imbued with human-like motivation through our theory of mind.

The Role of Consciousness in Religion: Spirits, Gods, and Morality

Our ancestors' behaviors were mediated not only by the social forces that be, as are chimpanzees' behaviors, but also by the assumptions that people made about what was appropriate and inappropriate, moral and immoral, evil and righteous. These beliefs were supported by intuitions about fairness and injustice, but were also strongly enforced by the community's shared belief in supernatural agents who were envisioned as having a vested interest in moral affairs. Some of these deontological assumptions, such as "one should never steal," were universal in nature because they contravened the fitness interests of individual members of any social group. Other deontological assumptions, such as "one should never disobey one's maternal grandfather," were limited to individual cultures, because in some societies following such orders was adaptive whereas in other socioecologies it was either maladaptive or not sufficiently adaptive to be supported through custom (Reynolds & Tanner, 1995).

Although subscribing to these moral and conventional rules led to social harmony in the group, which ultimately subserved the individual interests of in-group members, people were easily tempted to go astray,

especially when they felt that they were not being observed by social others and when they could benefit through transgressing. Unfortunately, human beings have never been especially good at avoiding detection, and they are prone to overestimating their ability to deceive others. Such errors can be genetically catastrophic, because the payoffs for a successful social transgression (e.g., stealing a neighbor's food) are not necessarily worth the risk of getting caught and facing the punitive actions of the other ingroup members.

Under conditions where individuals are uncertain of the presence of social others and are presented with opportunities to increase their own genetic fitness at the expense of others, there was likely selective pressure for a heuristic strategy leading to the inhibition of the socially proscribed behavior. If individuals are inclined to represent the presence of some supernatural agency that has "privileged" perceptual access to the transgressor's behaviors and that is also capable of responding to these actions in the form of aversive life events, then this might facilitate the inhibition of the social transgression, therefore promoting an adaptive outcome. In fact, Pascal Boyer (1994, 2001; also Atran, 2002; but see Bering, 2002) has shown that human cognition is naturally susceptible to supernatural agent concepts because such concepts violate people's intuitive ontological assumptions. For example, gods and spirits are represented as being essentially human and as such activate our folk psychology systems (e.g., they can see and hear and think), but gods and spirits also violate our intuitive assumptions about other agents (e.g., they are invisible). Such scholars as Boyer (2001) and Atran (2002) have argued that religious concepts gain their entrance to mundane cognitive mechanisms through such attention-grabbing properties.

Concluding Remarks

A central challenge for evolutionary approaches to consciousness is devising empirical procedures that address its functional role in various psychological adaptations. Although the works of Trivers on the origins of defense mechanisms and that of Burley on the loss of human estrus, for instance, are regarded as highly plausible, such models have yet to be validated through empirical means. Comparative analyses between human beings and closely related species, such as chimpanzees, can be extraordinarily informative in this regard.

Although there may be few classes of behavior that are truly unique to human beings, there are numerous categories of natural social behaviors that occur cross-culturally in human beings that are rarely observed, or altogether absent, in closely related species. Suicide is one such case, but feral chimpanzees have also not been observed to manufacture symbolic artifacts; to partake in non-functional, group-specific ritualistic behavior; to translate their developmentally canalized repertoire of vocalizations into new strings of communicative meaning unique to certain populations; to physically care for ill, maimed, or otherwise importuned conspecifics; to engage in juvenile pretend play; to construct material (i.e., clothing) designed to cover their anogenital region; to kill or conspire to kill others who possess damaging knowledge; or to cooperate to solve novel problems. Even pointing behavior (for either declarative or imperative purposes) and direct teaching of novel tasks have only rarely been observed in chimpanzees (e.g., Boesch, 1991), and even these have been questioned (see Povinelli et al., 2000).

All of these behaviors (and others) are considered standard fare in human groups, whether small hunter-gatherer societies or large industrialized nation-states. What is important is that each of these categories of adaptive behaviors requires the presence of a functionally organized intentionality system that not only provides individuals with access to the hidden causes of behavior but also leads them to engage in adaptive behaviors. We have proposed throughout this chapter that consciousness endowed human beings with information *sui generis* in the form of mental states, and that once

consciousness became standardized in human cognition, a new suite of adaptive behaviors, such as those listed above, evolved to satisfy its unique demands. There are no "precursory forms" of such behaviors in other primates because human beings alone faced the adaptive challenges of consciousness that led to their regular appearance in the species.

Note

1. Paleontologists refer to chimpanzees as a "conservative species," suggesting that they have changed relatively little over the past 7 million years, making them a reasonably good model for what our common ancestor may have been like.

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