#### CHAPTER 10

# The Capacity for Religious Experience Is an Evolutionary Adaptation to Warfare

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If we were forced to say in one word who God is and in another what the Bible is about, the answer would have to be: God is a *warrior*, and the Bible is about *victory*.

—Jack Miles, God, A Biography (1995, p. 106)

Recent events have reinforced a pattern observable for at least the past 6 millennia: that religion and warfare are tightly, perhaps inextricably, intertwined. Even a cursory review of the history of wars and warlike conflicts indicates that religion has played a central role in these events. The common use of words and phrases such as "crusade," "holy war," and the now-infamous "jihad" point to the intimate connection between religion and warfare. From the most exalted "god-kings" to the lowliest "grunts" in the foxholes (where, as tradition tells us, there are no atheists), religion has both accompanied and facilitated warfare.

That religion and warfare are at some level related is virtually undeniable. What is less obvious at first glance is the quality of this relationship; is it causal, and if so, in which direction? There are at least three possibilities:

- · Religions cause wars,
- · Warfare promotes religion, or
- Both religion and warfare are causally linked to other, more general causative factors.

However, a more sophisticated analysis may indicate that religion and warfare are both cause and effect of each other. That is the thesis of this chapter: that the capacity for religious experience exists among humans primarily because it has facilitated warfare, which in turn reinforces the underlying causes of religion. In other words, the human capacities for religious experience and warfare have adapted to each other in a co-evolutionary spiral that has made individual and group mass murder and suicide virtually inevitable, given prevailing ecological subsistence patterns.

## The Capacity for Religion Is an Evolutionary Adaptation

In *The Descent of Man*, Darwin argued that humans do not have an innate instinct to believe in God:

The belief in God has often been advanced as not only the greatest, but the most complete of all the distinctions between man and the lower animals. It is however impossible ... to maintain that this belief is innate or instinctive in man. (1871, p. 612)

He based this conclusion on the widespread observation that many human cultures do not include a belief in a deity that can be interpreted as being in any way conceptually similar to the monotheistic Judeo-Christian God. However, Darwin went on to point out that "a belief in all-pervading spiritual entities seems to be universal; and apparently follows from a considerable advance in man's reason, and from a still greater advance in his faculties of imagination, curiosity and wonder" (p. 612).

Implicit in Darwin's argument is the idea that only species-wide behavior patterns can legitimately be thought of as evolutionary adaptations. This is a common assumption among both ethologists and evolutionary psychologists, and in my opinion is at best misguided. I prefer G. C. Williams's definition of an adaptation: "An adaptation is any trait that enhances fitness and [has been] modified by selection to perform that role" (1966, p. 4). However, even this definition is somewhat muddied by the inclusion of the term "fitness." The working definition for "evolutionary adaptation" that will be used throughout the rest of this chapter is as follows:

• **An evolutionary adaptation** is any heritable phenotypic character whose frequency of appearance in a population is the result of increased reproductive success relative to alternative versions of that heritable phenotypic character.

Let us set aside for the moment the question of how such phenotypic characters are inherited. As we will see, this is not a trivial question, but one that in the long run does not fundamentally alter the argument I am about to make. Given this definition of evolutionary adaptation, it should be immediately clear why pan-specificity alone is a poor criterion for determining whether some character is an adaptation.

Implicit in this definition of evolutionary adaptation is the idea that there is some real (i.e., nontrivial) *variation* in the phenotypic characteristics present among the members of a population. Indeed, it was the recognition of the existence of such variation, and the insistence that this variation is the basis for natural selection, that was perhaps Darwin's most revolutionary discovery. Any trait that is an evolutionary adaptation will show some nontrivial variation in the expression of that trait, from individuals who express it to a very high degree, to individuals in whom its expression is virtually unnoticeable. What appears at first glance to be pan-specificity is

actually the numerical preponderance of individuals whose expression of the trait is close to the population mean for that trait.

Is there other evidence that can be used to determine if a particular characteristic is an evolutionary adaptation? In addition to showing that the numerical preponderance of a particular phenotypic trait is the result of differential survival and reproduction, it may also be possible to link the phenotypic trait with an underlying anatomical and/or physiological substrate that is the efficient cause of the trait in question. For example, it is commonly accepted at present that the ability to speak and understand speech is an evolutionary adaptation in humans. This conclusion was originally based primarily on linguistic grounds (cf. Lenneberg, 1964, 1967; Chomsky, 1965) but has more recently been correlated with underlying neurological processes (Pinker & Bloom, 1999).

Another way of determining if a characteristic is an evolutionary adaptation is to correlate the population dynamics of the adaptation with its evolutionary environment of adaptation (Bowlby, 1969):

• The evolutionary environment of adaptation (EEA) is the ecological milieu under which a particular adaptation has arisen as the result of selection.

The concept of an EEA can be fruitfully employed when trying to determine whether a particular characteristic is an adaptation by attempting to show how the ecological circumstances prevalent in the EEA would have resulted in differential survival and reproduction. However, application of this technique is complicated by the fact that determination of the EEA of a given adaptation can be a somewhat circular process. Ideally, the circumstances of the EEA should be determined by means other than reference to a particular adaptation, followed by an analysis of the effects of the inferred EEA on the survival and reproduction of the organisms inhabiting it.

Final verification that a particular trait is indeed an evolutionary adaptation would require all of the foregoing, plus linking the appearance of the trait to an underlying gene or gene complex and showing that the frequency of the controlling gene(s) in the population in question has indeed been altered as the result of differential survival and reproduction. This is difficult to do even with very simple genetic traits, such as sickle-cell anemia. Furthermore, it may be that the causal connection between the underlying genes and the trait for which they code may be indirect at best. However, rather than abandon the concept of evolutionary adaptation altogether (as some have suggested; cf. Margulis, 1997), it may still be useful to apply Definition 1 (above) with four further qualifications:

- **Qualification 1:** An evolutionary adaptation will be expressed by most of the members of a given population, in a pattern that approximates a *normal distribution*;
- Qualification 2: An evolutionary adaptation can be correlated with underlying anatomical and physiological structures, which constitute the efficient (or proximate) cause of the evolution of the adaptation;

- Qualification 3: An evolutionary adaptation can be correlated with a pre-existing evolutionary environment of adaptation, the circumstances of which can then be correlated with differential survival and reproduction; and
- **Qualification 4:** An evolutionary adaptation can be correlated with the presence and expression of an *underlying gene or gene complex*, which directly or indirectly causes and influences the expression of the phenotypic trait that constitutes the adaptation.

Given the foregoing, we can reframe Darwin's question thusly: Is *religion* an evolutionary adaptation? This question is similar to the question, "Is speaking English an adaptation?" Clearly, speaking English is not adaptive, any more than is speaking French or Tagalog. Given Definition 1 and the qualifications enumerated above, to assert that speaking English is an evolutionary adaptation would require that one verify that individuals who speak English survive and reproduce more often than individuals who speak some alternative language. Furthermore, their differential survival and reproduction must be shown to be causally related to their speaking English, and not to some other, related characteristic, such as the ability to speak, regardless of what language is spoken.

