

**Eckart Voland · Wulf Schiefenhövel**

Editors

THE BIOLOGICAL  
EVOLUTION OF  
RELIGIOUS MIND  
AND BEHAVIOR

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# Chapter 1

## Introduction

Wulf Schiefenhövel and Eckart Voland

**Abstract** Religion and religious practices have existed throughout the human history, and persist today in every corner of the world. In most societies religion is a prime motivator of both individual and collective behavior. This can be “good” (charitable, unselfish) or “bad” (oppressive, cruel, wasteful) behavior. The influence of religion in society is to be found throughout the entire spectrum of human activity – from wars and worship to gender roles, eating habits, and art.

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What caused our species to develop this propensity for religious behavior or “religiosity” as we will sometimes call it? How would an intelligent explorer from outer space explain this pervasive yet seemingly illogical phenomenon? Whereas much of human behavior can be readily accounted for in terms of simple needs or more complex evolved strategies, an explanation of the origins and role of religious behavior proves – even for us Earthlings – to be more elusive.

Sociologists, psychologists, and philosophers have all sought to analyze and understand “homo religious” and have put forward various hypotheses to explain the strong and often contagious hold that religion has over human individuals and societies. Yet none of these attempts, although providing plausible reasons why religion can help in our daily lives, has so far led to a consistent naturalistic explanation for how religious behavior first developed and became established. If we wish to understand and assess the importance of religion and religious behavior in modern society, then it is imperative that we seek its biological roots and investigate how these could have facilitated the emergence and persistence of this omnipresent phenomenon.

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The observation that religion is ubiquitous in all human societies, with the beliefs of one religion often in flat contradiction to those of the next, already gives us a strong hint concerning their natural origins. Indeed, the contradictory nature of different religions is also a main argument used in recent popular works that present religion as an irrational and harmful force. Several of these “new atheist” authors also draw attention to the need to explain why – despite its inherent contradictions and, in part, harmful side effects – religious behavior has evidently been such a successful human trait. Thus they too have helped to promote interest in the search for a consistent scientific explanation of the origins of human religiosity. It is this search, using the tools of science and rational discourse, but with no presuppositions about the validity, sense, or benefits of religious ideas, that occupies the editors and authors of the pages that follow.

The 18 further contributions to this book provide insights from a wide variety of perspectives, including evolution – theoretical, neurobiological, psychological, sociological, and historical. Together they lead to some preliminary answers about how natural selection could have favored individuals or groups engaging in religious activities. An alternative hypothesis – according to which religious behavior is simply a by-product of another adaptive trait – is also discussed.

The remaining paragraphs of this introduction touch upon the highlights of each contribution.

An impressive corpus of works of art, from anonymous accounts in oral history to paintings by great masters and to religion-inspired music, for example by Johann Sebastian Bach, tells of the motivational power exercised by religious beliefs and traditions. For many, the canon of sacred contents and teachings, such as those presented in the Bible or the Koran, must have come from outside our human sphere. In Chap. 2 Eckart Voland shows that a more parsimonious approach can be taken by viewing parameters such as spirituality, group identity, and following moral rules as biological adaptations. Religious metaphysics lies, according to him, outside the adaptational framework and represents a nonfunctional outcome of our general cognitive capacities.

What characterizes religion? Rüdiger Vaas (Chap. 3) lists seven main human traits, including transcendence, myth, morality, and rite. As they are present in all contemporary and past societies, a reasonable conclusion is that they are adaptive, evolved traits, not just a by-product of other cognitive capacities or a meme-like cultural institution. The advantage of evolutionary hypotheses is that they can be tested: universality, reproductive advantage, and heredity are among the criteria that need to be fulfilled. The author shows that an evolutionary explanation of religiousness is possible, but that there is not yet sufficient data to confirm the adaptation hypothesis. He raises the question whether modern disciplines such as evolutionary psychology and neurotheology can elucidate “belief,” “hope,” and “love,” the three main pillars of Christian faith.

How can an argument be constructed that proves the evolutionary origin of religion? Jay Feerman’s approach to this task in Chap. 4 is to break down religion into four components and to ask whether they in turn fulfill the requirements to be genetically transmitted to the next generation, the prerequisite for a process of natural

selection. Structural design features are identified that build up the four essential components: behavior, beliefs, moods, and feelings. The chapter also deals with the potential levels of selection (individual to group) of religiosity and ends by hypothesizing that belief in divine agents may have shaped the human mind – and not the other way around.

As is the case with other human capacities, our obviously hard-wired and hard-to-shed religiousness did not spring into existence *de novo*. David C. Lahti (Chap. 5) demonstrates that morality and religion have phylogenetic roots in the social behavior of our ancestors and changed in concert with the social transitions occurring in our hominid history. One motor for this, he argues, was the increased complexity of interactions taking place in groups of beings with an advanced brain and thereby complex perceptual and behavioral patterns. From nepotism and dominance, characteristic of many social mammals, evolution brought about, as suggested in an eight-step model, religion and, furthermore, the intellectual ability to reflect on moral and religious rules, including the possibility to overthrow the old and create new ones.

A key concept in Chap. 6 by Jürgen Kunz is cooperation. In contrast to hypotheses which hold that adaptive behaviors are brought about by religiosity and that the content of religion is shaped through natural selection, he argues that religions are “all-purpose-cooperation tools,” which do not need adaptive functions to evolve and have come about as a result of signal evolution. Ideational aspects of religion would not necessarily translate into behaviors. In cases where they do, they can have negative effects (e.g., loss of fitness for catholic priests who take celibacy seriously). Trust, cooperation, and an obliging cultural value system are seen as the main building blocks of religion, with honest signals and supernatural witnesses serving to safeguard them.

