6
What is Right and What is Wrong in the Darwinian Approach to the Study of Religion

Konrad Szocik
University of Information Technology and Management, Rzeszow

Abstract

One of the greatest challenges for the study of cultural evolution is an explanation of processes and mechanisms of transmission of cultural traits. Darwinian approach is a promising and useful research program. However, it is worth asking in what extent Darwinian account can provide appropriate and reliable explanation for origin and transmission of religious components. In this paper we would like to discuss some benefits and weaknesses of this approach for the study of religion.

It seems that Darwinian approach fails to explain transmission of acquired traits and non-random variation. We can look for biological benefits provided by religious affiliation when trying to explain it in terms of survival and reproduction. However, we assume that biological evolutionary explanation cannot explain ultimately some unique human traits like religiosity. Biological evolutionary account can explain a number of similarities between humans and non-human animals in some basic behavioral patterns (similarity by homology). The focal point is if this approach can provide reliable explanation for specifically human cultural phenomena that only analogically can be found among some social animals, especially social insects, like in the case of mechanism of eusociality. The key idea of our paper is that Darwinian approach to religion might explain only small part of human religiosity, and reliable explanation should combine Darwinian and cultural evolution, and cognitive account.

Keywords: Darwinian approach, religion, humans, cultural evolution

Introduction

Religion, religiosity, and religious components are still widely discussed topics. One view of religion is that it can be explained as a by-product of other adaptations and as an adaptation or something that possesses adaptedness. This

topic refers to a more basic and fundamental question: Is the Darwinian account an appropriate explanatory framework to explain religion? In this paper I am going to discuss the field of evolutionary study of religion but I go beyond the mentioned by-product/adaptation distinction. My aim is to consider again the Darwinian account to the study of religion and to find some benefits and disadvantages that are a domain of this approach. I will focus mainly on the set of problems that are a domain of cultural evolution.[1] For this reason, there will be discussed some conceptual challenges, advantages, and possible limitations that are associated with evolutionary explanations of culture including religion. My key idea is that the application of Darwinian account to the study of culture including religion requires too many exemptions, special interpretations, and extra explanations that drastically limits its applicability and effectiveness. After a brief inquiry I state that the Darwinian account may be applied only in some rare cases that makes this approach not very useful for the study of culture. My skepticism does not have metaphysical and ethical nature (we mean the critique of Darwinism based on naturalization and reduction of humans to animals) but purely definitional, conceptual, and in some sense, epistemological. I also argue that there are too many differences between genetic and cultural changes to enable the simple transmission of Darwinian conceptual framework to the study of totally different cultural phenomena.

Causal Agents of Cultural Change. Basic Questions in the Discussion on Darwinian Account and Religion

Cultural phenomena are so important and common in human species that talking about 'the extension of biology through culture' is obvious and accepted. I mean that culture may and should be explained by biology, especially in the evolution of genes. Andrew Whiten *et al.* enumerate three general conceptual frameworks at the intersection of cultural and biological evolution. Cultural evolution works as a second and parallel system of inheritance. Cultural changes include not only vertical transmission like genetic changes but also horizontal and oblique ones. Both kinds of changes may interact in ways described by gene-culture co-evolutionary approach (Whiten *et al.* 2017: 7778). Culture is a function and/or ability that is possessed by humans and some non-human animal species. For this reason, this ability as a general and formal function may be considered in terms of Darwinian selection as a feature that has evolved for fitness maximization. The problem appears when scholars are going to study particular cultural phenomena and products of this general ability. Darwinian

---

[1] Although the idea of cultural evolution is discussed for several decades, this field is still *in statu nascendi*. Many recently published papers still discuss the basic, definitional topics and concepts, including PNAS special issue *Sackler Colloquium on Extension of Biology Through Culture*, 2017, 114 (30); published ahead of print July 25, 2017.