Here is the essential distinction: the capacity to speak English (or any other language, for that matter) is quite clearly an evolutionary adaptation (Pinker, 1994). That it is so is reinforced by the fact that there are specific circuits and regions in the human brain that are dedicated to the production and understanding of speech. Damage to these structures can severely limit or even completely destroy a person's ability to speak or understand spoken language (Penfield & Roberts, 1959). Furthermore, although every neurologically normal person can learn to speak and understand speech, there is the same kind of natural variation in this capacity that Darwin first pointed out as the basis for natural selection. That is, some individuals learn to speak and understand speech with great difficulty, others do so with great facility, while the vast majority of humanity muddles through with one "mother tongue." The point here is that the *capacity* for religious experience appears to have the same characteristics as the capacity for language. While it is pan-specific, there is considerable individual variation in the capacity for religious experience, with some individuals having very high capacity, others very low, and the average person somewhere in the middle (see Qualification 1 above).

Furthermore, there is accumulating evidence that there are underlying neurological structures that facilitate religious experience. The work of d'Aquili and Newberg (1999), Newberg and d'Aquili (2001), Persinger (1987), Ramachandran and Blakeslee (1998), and Saver and Rabin (1997) all purport to find correlates between religious experiences and specific brain structures and neurological processes. The point here is not to argue for the specific neurobiology underlying the particular states described by these researchers nor to argue that the neurological states they have studied comprise the whole of what we mean by the term "religion." Rather, the fact that some psychological states identified with religious experience have been correlated with specific neurological activity in specific structures in the human brain satisfies, at least in part, the criterion enumerated in Qualification 2 (above).

Finally, is there a "religion gene" that can be shown to correlate with the capacity for religious experience and whose frequency can be shown to vary in such a way as to approximate the patterns characteristic of an evolutionary adaptation? No, nor should we expect there to be one. Only in so-called "vulgar socio-biology" are there presumed to be single genes (or even gene complexes) that code for complex human behaviors such as the capacity for speech or religion. Rather, there are genes that code for the assembly, operation, and modification of "mental modules" that bring about these complex behavior patterns.

One way to avoid the whole morass of gene-behavior linkages is to employ what Stephen Emlen has called the "correlation approach" to behavioral ecology (1976). According to this method, one may be able to "interpret and partially predict the social structure of a species on the basis of a limited set of environmental or ecological variables ... [that] impose limits on the range of types of social organization that will be adaptive" (p. 736). According to this viewpoint, "[Species] faced with similar ecological 'problems' exhibit a predictable convergence in their 'solutions,' as shown in their social organizations" (p. 737). Following Emlen's lead, we can compare the types of religious experiences and patterns of religious behaviors exhibited by humans in different ecological subsistence patterns and at different times and places. In so doing, we may find some general patterns that will point to the underlying evolutionary dynamics influencing the development of the biological and cultural mechanisms producing those experiences and behaviors.

Adaptive characteristics do not increase in frequency monotonically in populations, nor are selective pressures usually limited to one or even a few parameters. Following the lead of Sewell Wright (1968–1978), it has been very common for evolutionary biologists to model the *adaptive landscape* for a given population or species (cf. Ridley, 1996, pp. 215–219). However, what is sometimes lost in diagrams such as these is the fact that there are individual organisms represented by nearly every point on the surface illustrated. That is, not all individuals in the population have risen to the adaptive peaks in the population, nor are all of them slipping down into the troughs of maladaptation. Perhaps it would be better to imagine each individual and its descendents as a boatlike cluster of adjacent points on this surface, tossed up and down by the vicissitudes of ecological change.

In this viewpoint, it may be easier to see that some changes in the environment are much less important than others and that some shifts in adaptive character may be much more significant than others. In particular, it is quite possible for a major change in one parameter in the environment to cause a corresponding change in the adaptive characteristics of the population, swamping any effects of smaller changes. In essence, what I am describing here is an evolutionary over-ride of sorts, in which selection for one characteristic swamps selection for most or all other characteristics among the members of a population.

At this point, it appears likely that the capacity for religious experience has many of the characteristics of an evolutionary adaptation:

- the capacity for religious experience is pan-specific in humans, although there is considerable variation in this capacity, both within and between human groups,
- the capacity for religious experience has been correlated with underlying neurological structures and processes,
- the capacity for religious experience can be correlated with a known evolutionary environment of adaptation (i.e., intergroup warfare in agricultural societies, as will be discussed in more detail below), and
- although no underlying genetic mechanisms for the development of the capacity for religious experience are now known, the existence of consistent cross-cultural patterns of religious expression indicates that religious behavior is subject to evolutionary convergence in a manner analogous to other evolutionary adaptations.

## The Capacity for Warfare Is Also an Evolutionary Adaptation

Now it is time to address the other half of the co-evolutionary spiral, to whit: Is warfare (or, more precisely, the capacity for warfare) an evolutionary adaptation? Once again, Darwin was unequivocal on this subject. In *The Descent of Man*, he wrote,

When two tribes of primeval man, living in the same country, came into competition, if (other circumstances being equal) the one tribe included a great number of courageous, sympathetic and faithful members, who were always ready to warn each other of danger, to aid and defend each other, this tribe would succeed better and conquer the other .... Thus the social and moral qualities would tend slowly to advance and be diffused throughout the world. (1871, p. 130)

Two things are immediately noticeable about this description: that Darwin assumes that the ability to be successful in warfare arises from courage, sympathy, and faithfulness within human groups and that the level at which selection is operating in the evolution of such qualities is the group, rather than the individual. As we shall soon see, neither of these assumptions is necessarily in accord with the evidence.

Before we can decide if warfare is adaptive, it is first necessary to define precisely what we mean by warfare. There appear to be at least three intergroup aggressive activities that are often referred to by the same name. It is important to my later argument that these be distinguished, and so here they are:

- Raiding (or rustling, as in cattle rustling) is an activity in which small groups of humans, virtually always men and almost always close kin groups, spontaneously and with relatively little planning or hierarchical organization, temporarily enter the recognized territory of a nearby group with the intention of forcibly obtaining resources, usually domesticated animals or women, or both. Not all members of a given kin group will necessarily participate in raiding, and all "warlike" activity and organization occurs immediately before, during, and after a raid. At all other times, the participants in such a raid are engaged in other domestic activities, generally unrelated to raiding.
- Militia Warfare is an activity in which somewhat larger groups of humans, again almost
  exclusively male but not necessarily close kin groups, band together periodically with some

planning and hierarchical organization, with the intention of either forcibly entering the recognized territory of a nearby group or defending against the forcible entry by similarly constituted raiding parties or militias from other groups. In militia warfare, most of the able-bodied males in a given social group will participate in some way, either in direct combat or combat support. However, once the immediate warlike activity has ended, the militia disbands and most, if not all, of its members turn to other tasks. An important characteristic that distinguishes raiding from militia warfare is the presence in the latter of generally recognized hierarchical ranks and specialized duties and training, a situation generally lacking in raiding/rustling.

• Professional Warfare is an activity in which relatively large groups of humans (i.e., armies), again almost exclusively male but usually not close kin groups (and often including non-combatant female auxiliaries), band together regularly or permanently with considerable planning and hierarchical organization, with the intention of either forcibly commandeering the recognized territory of a nearby group or defending against the forcible entry by similarly constituted armies from other groups. In professional warfare, many of the ablebodied males in a given social group will participate in some way, either in direct combat or combat support. Furthermore, regardless of when or if the immediate warlike activity has ended, the army continues to exist, and its members pursue specialized tasks within the military organization. An important characteristic that distinguishes raiding and militia warfare from professional warfare is the proliferation in the latter of strictly defined hierarchical ranks and specialized duties and the existence of a permanent professional class of warriors which includes almost all officers, but not necessarily all combatants (i.e., the grunts get to go home and take up other occupations after the war ... assuming they survive).