All religions contain elements that are, to the mind of a natural scientist, exotic and counterintuitive, for example, the immaculate conception of St. Mary by her mother Anna and the parthenogenesis of Jesus himself, as well as the many miracles defying the laws of nature that have allegedly been brought about by God-like figures and prophets. Craig Palmer and colleagues focus their contribution (Chap. 7) on a much more down-to-earth factor, which they see as the prime mover toward religion: human communication. The function of speech is to influence others. In the same way the passing on of religious traditions must have had identifiable effects that would allow insight into the proximate mechanisms governing religiosity. Ultimate explanations may be found in the effects of religious concepts and behaviors passed on through generations: better cooperation among people with the same ancestry, willingness to be influenced by each other, and by the religious teachings of their forebears. Thus, strongly united groups were forged.

Increasing brain size and cognitive abilities of our ancestors is also the starting point of Michael Blume in Chap. 8. Cooperative tasks, including cooperative breeding, became possible in this process. Funerary rites and offerings, typical of *Homo neanderthalensis* and *Homo sapiens*, as well as the belief in supernatural agents whose attributed function is to watch over rules and norms, including those regulating reproduction and marriage, can be understood as behavioral traits that have convergently developed in phylogeny. Wrongdoers are believed to be punished by

these agents. Costly obligations function as honest signals, prevent free riding and defection, and create a strong sense of unity. Recent Swiss census data serve as a basis to infer that natural and sexual selection brings about religion-related dispositions and can foster successful demographic transitions.

When did the first member of the genus *Homo* start to exhibit religious behavior, that is, behavior that could be detected in the archeological record? Did Neanderthals bury their dead and place symbols of belonging and empathy in the graves? Matt Rossano (Chap. 9) provides a scenario for what could have happened about 80,000–60,000 years ago. In this time period *H. sapiens* had almost died out. Religion, argues the author, was a crucial factor that helped our species to become finally so successful that it was able to build civilizations in almost all regions of our planet.

Archaeology gives us, but little insight into the way early humans thought and behaved, into their cosmologies and religious ideas. Traditional societies with near-neolithic living conditions, such as the Eipo in rugged highland New Guinea, are good models to fill some of the gaps. Chapter 10 by Wulf Schiefenhövel describes their religious concepts and rituals and the recent change to Christianity. The new religion served as a mental and spiritual base for the new lives they had decided to embark on. The contribution argues that an important function of religion is to explain the bewildering world and, especially, to make sense of threatening events, which will otherwise deeply trouble the mind and psyche of people in a society without an advanced body of natural science. The group-binding function of religion is also an important part of the bundle of adaptive advantages that is likely to have caused religiousness and religion to evolve.

Studies of monozygotic twins reared apart are the most powerful instrument in assessing the relative strength of genetic–biological versus social–environmental inputs into our perceptive and behavioral system. By virtue of his large data base Thomas Bouchard (Chap. 11) is able to demonstrate that “traditionalism” (comprising authoritarianism, religiousness, and conservativeness, measures of which correlate with each other to a high degree) is a specific trait that may enhance Darwinian fitness and is likely to be connected with the evolution of moral intuition as well as with human docility. Whereas the tendency to obey authority can be exploited by religious authorities, this trait, which has possibly evolved as part of reciprocity, may still have adaptive value.

Children and juveniles are easily “imprinted” by religious convictions and by role models showing religious behavior. This fact is utilized by probably all denominations, which take great care that the next generation grows up in and with the right belief. Chapter 12 by Rebekah Richert and Erin I. Smith reports research carried out on children. Their concepts, for example of supernatural agents, creation, afterlife, and the soul, can be seen as the outcome of nonreligious cognitive mechanisms and serve as ontogenetic building blocks for later religious beliefs.

How strong is the role of culture, the way we are brought up, the social environment around us, in shaping functions of our brain? This question has kept generations of researchers busy and often led to hostility between the proponents of a predominance of either biological or social factors. Modern evolutionary biology and anthropology stress the fact that what happens always involves interplay between

nature and nurture. In Shihui Han's contribution (Chap. 13), recent results of brain imaging studies related to the concept of self are presented and discussed. He shows that there are clear differences between Chinese and Western individuals in how the self is experienced (more part of a family and more independent, respectively) and, particularly important in the discussion of possible psychosocial effects of different religious traditions, that individuals belonging to the Christian faith exhibit other types of brain activation, in some cases, and thereby different neurocognitive patterns than individuals who have a different religious background.

Specific, well-defined malfunctions of the brain can serve as heuristic approaches to understanding its normal functioning. Parkinson's disease provides such a window into neurocognitive processes and is the topic of Chap. 14. Erica Harris and Patrick McNamara have studied Parkinson patients and found that they report less religiousness than healthy controls. Patients are also less able to recall religious experience, and patients whose impairment is related to the right hemisphere report less detail with regard to religious rituals. The results support the notion that a depletion of dopamine in delimited regions of the brain, which is typical for persons suffering from Parkinson's disease, is responsible for their less developed religiousness.

Spiritual experiences, facilitated, for example, by mysticism and similar traditions and techniques, may provide valuable insights to some and may lie close to delusions for others. Psychiatry, as Martin Brüne shows in Chap. 15, has always had an interest in trying to understand the relationship between religiousness and religiosity on the one hand and possible psychopathology on the other. In his chapter he examines capacities such as evaluating evidence in support of or refuting hypotheses, propensity for causality, the ability to attribute mental states to self and others (the so-called theory of mind) and finds a continuum of trait variations from normal evaluation of one's beliefs and readiness to consider alternative hypotheses to extreme forms of religious delusions that "detect" divine interference in all spheres of life and resist doubt and re-evaluation. This condition can be described as "delusional religiousness."

As noted at the outset, religious systems are not free of inconsistencies, even of contradictions, and often have a weak basis, even concerning their most essential issues (e.g., for the Christian belief: the empty grave, Mary Magdalene seeing the "gardener" and the wanderers meeting "Jesus" on the way to Emmaus – not the strongest possible proofs of his resurrection). Which cognitive and psychological mechanisms make religions survive is the question that Ulrich Frey pursues in Chap. 16. He states that many of our intuitive assessments of the world, ascribing causality, etc., are part of primordial religiosity and support religious cosmologies. Specific cognitive steps ensure that beliefs in supernatural entities, once formed, will persist against counterevidence. Religiously motivated behavior serves, as has also been demonstrated by other scholars, as a very effective means of creating group cohesion and preventing the damaging acts of free riders. It becomes thus evident why religious systems have been quite a success in human history.

Keeping traditions seems a classic concern of religion, from those in animist cultures to the efforts of the Vatican and the sacred, unchangeable nature of holy



scriptures like the Bible and the Koran. Religion can, however, as Purzycki and Sosis argue in Chap. 17, be rather flexible in reacting to varying socio-ecological conditions by creating adaptive response patterns. This is, so the authors argue?, brought about by effectively utilizing cognitive and emotional mechanisms and by institutions that function to maintain social harmony and prosocial behavior, even when environmental and social conditions change.

Chapter 18 by Wolfgang Achtner deals with the historic and epistemic development of such concepts, especially with the question of how religion has been put into a functional, evolutionary, or quasi-evolutionary framework by thinkers of different periods, from ancient Greek philosophers to our contemporaries. The author proposes a model in which he combines essentially inherent features of religion with others that can be explained by an evolutionary approach.

In the last chapter, Chap. 19, Detlef Fetchenhauer addresses again some of the key questions which the authors of this volume have raised and which are currently being discussed by scholars of various disciplines. According to the author, an overarching, one may say “grand,” evolutionary theory of religion is still lacking. He lists different possible approaches to such a goal and critically discusses arguments that have been put forward by a number of previous authors, namely whether group selection can explain religiosity and religion, whether religion really brings about reproductive gains, whether it is really costly, and why it causes people to believe in entities for whose existence proofs cannot be provided.

The aim of this volume is to discuss the evolutionary origins of religiousness and religion and to define the status quo of this endeavor. It is obvious that many other interesting aspects of religion(s) are missing: historical accounts of the formation of religions, for example, in the fertile crescent and around the Mediterranean sea; their borrowing concepts and symbols; their mutual syncretism; their political functionality; their role as powerful and exclusive ethnic markers (including fostering fanaticism); as institutions promoting social and moral behavior; and in bringing about the first academic institutions, thereby fostering philosophy and other sciences. This, however, would have exceeded the scope of our undertaking by far.

Also missing are positions that do not, to some degree at least, integrate evolutionary thinking. Religiousness, that is, the capacity of humans to emotionally connect to religious ideas and rituals, to think along the lines of transcendency and eschatology, and to form religious institutions, has, that is the claim of the two opposing schools of thought, come about in one of the two mutually exclusive ways: (a) by divine action and revelation or (b) as a result of adaptive traits that helped our ancestors to survive, have more offspring, and develop more cohesive groups. It is indeed fascinating that the first position is still, on a global basis, the predominant one by far and that many intellectuals are able to make peace with its basic statements.

An interesting question is whether this will change in the course of time, whether evolutionary, that is atheist or (in slightly milder form) agnostic, positions will become more widespread in the future. Europe, after the dramatic political changes of the late 1980s provides an interesting model. In all former socialist countries but one, religion is booming, churches are being renovated, new ones are being

built in amazing numbers (e.g., in Romania), and religious viewpoints are being expressed in parliaments and other public institutions. Former East Germany is the exception: 45 years of Marxism sufficed to produce a predominantly atheist society, even the communist version of the First Communion for Catholics or Confirmation for Protestants has survived; many juveniles celebrate their coming of age in the “Jugendweihe,” a totally secular rite of passage.

One deeply troubling question plagues the minds of many who are convinced that religion is the product of human need rather than divine intervention: by what should it be replaced? Will an enlightened humanism be a sufficient and effective basis for the human societies on our planet? Or should one continue to adhere to religious dogmas and traditions, even when they are hollow, as is the case even for many believers, because the danger of creating a horrible vacuum is too great? This volume does not provide an answer; it tries to portray human religiosity in the light of the human evolutionary past.

The paradox of an evolutionary approach to religion is that it shows (convincingly, some would argue) how adaptive its deeply embedded basic neurocognitive mechanisms have been and still are for the human brain. Should we use its analytic capacity to surgically dissect these age-old adaptations, to finally overcome them? Would this not, in essence, constitute an anti-evolutionary stand? Many questions remain. We can only hope that readers will find the positions and answers in this book interesting, perhaps sparking off or renewing their own ideas about what religion really is.

# Chapter 2

## Evaluating the Evolutionary Status of Religiosity and Religiousness

Eckart Voland

**Abstract** Adaptations must meet three criteria: they are inherited, are the product of historical selective processes and thus show a special-purpose design, and they solve an adaptive problem or solved an adaptive problem at least at the time of their evolution. Central components of human religiosity (spirituality, group bonding, forming a personal identity, communication by honest signals and morals) meet these criteria. The exceptions are religious cognition and its product, religious metaphysics, which has to be understood as a non-functional by-product of mundane cognitive machinery, so that in summary, religious life and practice (mysticism, rituals, myths, ceremonies and taboos, fear of God, spirits or ancestors) are shaped to a very significant degree by biological adaptations.

### 2.1 Introduction

No human society appears to be without religion. In a far-reaching consensus, experts and laymen agree what the core phenomena of religion are. These phenomena exist in various forms in all human cultures. Without a doubt, religiousness is part of the canon of transcultural human universals (Antweiler 2007; Brown 1991). Religiousness is also very old. When exactly religiousness evolved cannot be precisely determined, because there are no paleo-anthropological fossils or archaeological remains of mental representations, of course, even if Rossano (this volume) has formulated an interesting hypothesis concerning the possible Upper Paleolithic temporal horizon of the evolutionary emergence of religiousness. Pre-Upper Paleolithic populations are assumed by this author to exhibit what he calls protoreligion (Rossano 2006). The use of ochre to paint the body and cannibalism could perhaps be linked with mental concepts which later developed fully into religious

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metaphysics. Anyway, religiousness is at least as old as other features of human symbolic culture and is inseparably interwoven with human nature (Mithen 1996).