Although there are many variations on these three themes (and an almost infinite gradation of one into the other), there are broad patterns of correlation between these three patterns across most societies. Furthermore, the three types of war-like organizations are generally correlated with ecological subsistence patterns. Raiding is most common among hunter-gatherers and pastoralists (i.e., people who raise domesticated animals as an important part of their subsistence). Militia warfare is more common among simple agriculturalists, especially those who live in widely dispersed villages and who depend primarily on domesticated crop plants for their subsistence. Professional warfare is most common among societies that are characterized by a combination of village agriculture and urban living. In particular, the maintenance of a professional army requires both large populations and a large surplus of food and other resources, as the members of the army themselves are no longer available for food production or distribution and must therefore be supported by the rest of the population.

According to Wallace, "[t]here are few, if any, societies that have not engaged in at least one war in their known history" (1968, p. 173) Indeed, there is reason to believe that warfare (or at least raiding) predates the evolution of the genus *Homo* and may not even be restricted to the order Primates. Jane Goodall (1986) describes behaviors among the chimpanzees (*Pan troglodytes*) of the Gombe preserve that are remarkably similar to the raiding behavior of humans in pastoral societies. Moving beyond the

Primates, Hans Kruuk (1972, pp. 253–258) describes behaviors among the spotted hyaenas (*Crocuta crocuta*) of east Africa, which bear some resemblance to the behaviors described by Goodall.

Given that raiding and other forms of social aggression appear to be pan-specific, can they be considered to be adaptations? Or, to be more precise, is the capacity for social aggression, either offensive or defensive (or both), an evolutionary adaptation? I believe the answer to this question is yes. Clearly, there are neurological modules for aggressive behavior in humans and related primates. Primatologist Richard Wrangham (1999) has proposed that both chimpanzee and human males have a genetically influenced tendency to raid and kill members of neighboring groups whenever there is a state of intergroup hostility and one group can muster sufficient force to raid the other with relatively little fear of losses (1999, pp. 1-12). Wrangham and Peterson (1996) have pointed out that there are striking similarities between the raiding behavior of wild chimpanzees and the raiding behavior of the Yanomami (pp. 64-72). Chagnon (1990) has taken this argument further; in a discussion of the behavior of Yanomami warriors designated as unokais (a designation given to males that have undergone a ritual purification following a killing), Chagnon points out that unokais have a significantly higher reproductive success than non-unokais, as shown by statistical analysis of reproductive success at different ages. Males with the highest relative reproductive success are middle-aged men with children, a pattern that is repeated in many other societies (1988, pp. 985-992).

Tooby and Cosmides (1988) have argued that the capacity for raiding and warlike behavior shown by humans and other primates is based on an evolutionary "algorithm" in which the costs of warfare are balanced by the corresponding benefits to reproductive success (p. 5). I think we need to be clear that, in this context, "reproductive success" is used in the same sense as it is used by evolutionary biologists: that is, the net number of offspring produced by individuals performing different behaviors. We are not necessarily speaking of a kind of sexual selection for the capacity for warfare. Rather, we are referring simply to the number of offspring that survive in each behavioral cohort, for whatever reason. Ecological factors, such as the availability of food resources (especially proteins), the spatial and temporal distribution of such resources (e.g., dispersed and nondefensible versus clumped and defensible), the availability of specific tools and weapons (such as metal tools), and the number, size, and physical development of potential fighters, all play a part in the calculation of potential costs and benefits of warlike social behavior. In other words, the algorithm postulated by Tooby and Cosmides is a mental means of factoring in all of the various costs and benefits of alternative behaviors to determine which alternative will result in the most positive outcome.

At what level—individual or group—must such outcomes be positive for the capacity for warfare to be adaptive? Sober and Wilson (1998) have argued that cooperative behavior (i.e., "altruism") can evolve as the result of natural selection at the level of groups. Although, at first glance, it may not seem that warfare is altruistic. However, it clearly is, as individual members of a society engaged in warfare risk (and sometimes lose) their lives in defense of the group. Sober and Wilson do not

specifically discuss warfare, but clearly it would qualify as a form of cooperative behavior. So, does the capacity for warfare evolve as the result of selection at the level of groups?

In the early 1960s, V. C. Wynne-Edwards used the concept of group selection as the basis for the explanation of nearly all of animal social behavior (1962). It was in response to Wynne-Edwards that G. C. Williams wrote *Adaptation and Natural Selection* (1966) in which he argued forcefully for the primary importance of selection at the level of individuals, rather than groups. Williams pointed out that any group of organisms in which reproductive success has been lowered by group processes (specifically by decreasing the number of offspring per individual by means of various mechanisms) is vulnerable to invasion and ultimate replacement by individuals who are not so constrained. His model for individual selection has been extended to the evolution of social behavior and cooperation by Hamilton (1964), Trivers (1971), Axelrod (1984), and Dawkins (1982).

Warfare is often thought of as an aberration, rather than a central characteristic of human sociality. However, even a brief review of human history should impress upon one that warfare has been a constant, if episodic, aspect of human social behavior. The point here is that, even if it does not happen regularly, warfare can have an effect on natural selection equivalent to—and in some cases greater than—a constant selective pressure. During periods in which warfare is not occurring, selection will result primarily from those sources of mortality and reduced reproductive success characteristic of peacetime society: disease, famine, competition for scarce resources, etc. However, during periods of warfare, these "everyday" forms of selection can be overwhelmed by the effects of warfare-specific changes in mortality and reproductive success. In other words, periods of warfare act like evolutionary "bottlenecks" selecting with greatly increased relative intensity for any physiological or behavioral characteristic that allows for differential survival and reproductive success.

Furthermore, it seems likely that these selective pressures will be exerted primarily at the level of individuals, rather than groups. To understand why, consider Sober and Wilson's definition of a group: "a set of individuals that influence each other's fitness with respect to a certain trait, but not the fitness of those outside the group" (1998, p. 92). To be consistent with standard practice in evolutionary theory, let fitness (symbolized by w) be defined as the average per capita lifetime contribution of an individual of a particular genotype to the population after one or more generations, measured in number of offspring bearing that individual's genotype. If we apply this definition of fitness to Sober and Wilson's definition of a group, then each individual member of a group will have some fitness  $(\mathbf{w_i})$ , with the group fitness reducing to the sum of the fitnesses of the individuals that make up the group ( $\mathbf{w}_{\mathbf{G}}$  $= \mathbf{w_I} + \mathbf{w_i} + \dots \mathbf{w_n}$ ). Furthermore, let us assume that fitness is a function of some limited resource. In real terms, this resource might be food, or shelter, or access to mates, or some other factor that contributes directly or indirectly to survival or reproduction. Each individual can exploit some small fraction of the limited resource with the aggregate consumption of resources eventually reaching a maximum value (i.e., when each individual has maximized its fitness via the exploitation of that resource and the resource has been completely subdivided among the individuals in the group). Until that limit has been reached, competition between individuals in the group is relatively unimportant, and so individual fitness of each member of the group will not be limited by group membership.

Under such circumstances, there are at least three different ways in which intragroup cooperation could affect individual fitness:

The fitness effect of group membership on individual fitness could be negative, compared
with the fitness of each individual acting alone; that is, being a member of the group

detracts from each individual's fitness, compared with acting alone; see Figure 10.1.

This is the situation described by Wynne-Edwards (1962) and criticized by G. C. Williams (1966). Under these conditions, the addition of each new member to a group *decreases* the average fitness of each member of the group, with the effect that such a group is constantly vulnerable to invasion and replacement by individuals who act entirely in their own interests. Given the relationship between group size and individual fitness, it is unlikely that this type of group selection would prevail under most natural conditions.

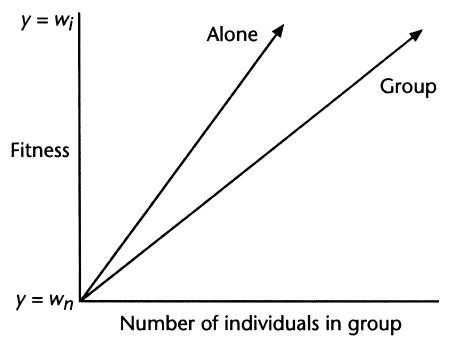


Figure 10.1 Negative Group Selection

The fitness effect of group membership on individual fitness could be positive, compared
with the fitness of each individual acting alone; that is, being a member of the group adds
to each individual's fitness, compared with acting alone; see Figure 10.2.

This is the essentially the situation proposed by Sober and Wilson (1998). Under these conditions, the addition of each new member to a group *increases* the average fitness of each member of the group, with the overall effect that such a group becomes less vulnerable to invasion and replacement by "selfish" individuals as it grows larger. Unlike the situation with negative group fitness above, this type of group selection could easily evolve, as membership in the group clearly benefits individuals and vice versa.

• The fitness effect of group membership on individual fitness could be **negative** when the group size is below some critical value but could become **positive** as that critical group size is exceeded; see Figure 10.3.

Under such conditions, a group would have to reach a "critical group size" before the fitness benefits of intragroup cooperation would begin to be felt. This would seem to present a barrier to the evolution of such cooperation via group selection. However, the group might reach critical size for reasons unrelated to the activities

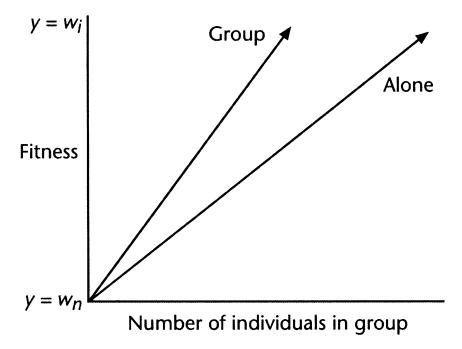
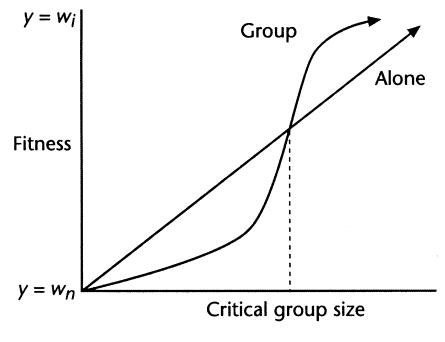


Figure 10.2 Positive Group Selection



# Number of individuals in group

Figure 10.3 Variable Group Selection

resulting in reduced aggregate fitness. Once above the critical size, adding new members to the group would add to the fitness of each individual.

There are many circumstances in nature in which the kind of variable group fitness described above has been shown to exist. For example, in a study of the hunting behavior of wolves (*Canis lupus*) on Isle Royale, Mech (1970) found that the larger a wolf pack was, the better able it was to exploit larger prey (1970, p. 38). Intragroup cooperation is often essential to the success of hunting forays among social carnivores in general. Teleki (1973) found the same to be true for hunting behavior among wild chimpanzees. Indeed, chimpanzees exhibit unusually cooperative behavior when hunting, especially when their prey is other primates.

It is very likely that human warfare follows the pattern described in Figure 10.3. That is, there is a critical group size above which the effectiveness of warfare increases, as reflected in its effects on fitness. There are two primary reasons for this:

As virtually any military commander would point out, the larger the military force, the
more likely it is to prevail over its opponents. Calculation of the relative sizes and strengths
of the opposing sides in any warlike interaction would be of crucial importance to the

participants, regardless of rank. Therefore, it is likely that natural selection would have resulted in the evolution of mental algorithms that would facilitate such calculations under conditions of repeated or sustained warfare.

• As the size of a military force increases, the probability of injury or death to each individual member of the group generally decreases. One-on-one violent interactions between individual combatants are most likely to result in the injury or death of one or both combatants. As the number of combatants increases, the number of injuries and deaths per capita generally decreases (except in the case of modern technological warfare, where overwhelmingly powerful weapons can injure or kill huge numbers of combatants and noncombatants). This decrease in probability of injury and death with the size of a military force is another factor in the mental calculations performed by any potential participant in warfare.

Given the foregoing, it should now be clear that participation in warfare can have positive effects on both individual fitness and group fitness, when group fitness is measured as the aggregate fitness of the individuals making up the group. Participants in warfare—combatants and their supporters—can gain access to territory and to resources if they are on the winning side in a conflict. In particular, it is a well-known (but not often discussed) fact that the winners in virtually all warlike conflicts have greatly increased reproductive success compared with both the losers and nonparticipants in their own group. Wars and warlike interactions (including simple raids) are often followed by increases in birth rates among the winners. In particular, soldiers (i.e., combatants) are notorious for the commission of rape during war (Thornhill & Palmer, 2000). That this is the case has been recognized as far back as the founding myths of Western civilization: the legend of the rape of the Sabine women is based on an actual event in the early history of the city of Rome. Many authors have pointed out that access (including, of course, forcible access) to reproductive females is a constant theme in the genesis and prosecution of warfare. The Old Testament contains numerous examples of such forcible reproductive access, including several cases in which God specified which females (young, but not yet pregnant) were to be forcibly taken for reproductive purposes and which females (pregnant, old, or infertile) were to be killed, along with all males (including children).

Rape as a constant in warfare has of course continued to the present day (cf. Beevor, 2002). That rape would result in increased reproductive success on the part of soldiers is fairly obvious. What is not obvious is that this would also result in increased reproductive success on the part of the females being raped. So long as being raped does not result in injury or death, and so long as the person being raped is not subsequently harmed or placed under conditions of increased risk of harm, having been raped by a soldier would result in essentially the same increase in reproductive success as any other form of copulation. That the male Yanomami studied by Chagnon (1988) who participated in raids on neighboring groups in which females were forcibly abducted would have an increased reproductive success as a result has not been seriously questioned (except see Ferguson, 2001). What has not been systematically investigated are the effects of such abduction on the reproductive success

of the females so abducted. In the absence of such data, the idea that such victims could indeed benefit (in a purely Darwinian sense) from the affects of warfare remains at present an interesting but untested hypothesis.