Now, the universal dissemination of a feature, such as religiosity, and its pre-historic origins are by no means sufficient criteria for a biological adaptation. The crucial question must be whether religiosity has evolved, because there are very direct and immediate fitness benefits associated with religiosity in the Darwinian competition, or whether the mental basis for religiosity has evolved for completely different reasons instead, and therefore, religiosity would tend to have to be understood as a biologically functionless by-product of originally non-religious mental adaptations. If this were the case, all those sceptics who have always claimed that religious behavior cannot be beneficial, from a biological point of view, would be right, because the effort associated with the exercise of religion in terms of time, resources and risks could never pay off in units of reproductive fitness. Even if it should prove to be the case, however, that religiosity cannot be assessed as a biologically functional adaptation, it will, nevertheless, be necessary to clarify from which evolutionary adaptations religiosity represents a non-functional by-product; i.e. which evolved mechanisms of the mind can be exploited by religions and for what non-adaptive reasons religiosity has historically persisted through thousands of generations.

At this point, there seems to be a need to clarify the terminology. In the following, religiosity is understood to be the mental ability to be religious. Religiousness is the individually varying psychic and behavioral manifestation of religiosity and religion is the local and culturally based symbolic niche, in which the development of religiosity to religiousness occurs. In accordance with this terminological classification, the question of the evolutionary status of religiosity, i.e. the human ability to be able to behave religiously, forms the heuristic foundation, on which further evolutionary analyses of religious behavior in different social, ecological and biographic contexts should be based.

## **2.2 Is Religiosity an Adaptation or a Non-functional By-Product of the Human Mind?**

When evaluating the evolutionary status of religiosity, opinions diverge. Opinions holding that religiosity is to be understood as an adaptation contrast with those opinions, which merely classify religiosity as a by-product of an ordinary cognitive and emotional machinery evolved for non-religious, but mundane purposes. In my view of the discussions, the reasons for this lack of consensus are not primarily due to the differing evaluations of the sociobiological role of religiosity, but terminological fuzziness instead. The pertinent concepts – adaptation, exaptation, by-product and spandrel – are simply not used uniformly. For the most part, authors agree insofar as adaptations must meet three criteria: they are inherited, are the product of historical selective processes and thus show a special-purpose design, and they solve an adaptive problem or solved an adaptive problem at least at the time of their evolution.

On the other hand, there is much disagreement concerning the evaluation of a fourth criterion, which focuses on the functional history of the feature. Accordingly, an adaptation is defined by the fact that it has evolved for the same reasons for which it is now biologically useful (Ridley 2002). If this does not apply, one usually speaks of exaptations. Thus, the criterion for distinguishing between adaptations and exaptations, i.e. adaptations that were co-opted by new functions, is linked to a possible change in function. According to this view, it would be false, for example, to speak of bird feathers as adaptations for flying, because feathers originally came about for the purpose of heat regulation in dinosaurs that were unable to fly. Some authors subsume exaptations under the category of by-products, with the consequence that by-products can either be non-functional (standard example: the navel) or functional (exaptation).

In agreement with Thornhill (2003) and many other authors, I do not consider this distinction to be very useful. As is known, adaptation processes start with the building blocks that they find, i.e. the products of previous adaptation processes. Hardly any evolutionary change could be conceivable which did not occur through a change in the function of existing adaptive traits. This change in function is a constituent element of the process of adaptation and it makes little sense not to describe a naturally selected functional feature of an organism as an adaptation only because it had a different function in its earlier evolutionary history. Or would it make sense to not designate the inner ear as an adaptation for the perception of acoustic pressure only because it originated as the sense of balance? Does it make sense not to designate the bonding system of mammals as an adaptation for the regulation of sexual relationships only because it presumably originated from the mother-child attachment system?

These examples may serve to illustrate that the distinction between adaptation and functional exaptation is linked to the issue of whether natural selection had sufficient opportunity to assess a change in function. The ability to use modern technologies is not very likely to be described as a biological adaptation, because it is only a few generations old. The ability to write will also not necessarily be described as an adaptation. Even if this is likely to be 150 generations old perhaps, it is still too recent to have become evolutionarily fixed because of its genuine benefit. Accordingly, writing would be a functional exaptation. Religiosity is much older, however. Whatever biological adaptations were originally co-opted from this, the change in function coinciding with religiosity was being tested by natural selection for at least as long as the so-called “symbolic revolution” (Mithen 1996) and had sufficient opportunity to prove itself or fail from an evolutionary standpoint. In this sense, religiosity would have to be referred to as a biological adaptation, if it adequately fulfilled both of the criteria cited, namely “special-purpose design” and “function”. If the criterion of inheritance does not need to be dealt with any further, because the programmes for developing the brain, the site of human religiosity, are indisputably inherited, then the question regarding the evolutionary status of religiosity concentrates on the verification of these two criteria, i.e. those two criteria whose heuristic meaning for the identification of adaptations has been developed so lastingly by Williams (1966).

Religiosity has several components, namely a cognitive, a spiritual, a socially binding, an identity-forming, a communicative and a moral component. Therefore, it lends itself to structuring the question about the evolutionary status of religiosity according to this internal order and to deal with these six partial aspects of religiosity in detail and initially separately from one another. Let us begin with the role of cognitions in religiosity and question their special-purpose design and biological function.