Being on the losing side in a warlike conflict need not be entirely negative for males either. From a Darwinian standpoint, what matters is reproductive success, not happiness or freedom from oppression. In ancient Rome, it was quite common for members of the conquered peoples to be pressed into slavery by the Romans. Although being a slave under such conditions might not be what one would have preferred, it was quite common for slaves to be allowed to marry and have children. Indeed, if the children of a slave became the property of the slave's owner, then there would have been a positive incentive for the slave owner to encourage the fecundity of his slaves. The point here is obviously not to endorse slavery but rather to point out that there are conditions under which the losers in a warlike conflict might benefit from participation in such conflict almost as much as the winners.

In sum, then, we may also conclude that the capacity for warfare, like the capacity for religious experience, has many of the characteristics of an evolutionary adaptation:

- the capacity for warfare is pan-specific in humans, although there is considerable variation in this capacity, both within and between human groups,
- although it has not yet been possible to correlate the capacity for warfare with underlying neurological structures and processes, there is ample evidence for a correlation between aggressive and violent behavior and the emotional control centers of the brain,
- the capacity for warfare can be correlated with known evolutionary environments of adaptation (raiding with hunting/gathering and pastoral agriculture, militia warfare with settled agriculture, and professional warfare with large-scale agriculture and urban culture), and
- although no underlying genetic mechanisms for the development of the capacity for warfare
  are now known, the existence of consistent cross-cultural patterns of group violence and
  coercion indicates that warlike behavior is subject to evolutionary convergence in a manner
  analogous to other evolutionary adaptations.

## The Evolution of Religion: The Standard Model

Before turning to the crux of the argument, it is necessary to consider in more detail what the capacity for religious experience consists of. Recent work on the evolutionary dynamics of religion have converged on a "standard model" in which religions are treated as epiphenomena of human cognitive processes dealing with the detection of and reaction to agents, especially human agents, under conditions of stress anxiety and perceived threat. Boyer has proposed a comprehensive theory of the evolution of religion based on an underlying cognitive process whereby "Our minds are prepared [to give] us particular mental predispositions" (2001, p. 3). In particular, "evolution by natural selection gave us a particular kind of mind so that only particular kinds of religious notions can be acquired" (p. 4).

Boyer begins by asserting that "[r]eligion is about the existence and causal powers of nonobservable entities and agencies" (p. 7). He then proceeds to show that the common explanations for the origin of religion—explanations of puzzling physical and mental phenomena, explanations of evil and suffering, provision of comfort in times of adversity, and provision of the moral basis for social order—cannot be reduced to or included in an explanation of the evolutionary origin of the capacity for religious experience (pp. 5–12). Boyer then points out that "there is only a limited catalogue of possible supernatural beliefs" (p. 29). This is because "[t]he religious concepts we observe are relatively successful ones selected among many other variants" (p. 32). Therefore, "religion emerges ... in the selection of concepts and the selection of memories" (p. 33).

What are the criteria by which certain concepts are reinforced and others are lost? Following Sperber (1985), Boyer distinguishes between simple concepts and templates. The latter are large-scale concepts that subsume many smaller, simpler concepts, essentially by analogy. For example, the word "animal" designates a template, which is usually applied to any entity that is obviously alive (especially because it moves under its own power and with intentionality), eats things, reproduces, and has a general body plan that conforms to what most people would agree is an animal body plan. According to this model of mental classification, religious concepts are easily transmitted from person to person because they both conform to such templates in most respects but violate them in obvious and memorable ways: they "surprise people by describing things and events they could not possibly encounter in actual experience" (p. 55).

In this way, religious concepts are much more easily remembered and transmitted than nonreligious concepts:

Some concepts ... connect with inference systems in the brain in a way that makes recall and communication very easy. Some concepts ... trigger our emotional programs in particular ways. Some concepts ... connect to our social mind. Some ... are represented in such a way that they soon become plausible and direct behavior. The ones that do *all* this are the religious ones we actually observe in human societies. They are most successful because they combine features relevant to a variety of mental systems. (Boyer, 2001, p. 50)

Central to Boyer's theory on the evolution of the capacity for religious experience is the concept of *agency*:

• **Agency** is that set of characteristics by which we infer the existence and action of an *agent*; that is, a living (or lifelike) entity whose behavior indicates that it has intentions and can act upon them. Agents are purposeful, and purposeful (i.e., teleological) action is the hallmark of agency.

Along with other cognitive and evolutionary psychologists, most notably Barrett (1996), Boyer asserts that the ability to detect agency has high selective value. Barrett points out that humans, like other potential prey animals, should have "hyperactive agency detectors," because any human who did not would be more likely to be

injured or killed by a predator. Selection for ultrasensitive agency detectors would result in a tendency for such detectors to produce "false positives," that is, the tendency to infer the existence of agency in an entity in which it is absent.

Although Boyer seems to be on the right track, there is a strong implication throughout his work that the capacity for religious experience is an epiphenomenon that arises secondarily as the result of the action of agency detection and the increased mnemonic transmissability of concepts that violate cognitive templates. J. Donovan (1994, 2002) disagrees: for him, "religion has direct evolutionary advantages that have been directly selected. That benefit relates to the mitigation of existential anxiety with its roots in death awareness" (Year, p. XXXAI). Donovan asserts that religion arises primarily as the result of the selectively positive effect of the reduction of anxiety arising as the result of the awareness of death. Donovan looked at the ability of "spiritual healers" to enter into possession trances, and he concluded that this is arguably a genetically based ability that has been selected as a belief-enhancing mechanism by which the palliative effect of religious participation can be rendered (1994, personal communication, March 19, 2003).

Atran incorporates Boyer's argument from cognitive processes into a more comprehensive selectionist explanation for the evolution of the capacity for religious belief and behavior. Atran agrees with Boyer that there are underlying cognitive (and therefore presumably neurological) processes by which certain types of beliefs can be spread with greatly increased ease and fidelity of transmission. However, he adds a social and political dimension to Boyer's argument, tying religion to the establishment and maintenance of social organization and political power. He quotes Irons (1996) to the effect that "[r]eligions in large-scale societies all show evidence of social dominance" (Atran, 2002, p. 103). Atran goes on to point out that religious rituals usually involve submissive displays, such as kneeling, bowing, prostration, hand spreading, and throat baring, which he likens to the submissive displays of subordinate non-human primates (p. 127). Taking this line of reasoning further, Atran points out that "[h]uman worship requires even dominant individuals to willingly submit to a higher moral authority in displays of costly, hard-to-fake commitment or risk losing the allegiance of their subordinates" (p. 127).

This is the heart of Atran's argument: that religion forms a kind of "social glue" that uses ritualized demonstrations of commitment to supernatural authority to encourage and even coerce individual adherence to group norms and goals. Atran's argument is essentially that all members of a society (i.e., a "group," in the parlance of group selection), from the most subordinate to the most dominant, benefit from the social cohesion and singularity of purpose that religion fosters. He states that "[t]he more a ruler sacrifices and suffers, the more the ruler earns respect and devotion" (p. 127). But clearly the same principle would apply to his subordinates, at any level: individual demonstrations of sacrifice and suffering (or at least the willingness to do so) on behalf of the group tend to encourage group solidarity.