### ***2.2.1 Cognition***

Religions make statements about ultimate truths; they produce metaphysics. In doing so, they necessarily have to rely on the whole range and breadth of the human mind which is the result of biological selection processes, so that metaphysical considerations always have to be biologically “earthed”. The biologically evolved range of the human mind includes such phenomena as “naive dualism” (Bering 2006), “teleological thought” (Kelemen and DiYanni 2005), “psychological essentialism” (Gelman 2003), a “theory of mind”, an “agency detection device” (Atran and Norenzayan 2004; Barrett et al. 2001; Guthrie 1993), “intuitive ontologies” (Boyer 1996) and a few more (cf. Frey this volume). When taken together and considering their interactions, this range ensures an adaptive mastery of many real living and survival problems. Children under the age of 5 years attribute omniscience to all of the persons in their immediate environment (Barrett and Richert 2003; Knight et al. 2004; Richert this volume). Only with the development of a “theory of mind” do children begin to understand that different sets of knowledge are at home in different brains. Children under the age of 5 years think teleologically: there are clouds so that it rains; and it rains, so that flowers can thrive (Kelemen and DiYanni 2005). Finally, younger children attribute mental states to dead individuals (Bering 2006). Therefore, they not only think dualistically, but at the same time, they store the assumption of a life after death. Interestingly enough, these cognitive basic attitudes of early childhood, namely the assumption of omniscient persons and a teleological and a dualistic way of thinking, also form the basis of crucial theoretical assumptions in many theistic systems of beliefs. Thus Bulbulia (2007, p. 632) concludes that “Children appear [to be] born to believe” and Kelemen (2004) summarizes that “Children are ‘intuitive theists’”. “Belief in God does not amount to anything strange or peculiar; on the contrary, such belief is nearly inevitable”, is how Barrett (2004, p. 122) puts it, and elsewhere, “The design of our minds leads us to believe” (p. 124). Accordingly, religiosity would not first have to be arduously learned. On the contrary, religiosity would almost automatically result from the cognitive equipment of human beings, whereas the actual intellectual effort would consist of renouncing faith as a rationalist.

The unique features of the human mind also include what D’Aquili (1972) has designated the “cognitive imperative” (Newberg et al. 2001). The cognitive imperative forces one to constantly reflect on the regularities and rules of one’s experiences. The cognitive imperative compels a plausible and coherent design of the

portrayal of world happenings, without any gaps in explanations, without any islands of irrationality. Human beings obviously cannot stand contingencies, irrationality or causal uncertainty, because what is not understood generates fear. To avoid this, reasons and causes are seen, even where there aren't any (cf. Frey this volume). The brain is a permanently working generator of stories. It not only sees rules where there aren't any, but also makes up stories, which allow these rules to appear to be more or less plausible. In this context, cognitive psychologists speak of the "need for closure" or "jumping to conclusions" (cf. Brüne this volume). Basically, Francis Bacon already knew this when he wrote in 1620,

The human understanding is of its own nature prone to suppose the existence of more order and regularity in the world than it finds. (Bacon 1620, book 2, aphorism no. 45)

Viewed in this light, the metaphysics of religion are based on errors and false classifications of basically functional cognitive machinery. In this way, the basic metaphysical assumptions are merely unavoidable by-products, with consequences that tend to be biologically harmless, of the biologically evolved psyche that is aimed at coping with adaptive problems and which although efficient does not function without making mistakes (Atran and Norenzayan 2004; Boyer 2001; Kirkpatrick 2005). How perfectly the mind works is a question of the cost/benefit balance of error avoidance, especially the fitness risks, which come from cognitive errors. In this context, Nesse (Nesse 2001) has formulated the "smoke detector principle". If a greater harm comes from the non-recognition of a risk than from occasional errors in performance, the cognitive machinery should be adjusted to be super sensitive, just like fire alarms are. An occasional false alarm does not have any negative consequences, for the most part. However, overlooking a danger can be fatal. In this sense, it is more harmless, in terms of biological consequences, to occasionally err and to interpret the mere rustling of leaves animistically, then to go through life without an agency detector. It is more harmless to occasionally succumb to suggestions and to see the wrong thing in twilight than to live completely without any intuitive ontologies and not recognize risks or opportunities that really do exist. This fuzziness of the cognitive mechanisms is the breeding ground for a religious metaphysics, which is why they have to be classified as a non-functional by-product of cognitive adaptations.

### ***2.2.2 Spirituality***

Spiritual practice makes use of special mental states such as meditation, hypnosis, trance and ecstasy. Talented persons are able to achieve these mental states with the aid of special techniques and to explore special worlds of experience. The neurochemical processes which coincide with these mental states are associated with consequences for health and well-being: they reduce the perception of pain, regulate temperature, support the immune functions, reduce the loss of blood, mitigate the effects of psychopathological dysfunctions and activate the bonding system (McClenon 2002; Winkelman 2006). Mystical experiences and therapy are

obviously inseparably linked, and this is exploited by shamanism. Owing to the close connection between therapy and mysticism, it is debatable as to whether or not shamanism belongs to the history of medicine or to the history of religion. In any case, mystic elements in day-to-day living can improve one's physical and mental well-being and thus provide for improved mastery of contingencies. This connection has an interesting evolutionary feedback: to the degree that shamanism was therapeutically successful, it selected genotypes which tended to accept suggestions and precisely for this reason, they were also open to unusual experiences that we call religious (McClenon 2002).

There is an extensive literature on the correlation between religious practice and mastery of life events; not only have interesting single studies repeatedly found a positive correlation, but so have statistically reliable meta-analyses. Of course, there is also the "dark side" of religious fears and obsessions, which are definitely associated with significant health risks (Guthrie 1993; Magyar-Russell and Pargament 2006). Overall, however, the positive effects clearly predominate (e.g. Grom 2004; Koenig et al. 2001; McCullough et al. 2000, Newberg and Lee 2006; Powell et al. 2003), which is why religion proves to be extremely functional from a biological standpoint. Fear, stress and pain are fended off by mystical devotion to religious fictions. Therefore, a first biological benefit function for religious behavior is described: self-preservation through an improved mastery of contingencies.