There are two problems with this outlook: it assumes that costs and benefits are shared approximately equally throughout such groups, and it implicitly focuses on the group as the primary unit of selection. Atran is clearly aware of the first of these

shortcomings. He refers to the classical Marxist "coercion argument" for the origin of religion, by which he means that "religion was [according to Marx] created by and for rulers to materially exploit the ruled, with ... secondary benefits to the oppressed masses of a low but constant level of material security" (as cited in Atran, p. 128). He then goes on to cite Diamond's theory that in large-scale societies (by which he presumably means settled agricultural societies with a mixed village and urban settlement pattern), the members of the ruling hierarchy (or "kleptocracy") gains the support of their subordinates by "constructing an ideology or religion justifying kleptocracy" (Diamond, 1997, p. 277). Diamond asserts that this reification of the supercision of the ruling hierarchy by religion represents a fundamental shift from the situation in bands and tribes (of hunter-gatherers and pastoralists), in which "supernatural beliefs ... did not serve to justify central authority" (p. 277).

Diamond concludes his discussion of the origin of religion by asserting that institutionalized religion confers two important benefits to centralized societies:

- shared ideology or religion helps solve the problem of how (genetically) unrelated individuals can cooperate, by providing a bond not based on (genetic) kinship, and
- religion gives people a motive, rather than genetic self-interest, for sacrificing their lives on the behalf of others (Diamond, p. 278).

I believe that both Atran and Diamond are on the right track, but their arguments are derailed by a common misapplication of selectionist thinking. Atran proposes what appears to be a relatively weak counterargument to the coercion argument, pointing out that religions can be liberating as well as oppressive (Atran, p. 129). While this is true in some cases, I believe it misses the point: if religion (or, more properly, the *capacity* for religious experience) is to evolve by natural selection, it must do so at the level of individuals in the context of specific ecological circumstances.

If Williams is correct about the nonexistence of group selection, then for the capacity for religion to evolve it must somehow increase *individual* reproductive success. In the context of small, relatively nonhierarchic bands or tribes of hunter-gatherers or nomadic pastoralists, it seems most likely that selection at the level of individuals would result in behaviors that would approximate those observed in hunting groups of primates and social carnivores. Although there are clearly recognized dominant individuals in such groups, all of the members of such groups clearly benefit from their membership in them. This is because there are circumstances in which groups of cooperative individuals can obtain resources that would be out of the reach of individuals acting on their own.

This same argument applies at all levels of social organization. For particular social processes to evolve by classical Darwinian selection, there must be some benefit that accrues to individuals from participating in such processes, a benefit that equals if not clearly supercedes the benefit to be gained from acting alone. That such benefits to individuals do result from highly organized social interactions in human and other animal societies is not in question. What is still to be decided here is whether such

increases in individual fitness can be observed as the result of the capacity for religious experience, specifically in the context of warfare.

## The Capacity for Religious Experience Has Evolved via Individual Selection Among Humans in the Context of Warfare

Here we come to the crux of my argument: that the capacity for religious experience is an adaptation that facilitates warfare. Let me begin by carefully defining the following terms:

- The capacity for religious experience is the capacity to formulate, communicate, and act on beliefs (that is, concepts, memories, and intentions or plans) that include reference to supernatural entities and processes. Like the capacity for language, such a capacity must be based on a corresponding neurological "hard wiring," although the dimensions (and limitations) of such neurological structures and processes await further investigation.
- Religion is not the specific content of the beliefs that arise from such a capacity. Rather, religion is the overall pattern of such beliefs, including concepts like omniscience, omnipotence, and omnipresence (on the part of supernatural deities), the existence of a soul that is separable from (and can live on after the death of) a physical body, and the existence of supernatural realms inaccessible to normal senses but accessible to deities and incorporeal entities such as souls.

Note that this definition of religion is not as inclusive as that used by Boyer, who includes not only the concepts and entities noted above, but also virtually all forms of "folk belief" (i.e., superstition) (2001). It seems likely to me that the origin of the capacities for both folk beliefs and religion has its roots in the same neurological substrate: a neurological mechanism that reduces anxiety in the face of stress induced by unknown, unpredictable, and presumably dangerous circumstances. However, part of my thesis here is that true *religious* experience is a later development in the evolution of the human mind (and presumably the human nervous system), one that has evolved as the result of individual selection primarily in the context of warfare.

How, precisely, does the capacity for religious experience evolve in the context of warfare? Consider the decision that each potential combatant must make prior to participating in a raid, a battle, or an extended military campaign. This decision will include (but is certainly not limited to) the following:

- The probability that one will be seriously injured or killed in the raid, battle, or campaign,
- The possible consequences of *not* participating (e.g., everything from social disapprobation to summary execution),
- The probability that one will gain something (e.g., resources, social position, access to mates, etc.) as the result of one's participation, and
- The quality of such gains, especially when compared with the costs of nonparticipation.

It is important to note that the calculation of such costs and benefits need not be overtly conscious. Whether conscious or unconscious, the outcome of such a calculation would be either an increased or decreased motivation to participate in the impending conflict.

What happens during war? According to von Clauswitz,

War is nothing but a duel on an extensive scale. If we would conceive as a unit the countless number of duels which make up a war, we shall do so best by supposing to ourselves two wrestlers. Each strives by physical force to compel the other to submit to his will: his first object is to throw his adversary, and thus to render him incapable of further resistance. (1832, p. 12)

War involves violent force, up to and including killing people. To participate in a war means to participate in an activity in which there is a significant probability that one will either kill other people or will be killed by them.

This means that any participant in warfare is faced with the possibility of painful and violent death as the result of such participation. Given this probability, if natural selection acts at the level of individuals, how can natural selection result in a propensity to participate in warfare? Clearly, either the probability that one will be killed must be perceived as low or the potential payoff from such participation must be perceived as high. If natural selection is to operate at the level of individuals, these two circumstances should ideally be obtained simultaneously,

Here is where the capacity for religious experience is crucial. By making possible the belief that a supernatural entity knows the outcome of all actions and can influence such outcomes, that one's "self" (i.e., "soul") is not tied to one's physical body, and that if one is killed in battle, one's essential self (i.e., soul) will go to a better "place" (e.g., heaven, valhalla, etc.) the capacity for religious experience can tip the balance toward participation in warfare. By doing so, the capacity for religious belief not only makes it possible for individuals to do what they might not otherwise be motivated to do, it also tends to tip the balance toward victory on the part of the religiously devout participant. This is because success in battle, and success in war, hinges on commitment: the more committed a military force is in battle, the more likely it is to win, all other things being equal. When two groups of approximately equal strength meet in battle, it is the group in which the individuals are more committed to victory (and less inhibited by the fear of injury or death) that is more likely to prevail. To give just one example, the battle cry and motto of the clan Neil has always been "Buaidh na bas!"—"Victory or death!"

Religions tell people what they most want to hear: that those agents and processes that they most fear have no ultimate power over them or pose no threat to themselves or the people they care about. In particular, by providing an intensely memorable, emotionally satisfying, and tension-releasing solution to the problem of mortality, religions make it possible for warriors to master their anxieties and do battle without emotional inhibitions. This makes them much more effective warriors, especially in the hand-to-hand combat that humans have fought throughout nearly all of our evolutionary history.

Consider the characteristics that are most often cited as central to religious experience. Newberg and d'Aquili have presented an integrated model of the neurobiological underpinnings of religious experience. They have pointed out that central to most religious experience is a sensation of awe, combined with "mildly pleasant sensations to feelings of ecstasy" (2001, p. 89). They have shown that such sensations can be induced by rhythmic chanting and body movements, combined with loud music and colorful visual displays, all of which produce a condition of sensory overload. This process then induces a neurological condition characterized by a sense of depersonalization and ecstatic union with one's surroundings.

This is precisely what happens as the result of military drill and training. It is no accident that humans preparing for war use exactly the same kinds of sensory stimuli described by Newberg and d'Aquili. They have tied such displays to religious activities and shown the deep similarities between religious rituals and secular ones: "patriotic rituals ... emphasize the 'sacredness' of a nation, or a cause, or even a flag ... turn[ing] a meaningful idea into a visceral experience" (p. 90). The two types of activities—religious rituals and patriotic rituals—use the same underlying neurological pathways and chemistry.

Religious experience is often equated with a state of mystical union with the supernatural. But what exactly does this mean, and in the context of this chapter, is there a connection between mystical experience and warfare? The answer is almost certainly yes. That combatants have had experiences that would be classified as mystical before, during, and after battle is a simple historical fact. The Scottish flag is based on just such an experience: the white crossed diagonal bars against a field of azure of the St. Andrew's cross is said to have appeared to King Hungus and his warriors during a battle against in the Saxons. Legend says this so encouraged the Scots and frightened their adversaries that a victory was won (Middlemass, 2000).

A common thread in all mystical experiences is a loss of the sense of self and a union with something larger than oneself (Newberg & d'Aquili, 2001, p. 101) Additionally, there is often a sense of submission to a higher power, in which one's personal desires and fears are subordinated to the purposes of that higher power. If that higher power were identified with the leaders of a military hierarchy, it is easy to see how such experiences could be used to increase one's loyalty and submission to that hierarchy.

It is likely that the same underlying neurological circuits that produce the sensations described by mystics also produce the sensations of fear, awe, and ecstasy that are experienced by combatants during the course of a battle. Like the evolutionary implications of rape, this is a topic that is rarely discussed outside of military circles but is a well-known phenomenon during battle. The noise and movement, the confusion and excitement, intensified tremendously by the imminence of injury and death combine to produce a state of massive arousal in the sympathetic nervous system of the combatant. This state of intense arousal is very similar to the state of arousal felt during copulation; indeed, some soldiers will candidly admit that during the heat of battle, they often experience a kind of sexual arousal, leading in some cases to ejaculation. This fusion of sensory and motor states in a condition of intense

arousal, combined with a sensation of depersonalization, can easily produce in susceptible individuals a condition in which a kind of "blood lust" overwhelms most thoughts of self-preservation.

#### The Ultimate Sacrifice

Let us return to group selectionist arguments for the evolution of both religion and warfare. D. S. Wilson (2002) has proposed that the capacity for religion has evolved among humans as the result of selection at the level of groups, rather than individuals. Specifically, he argues that benefits that accrue to groups as the result of individual sacrifices can result in increased group fitness, and this can explain what is otherwise difficult to explain: religiously motivated behaviors (such as celibacy and self-sacrifice) that apparently lower individual fitness as they benefit the group.

At first glance, Wilson's argument seems compelling. Consider the most horrific manifestation of religious warfare: the suicide bomber. A person who blows himself or herself up in order to kill his or her opponents has lowered his or her individual fitness. Does this not mean that such behavior must be explainable only at the level of group selection? Not at all: the solution to this conundrum is implicit in the basic principles of population genetics. Recall that one of Darwin's requirements for evolution by natural selection was the existence of variation between the individuals in a population (1859, pp. 7–59). Variation within populations is a universal characteristic of life, an inevitable outcome of the imperfect mechanism of genetic replication. Therefore, it follows that if the capacity for religious experience is an evolutionary adaptation, then there will be variation between individuals in the degree to which they express such a capacity.

Furthermore, it is not necessarily true that when an individual sacrifices his or her life in the context of a struggle, the underlying genotype that induced that sacrifice will be eliminated by that act. Hamilton's principle of kin selection (1964) has already been mentioned as one mechanism, acting at the level of individuals (or, more precisely, at the level of genotypes), by which individual self-sacrifice can result in the increase in frequency of the genotype that facilitated such sacrifice. Trivers (1971) has proposed a mechanism by which apparently altruistic acts on the part of genetically unrelated individuals may evolve by means of reciprocal altruism.

Given these two mechanisms, all that is necessary for the capacity for religious behavior, including extreme forms of self-sacrifice, to evolve is that as the result of such behaviors, the tendency (and ability) to perform them would be propagated throughout a population. The removal of some individuals as the result of suicide would merely lower the frequency of such tendencies and abilities in the population, not eliminate them altogether. If by making the ultimate sacrifice, an individual who shares his or her genotype with those who benefit by that sacrifice will, at the level of his or her genes, become more common over time (E. O. Wilson, 1975, p. 4).

## To the Winner go the Spoils

Let us now consider the flip side of war: the benefits that accrue to the winners of warlike conflicts. Given the mechanisms of kin selection, one can see how warfare and the religious beliefs that facilitate it might evolve among the closely related kin groups that constitute the raiding parties characteristic of hunting/gathering and pastoral peoples. It is also possible to construct an explanation for militia warfare and professional warfare on the basis of a blend of kin selection and reciprocal altruism. However, a closer examination of the spoils of war make such explanations relatively unnecessary.

Betzig (1986) performed a cross-cultural analysis of the correlation between despotism and reproductive success in 186 different cultures. Her conclusion was that

[n]ot only are men regularly able to win conflicts of interest more polygynous, but the degree of their polygyny is predictable from the degree of bias with which the conflicts are resolved. Despotism, defined as an exercised right to murder arbitrarily and with impunity, virtually invariably coincides with the greatest degree of polygyny, and presumably, with a correspondingly high degree of differential reproduction. (Betzig, 1986, p. 88)

In other words, males who most successfully use violence and murder as a means of influencing the actions of others have historically had the most offspring. In the context of warfare, this means that the winners of a battle, or even more so, of a war will pass on to their offspring whatever traits facilitated their victory, including the capacity to believe in a supernatural force that guides their destiny and protects them in battle. The effects of such capacities are not trivial; as Betzig points out, the differences between the reproductive success of the winners of violent conflicts and the losers is measured in orders of magnitude. As noted earlier, wars are bottlenecks through which only a relative few may pass, but which reward those who do with immensely increased reproductive success.

Putting all of this together, it appears likely that the capacity for religious experience and the capacity for warfare have constituted a co-evolutionary spiral that has intensified with the transitions from a hunting/gathering existence through subsistence agriculture to the evolution of the modern nation-state. As pointed out earlier, there is a correlation between the type of intergroup violence and the ecological context within which that violence occurs. Generally speaking, raiding/rustling is correlated with hunting/gathering and pastoralism, militia warfare with village agriculture, and professional warfare with urban society and the nation-state. There is a corresponding progression in the basic form of religious experience and practice: animism is most common among hunter-gatherers, while polytheism is more common among agriculturalists, and monotheism is most common in societies organized as nation-states. This is not to say there are no exceptions to this correlation. However, the fact that such a correlation can even be made points to the underlying ecological dynamics driving the evolution of subsistence patterns, patterns of warfare, and types of religious experience.