### ***2.2.3 Bonding***

The function of spirituality is not limited to personal benefits, however. Joint participation in rituals lends it a social dimension. Not infrequently, ritual performances are very rigid, redundant, compulsory and oriented towards "useless" behavioral goals. The whole process is frequently supported by rhythms and ends in a kind of "emotional synchronization" of the participants (Hayden 1987; Winkelman 2006). Without rituals that have an emotional impact, religions would lack both an emotional depth and a motivating power. This means that rituals are used in particular when the intent is to demand collective efforts or special altruistic services from the faithful (war, competition or solidarity). Physiologically, this is done by activating the bonding system common to mammals (Kirkpatrick 2005; Winkelman 2006). Psychologically, this is done by a form of the loss of self, by the feeling of being at one with the universe (Newberg et al. 2001). Individuality and egocentrism are displaced in favour of collectiveness. Accordingly, collective rituals have a lot to do with social coordination and cohesion, with the bundling of forces and with enabling gains through cooperation. Ecological and social risks of life can only be successfully countered through coordination under certain circumstances, and in a Darwinian world of personal utility maximizers, the motive of social cohesion first has to be arduously implemented. Various empirical studies show a clear correlation in migrant groups (e.g. Van der Lans et al. 2000 for Moslem youths in the Netherlands) between finding one's personal identity through group cohesion,



personal well-being and religious practice. Thus, there appears to be a second biological benefit function of religiosity: strengthening the community by obligating its members to work towards common goals.

### ***2.2.4 Personal Identity***

Human history is characterized by the constant competition of autonomous groups for the chances for life (Alexander 1987). This situation also holds true for chimpanzees who engage occasionally in extremely violent group attacks (Wrangham 1999). Jane Goodall (1986) called these aggressive encounters “wars” and found them psychologically similar to human wars. A neutral encounter between two groups is practically unknown, there are only friends or enemies, and the accident of group affiliation lastingly determines the personal identity and biography of every individual. However, it is unclear a priori, who actually is a friend or an enemy. Reliable markers are required to make this distinction and it appears that the human language makes a considerable contribution here. Essentially, language fulfils two functions within this context. Because dialects serve as cultural and ethnic markers, the “we” is also externally recognizable from “the others”. Due to social knowledge being exchanged, every participant in the linguistic exchange is informed about the social ties and tendencies of all other participants. Thus a common social network is created, with the consequence that all members of an in-group play their roles on the same stage and their well-being and lack of well-being depends, in various ways, on the well-being or the lack of well-being of the others. What non-human primates typically achieve through “grooming”, humans are able to do much more efficiently through the linguistic exchange of social knowledge, namely the integration of the individual into the social web of roles, thus adding a social dimension to one’s personal identity (Dunbar 1996). This is why the common experience with others and the resulting participation in a common culture of memories contribute to one’s personal identity. This is precisely what myths do. Common stories, common memories and common truths endow a community with a social identity and serve to hold the group together (cf. Palmer et al. this volume). In short, myths contribute to designing and psychologically maintaining the so lastingly important distinction between “we” and “the others” in human history. This describes a third function of religiosity: by propagating myths and creating a social identity in this way, competitiveness is promoted in disputes between social groups.

### ***2.2.5 Communication***

With their ceremonial practices, religions co-opt the “handicap principle”, an old biological communications system. In the animal world, “honest signals” about hidden qualities have evolved in three contexts (Zahavi and Zahavi 1997), namely in the interspecies communication between prey and their predators; in the social competition for positions of rank, where they help to negotiate hierarchies without the need

to fight battles; and finally, in sexual competition, where they permit conclusions to be drawn concerning the health qualities that a partner has. A special human feature is the implementation of the handicap principle in the field of morality (Voland 2003, 2004).

A pressing adaptive problem of early human history was, without a doubt, competition between neighbouring groups. As an adaptive response, in-group/out-group moral standards were developed that were as firm as possible, the essential function of which was to bond the members of a group into a social alliance and to commit them to a “feeling of togetherness”. Like all public goods, however, group solidarity is also subject to the “free-rider” problem. In a conflict between self-interest and the well-being of the group, the probability is greater that self-interest will win out. Although one might be inclined to use the benefits of group affiliation to one’s own personal best advantage, there are strong incentives, as personal utility maximizers, for avoiding costs accruing from the social alliance as far as possible. Not only can moral integrity not be seen, but it is even *a priori* unbelievable in a world of personal utility maximizers. This is why group solidarity always runs the risk of being exploited – unless its members and especially the newly joining members express their moral integrity with “honest signals”. This function is assumed by rituals, ceremonies and taboos (Dunbar 1999; Knight 1998; Palmer and Pomianek 2007; Voland 2003). The fact that the “adaptive calculation” of the handicap principle really does work was able to be demonstrated in a series of studies by Sosis and his co-workers (e.g. Purzycki and Sosis this volume; Sosis and Bressler 2003; Sosis et al. 2007). In summary, it can be noted that religions offer a matrix for communication via honest signals. Ceremonies and taboos serve to establish reliability within a moral in-group completely in the logic of signal evolution. Religion thus provides another biological benefit. It combats the “free-rider” problem in shared-risk communities by compelling communicative honesty.

### **2.2.6 *Morals***

Religions aim to strengthen the moral standards within a group. For reasons which are discussed under the label of the “prisoner’s dilemma”, and for which there is a long history of economic and sociobiological research, cooperation does not occur spontaneously, however. Behavior that serves groups tends to be an improbable affair, because a recurring moral dilemma is inseparably associated with a social lifestyle. It consists of the fact that short-term self-interest stands in the way of long-term gains through cooperation. Internal moral standards that serve groups constantly run the risk of being opportunistically undermined. High internal moral standards must, therefore, overcome incentives for short-term self-interest, so that self-interest can be realized in the long run. This can be successfully done through social controls. Opportunistic breakers of the rules are recognized as such and can be punished. This makes immoral behavior expensive and thus reduces its incidence, reinforces the group and promotes long-term gains through cooperation. Social controls do not completely dissolve the prisoner’s dilemma, however, because the punishment of the rule-breakers is an altruistic act by itself (Fehr and

Gächter 2002). Why should someone take the time, effort and risk to sanction a third party, if that someone does not have any immediate gain? Accordingly, social control is a form of altruism that cannot be evolutionarily stable.