#### Genes, Memes, or Both?

It is extremely unlikely that any human behavior (or the behavior of any animal with a nervous system complex enough to allow learning) is the result of the expression of any single gene. On the contrary, it is almost universally accepted among evolutionary psychologists that all behaviors show a blend of innate and learned components. What is interesting to ethologists is not the question of "how much," but rather the much simpler question of "how"?

One answer that has been suggested is that there are two different carriers of information that can be transmitted among humans: genes and memes. According to Dawkins, a meme is "a unit of cultural transmission" corresponding to things like "tunes, ideas, catch-phrases, clothes fashions, ways of making pots or of building arches" (1976, p. 206). Dawkins even addressed the possibility that God Himself might be a meme:

Consider the idea of God ... . What is it about the idea of a god which give it its stability and penetrance in the cultural environment? The survival value of the god meme in the meme pool results from its great psychological appeal. It provides a superficially plausible answer to deep and troubling questions about existence. It suggests that injustices in this world may be rectified in the next .... God exists, if only in the form of a meme with high survival value, or infective power, in the environment provided by human culture (p. 207).

Is all of religion simply a meme, or more precisely, a "meme complex"? And does the answer to this question tell us anything about the connection between the capacity for religion and warfare? There are at least three hypotheses for the mode of transmission of the capacity for religious experience:

- Hypothesis 1: The capacity for religious experience might be almost entirely innate; that is, it arises almost entirely out of "hard-wired" neural circuits in the human brain, which produce the sensations, thoughts, and behaviors that we call religious.
- **Hypothesis 2:** The capacity for religious experience might be almost entirely learned; that is, it arises almost entirely from concepts (i.e., "memes") that are transmitted from person to person via purely linguistic means, and without any underlying neurological predisposition to their acquisition.
- Hypothesis 3: The capacity for religious experience might arise from a combination of
  innate predispositions and learning; that is, like many animal behaviors, the capacity for
  religious experience might be the result of an innate predisposition to learn particular
  memes.

Both Boyer's and Atran's theories of the origin of religion are closest to the third hypothesis. From the foregoing analysis, it should also be clear that my own hypothesis for the origin of the capacity for religious experience is closest to hypothesis 3. However, unlike Boyer and Atran, I have proposed that the specific context within which the human nervous system has evolved has been persistent, albeit episodic, warfare.

A common objection to the hypothesis that the capacity for religious experience is an evolutionary adaptation is that there has been insufficient time for natural selection to produce the vast diversity in religious experiences and practices that exists in our species. I think there are two responses to this objection. First, although the diversity of religious beliefs and practices is quite surprising at first glance, this diversity is neither unlimited nor devoid of general trends. For example, virtually all religions include supernatural entities. However, the class of actual supernatural entities is not unlimited. Indeed, most supernatural entities bear a strong resemblance to humans, although with some qualities that humans are not observed to possess, such as the ability to fly, pass through walls, hear other's thoughts, etc. Furthermore, the qualities of most deities are remarkably similar to those attributed to kings, priests, and military leaders, although to a greater extent and with fewer "human" limitations. The global pantheon is overpopulated with warrior gods, and this overpopulation is not accidental.

Furthermore, there are circumstances under which selection can produce a dramatically accelerated rate of evolutionary change. Lumsden and Wilson (1981, 1983) describe this kind of evolutionary change as "autocatalytic gene-culture coevolution" (1981, p. 11) According to their theory, genes prescribe, not specific behaviors, but rather epigenetic rules of development by which minds are assembled (1983, p. 117). The mind then grows by incorporating parts of the culture (i.e., memes) already in existence. Culture, therefore, is created constantly from the combined decisions and innovations of all of the members of society. Most importantly, some individuals possess genetically inherited epigenetic rules that enable them to survive and reproduce better than other individuals. Consequently, the more successful epigenetic rules spread through the population, along with the genes that encode them. In other words, culture is created and shaped by biological processes, while those same biological processes are simultaneously altered in response to further cultural change. Genes and memes co-evolve, with each change in one catalyzing a corresponding change in the other (1983, pp. 117–118)

The primary reason for the accelerated rate of evolution that results from gene/ meme co-evolution is the alternation between the temporal modes of the two types of evolution. If one conceives of time as passing along a vertical axis, then genetic transmission is almost entirely vertical. That is, genes are passed from parents to offspring. Genetic transmission also involves a very low mutation rate, relative to memetic evolution. Memetic transmission, by contrast, is both vertical and horizontal. That is, memes can be transmitted between contemporaries, as well as between parents and offspring. Furthermore, as Boyer has pointed out, the mutation rate of memes is immensely higher than that of genes. "Cultural memes undergo mutation, recombination, and selection inside the individual mind every bit as much and as often (in fact probably more so and more often than) during transmission between minds" (Boyer, 2001, p. 39).

Combining the concept of gene/meme co-evolution with the episodic nature of selection during warfare, it appears that the evolution of the capacity for religious experience evolves via a kind of bootstrap effect. Each change in the underlying

neurological capacity for religious experience is followed by a corresponding change in the conceptual (i.e., "memetic") structure of the religions that are produced as a result of that capacity. This, in turn, sets the stage for further selection at the level of genes, as individuals with particular religious meme complexes succeed (or fail). Stir warfare into the mix, including the tremendous assymetries in reproductive success described by Betzig (1986), and it appears likely that a substantial fraction of the whole of what we call "religion" is the result of gene/meme co-evolution in the context of intergroup warfare.

## New Directions in the Evolution of Religion and Warfare

Given the current state of our knowledge of the underlying neurobiology of religious experience, the foregoing amounts to little more than a tantalizing hypothesis for the evolution of the capacity for religious experience. However, it suggests some avenues of investigation that would help to clarify the relationships between the capacity for religious experience and warfare. For example, it would be very interesting to know whether and to what extent religious experience and concomitant beliefs are reinforced by participation in warfare, and whether there is a positive or negative effect on such experiences and beliefs as the result of being on the winning or losing side in a warlike conflict. Collection of what would essentially be natural history data on the prevalence, spread, or disappearance of religious experiences or beliefs in the context of warfare vs. peacetime would help to determine both rates of change and possible mechanisms of spread or extinction. Empirical studies using controlled test populations could also shed light on the connections between religious experiences and beliefs and stress and perceptions of potential threat. Finally, and most importantly, detailed demographic analysis of reproductive success and religious beliefs, especially as they relate to a history of warfare, might find the kinds of correlations suggested here.

In closing, it seems likely that throughout the history of our species warfare has contributed significantly to the evolution of the capacity for religious experience, which has in turn facilitated warfare. Intergroup warfare can be adaptive whenever resources are concentrated, predictable, and defensible. Agriculture and industrial/ urban subsistence patterns have facilitated warfare but have also steadily increased its costs. High technology warfare, especially when waged using weapons of mass destruction, has greatly increased the costs of warfare without appreciably increasing its benefits. In an age when the decisions of a single military leader can unleash nuclear annihilation, warfare is clearly maladaptive. As a consequence, it may be desirable to eliminate, or at least redirect, our capacity for warfare. However, if the deep evolutionary connections between the capacities for religion and warfare that I have proposed do, in fact, exist, this may mean redirecting (or possibly eliminating) the capacity for religious experience. Only time will tell, and only God (if He exists) knows how much time we have left.

#### Notes

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