Religiosity may have evolved in order to deal with this problem, namely the so-called second-order “free-rider” problem. When the Gods, spirits and ancestors sanction false behavior, the members of a group are released from the costs of a judicial review. Instead, the punishment for breaking the rules is internalized, by achieving conformity with the norms through a religiously fixed conscientiousness. Some cross-cultural findings support this hypothesis. Thus Johnson (2005) was able to show that the more strongly the members of a group cooperate with one another, the more distinctive the local ideas of all-seeing, omniscient and punishing and omnipotent Gods are. The findings of Roes and Raymond (2003) also fit into this picture; these findings show that the belief in a punishing God correlates with the size of the social group. This belief is practically unknown in simple subsistence groups. Experiments that show that priming God concepts increase prosocial behavior in economic games (Shariff and Norenzayan 2007) speak in favour of this point of view.

The idea that the fear of God could have evolved as the adaptive response to the problem of public goods will have to explain, however, how conscience was actually able to evolve as a moral regulatory instance. Why should someone “voluntarily” submit to the dictates of a conscience?

Regardless of such issues in detail, however, it really does look like religiosity helps to overcome the second-order “free-rider” problem (Johnson and Bering 2006). Sanctions of moral misconduct are internalized by exploiting the performance of a conscience.

### ***2.2.7 Again: Is Religiosity an Adaptation, or a Non-functional By-Product of the Human Mind?***

In Table 2.1, considerations about special-purpose design and function, regarding the individual components of religiosity, have been summarized. With the exception of the basic metaphysical assumptions of religions which are able to be understood as by-products of the biologically evolved human cognitive machinery that are useful in this life, all of the components of religious practice show biological utility, namely mastery of contingencies, identity formation, social-alliance bonding and the solution to the prisoner’s dilemma on two levels.

When can it be claimed that a feature has a special-purpose design? If one takes Williams’ (1966) criteria as the baseline, namely, efficiency, complexity and universality, then the question related to special-purpose design can in my opinion be answered in the affirmative for at least five of the six components. Religious metaphysics are generated by special cognitive modules, as discussed. Social rituals activate the attachment system. Self-awareness has been designed to form identity. The handicap principle and the conscience are surely subject to a special design, even if it is not fully clear yet what this looks like in detail. In my view, the only question left unanswered is whether the neuronal circuits of the frontal lobe that enable mys-

**Table 2.1** Special-purpose design and function of religious components

Component	Religious practice	Special-purpose design of the mechanisms involved	Biological function of religious practice	Evolutionary status of religious practice
Cognition	Metaphysics	Yes (cognitive machinery, e.g. agency detection device, etc.)	No	Functionless by-product
Spirituality	Mysticism	?	Mastering contingencies	Adaptation?
Bonding (communion)	Rituals	Yes (attachment system)	Formation of alliances	Adaptation
Personal identity	Myths	Yes (self-awareness)	In-group / out-group distinction	Adaptation
Communication	Honest signals (ceremonies, taboos)	Yes (handicap principle)	Solution to the first-order “free-rider” problem	Adaptation
Moral	Conscientiousness, fear of God, spirits or ancestors	Yes (conscience)	Solution to the second-order “free-rider” problem	Adaptation

tical experiences show a special design for mysticism or not – hence the question mark in Table 2.1. On the whole, I personally think it safe to conclude that religiosity can be seen as a complex conglomerate of evolutionary adaptations and one by-product.

The question of a possible change in function remains unconsidered – as explained – in this diagnosis. Indeed, there are some indications that there could have been functional changes in the biologically evolved components of religiosity. For example, it seems as though the neuronal mechanisms which are used by mysticism and which essentially are reward mechanisms originally arose in connection with sexuality and were only co-opted by religiosity later on. It could be that the original benefit of sexually fed excitement is able to be exploited through meditation techniques. The similarity of orgiastic and mystical experiences speaks in favour of this interpretation (Newberg et al. 2001). Whatever the case may be, this does not affect the validity of the criteria of “special design” and “function”. The

same applies to the handicap principle in analogy. It originally came about in the context of adaptive mate choice; however, it experienced an expansion in the direction of moral communication later on. In other words, there is much that speaks in favour of the fact that the individual components of religiosity have pre-religious, and evolutionary roots. The evolution of religiosity has surely not occurred without various co-options of functions that already existed, i.e. predispositions. However, this should not induce us to designate religiosity a by-product, because natural selection has had enough time during the course of hominization to reassess the results of the co-options itself. This distinguishes religiosity, for example, from soccer games or other modern activities. Even soccer co-opts evolved mechanisms; nevertheless, one would not want to label soccer as an adaptation, because natural selection has previously not had the opportunity to assess the biological consequences of playing or watching this kind of sport. In sum, the components of religiosity – at least to a significant part – can be recognized as special-purpose design endowed with biological functionality. This view leads to some interesting consequences.

## **2.3 If Religiosity Is an Evolutionary Adaptation . . .**

### ***2.3.1 Then We Can Expect that Religiosity Is Present in the Minds of Essentially All People***

It is one of the typical features of adaptations that they are present in practically all members of a species (Thornhill 2003; Williams 1966). Of course, there are also sex- and age-linked adaptations, but apart from these special cases, the adaptations of *Homo sapiens* overall form what is called “human nature”. However, both religiously obsessive and absolutely unbelieving persons can be observed. From the perspective of adaptation, it cannot be claimed that persons rejecting religion do not have the adaptations for religiosity, but that for reasons which would have to be studied their religiosity did not overtly manifest itself. Adaptations can be “conditional universals” (Gaulin 1997), such as corns or fever, which develop their adaptive logic only under very specific biographical circumstances. Or could it be that religiosity manifests itself in ways other than through traditional religiousness? Could it be that these adaptations generate behavior in day-to-day lives that are not directly and immediately recognized as being religiously motivated? What about the fanatic fans of a sports club, a revolutionary movement, an ideological basic conviction, a lifestyle, a pop culture, of parapsychology or pseudoscience? In short, is there religiosity without religion?

### ***2.3.2 Then We Can Expect Special Design in Ontogenetic Development of Religiousness***

The characterization of religiosity as a biological adaptation and religiousness as its manifestation raises the question of whether we are not dealing with a case that

is analogous to language here. Languages, like religions, have a cultural tradition and differ from one another historically. This process of passing down either a language or a religion occurs through the individual acquisition of a language/religion through learning processes that are “similar to imprinting”, which is why Pinker (2000) refers to the “language instinct” and Söling (2002) to the “God instinct”. All of this is done on the substrate of a biologically evolved ability to speak or to be religious.

Taking this perspective seriously means that religions are taken over ontologically in a specially designed way. Just like the individual acquisition of language preferably occurs during specific sensitive phases, during which the prepared brain seeks specific inputs in order to develop linguistic competence, it can be expected that the takeover of the local religion also occurs in prescribed timeframes. Alcorta and Sosis (2005) see in adolescence a critical period for the learning of emotionally valenced symbolic systems and the *rîtes de passage* as the practice hereof. Should it prove to be the case that the individual takeover of local religious practice actually is based on domain-specific learning mechanisms, this would indeed be the best argument for the hypothesis of religiosity as a biological adaptation. From the point of view of the by-product hypothesis, religion would only be learned by the way and in a non-specific manner, comparable to a memetic infection – without the brain assembling specific modules for taking over precisely this content.

### ***2.3.3 Then We Can Expect Genetics of Religiosity***

Adaptations are inherited, i.e. their genetic basis is passed on from one generation to the next. Because adaptations exist in all members of a species, they have a hereditability which approximates zero (Thornhill 2003):

Heritability is a term that describes the extent to which the variation among individuals in a phenotypic trait . . . is caused by genetic, as opposed to environmental, variation among individuals. (Thornhill 2003, pp. 15–16)

The adaptive perspective supports the hypothesis that human variation in religiousness arises primarily not from genetic differences, but from differing conditions affecting the adaptation, i.e. from environmental and condition-dependent experiences. The experience may involve the past, as in the person’s ontogeny or upbringing, or it may be solely due to cues of the moment. Accordingly, different levels of religiousness would be the condition-dependent manifestation of the adaptation, so the question is: What specific circumstances and experiences contribute to the development of religiousness?

However, the variance of religiousness is not completely able to be explained by differential milieu influences, because it seems that religiosity, like other personality traits, also has a remarkable heritability (cf. Bouchard this volume). What does this observation mean for our topic? Is religiosity an example of selection in progress? Or is the ratio of religiosity to non-religiosity regulated by frequency-dependent selection? “Religion survives because it produces children, not because it

is true” is something that the rationality sceptic and Economics Nobel prize winner Friedrich-August von Hayek (as cited by Vaas 2006) already knew. Like Blume et al. 2006 (cf. Blume this volume, for Germany and Switzerland), Adsera (2006), Frejka and Westhoff (2008) and Zhang (2008) were able to show for Spain or the US that religious commitment actually correlates with fertility. Accordingly, it appears that religious people, even in modern, enlightened societies, are more successful than others in overcoming the personal barriers in having children. However the correlation between religiosity and differential reproduction might have come about, religious persons are often observed to overreproduce. Of course, fertility does not equal fitness, but is only one of its components. Survivorship and social placement of the offspring in the community are other components. Whether differential reproduction by religiousness is linked to genetic differences is unclear. This could be the case if, for example, genetic personality factors predispose religiousness. This does not have to be case, however, because the same genotypes occupying varying social niches could utilize varying opportunities for reproduction. Correlations of fertility and religiousness could simply be confounding effects. At the moment, it is still completely unclear whether differential fertility by religiousness is related in some way to directional selection in progress.

However, it could also be that religious commitment is associated not only with selective advantages but also with significant costs, the amount of which depends on the ratio of believers to atheists in a society. This would then be a case of frequency-dependent selection. Although no case study has been developed to date, to my knowledge, to find out which costs specifically these could be and how they would be reflected in the pay-off matrix for religiousness, the model of frequency-dependent selection could offer a better explanation than the assumption of targeted selection, as to why there are actually so many liberal atheists.

## 2.4 Conclusion

To answer the question regarding the evolutionary status of religiosity and religiousness, we have varyingly extensive and reliable knowledge at our disposal. It is becoming increasingly clear that the constituent mental elements of religiosity, that is, the ability to be religious, show a special-purpose design and that its practice in religious day-to-day life (be it in the form of mysticism, rituals, myths, ceremonies and taboos, fear of God, spirits or ancestors and conscientiousness) is biologically functional on average. This is why religiosity can be regarded as an evolutionary adaptation which belongs to universal human nature as a genetically fixed component. The biological function of religiousness, i.e. the individually varying manifestation of religiosity, is less clear, however. Behavioral ecology theory makes a few predictions here (e.g. it predicts a correlation between the investment into honest signals and intergroup competition), but empirical reviews of evolutionarily inspired theses on differential religiousness are absolutely scarce. All these considerations lead to the conclusion that it is no longer a matter of verifying an evolutionary perspective on religiosity, but of closing the gaps in sociobiological research with

regard to the individual, ecological and cultural differences in the manifestations of religiosity in religiousness.

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