theory describes the concept of evolution by natural selection. This theory was primarily developed on the basis of observation of human artificial selection on some animal species, and as a theory that has described differences in shapes of beaks of finches at Galapagos Islands. The starting point for this approach is thus a question about the causal agent of natural selection. Who or what is the causal factor of natural selection that acts on cultural traits including religious ones? In the case of building canoe, one can assume that the causal factor is the sea and the marine environmental conditions that require careful building and faithful copying of boats. In the case of Darwinian finches, the causal agent is a pool of available seeds affected by weather conditions. Natural random variation of various finches or any other birds is then limited, and only some kinds of beaks are preferred for survival dependent on available resources. Definitely, this theory is easy, convincing, and by that elegant but more with regard to 'simple' physical traits like speed, power, or agility. Psychological variants are much more difficult to explain. One of still debated and rather unresolved topics is the evolution of cooperation including altruism. One can say the same about cultural traits including religious ones. What is the causal agent of natural selection in regard to religious components? One can try to find some possible candidates among such factors such as the need for social cohesion affected by human sociality and sociability, the importance of human reproduction (because religiosity and religious affiliation is correlated – however, in causally unclear and ambiguous way – with higher reproductive rate), or in looking for consolation (because psychotherapeutic support provided by religion is one of the most important functions of religious components). However, is it possible to assume that these, definitely important factors, could lead to the evolution of religious components and could favor their development and transmission? In ancestral environments, supernatural/religious components were expected to be too complex and too unnatural to be selectively favored for the purposes described in terms of Darwinian selection. It is the key idea of Lee Kirkpatrick's critique of adaptationist explanation of religion. He argues that religious components are too complex to fit the criteria of biological adaptation, and for this reason they may be easily replaced by other, non-religious traits (Kirkpatrick 2006). One can imagine that other natural and less complex phenomena are provided to achieve the above mentioned purposes. However, to avoid methodological misunderstanding, it is worth indicating precisely an appropriate level of analysis. The concept of memetic adaptation states that if someone is going to measure impact of a given cultural trait on fitness, he should measure fitness of this trait, not genetic fitness of its vehicle like individual or organism (Dunbar 1998: 81). Measuring of memetic fitness shows that religious components often have a high rate of reproduction. This is a metaphorical and analogical interpretation of the Darwinian approach that is not definitely equal to a pure

Darwinian account. The Darwinian explanation of culture requires looking for fitness of the vehicle of a studied cultural trait, not for fitness of that trait itself.

Three Darwinian principles include a struggle for existence affected by overpopulation and limited resources, variation among populations, and inheritance of adaptive traits. Darwinian natural selection is 'evolution by variation and selective retention' (Boyd and Silk 2015: 6). Lewontin's famous brief definition of natural selection enumerates such principles like variation, heredity, and differential reproduction. Adaptation is understood here as the product of competition among individuals, not between groups or species. Natural selection produces adaptations that are useful for an individual even if they are deleterious for the whole group (*Ibid.*: 10). However, some scholars favor the concept of multilevel selection theory including group selection. I appreciate the idea of multilevel selection theory but I also assume that this approach is more plausible with regard to some transitions in biology like evolution of multicellular organisms. We are skeptical of applying the idea of group selection to human populations for the reason that very strict rules should be at work for natural group selection to occur, such as small groups of mutually dependent members that have extremely low rate of migrations. I start my considerations by enumerating some basic questions.

Cultural traits such as beliefs compete for human attention. Some of them are acquired and transmitted better and easier than others. They may be copied in a faithful way. However, genes are transmitted from parents to offspring, while cultural traits may be transmitted not only vertically but also from all other members of community. Vertical transmission of genes guarantees its faithfulness. Transmission of ideas does not depend necessarily on their impact on fitness. Consequently, also selectively neutral or maladaptive ideas are transmitted and spread through populations (*Ibid.*: 426). I find here the first great challenge for an opportunity of application of Darwinian account to the cultural evolution and its explanatory usefulness. It is obvious that many cultural phenomena are not correlated with maximization of fitness, and they are transmitted and acquired independently of it. One can assume that most of them are selectively neutral. This phenomenon may be interpreted in many ways. One interpretation assumes that there is cultural equivalent of genetic noise and genetic drift that does not exclude an opportunity of adaptive nature of other cultural phenomena. Another approach assumes that selectively neutral nature of many cultural phenomena suggests that the Darwinian account is not an appropriate approach to explain cultural changes. I am familiar with this second account. Darwinian account sometimes may be successfully applied to cultural evolution but perhaps it is not the success of this method but the result of random coincidence between culture and fitness maximization.

Another problem is as follows: culture includes various phenomena, from simple clothes that protect against the cold to the International Space Station.

Is it possible to explain such different phenomena in terms of the same conceptual framework? Is the space station an extravagant by-product of human cognitive and technological abilities, or can it be understood as something necessary for our further survival as a species (advancing space technologies, warning against threats, testing new technologies useful for the all mankind, *etc.*)? The problem increases when we include not only products of culture like the mentioned clothes or space station but also the ways of transmission and acquisition including language. Language is definitely necessary for human survival, reproduction, and development but it does not necessarily have to maximize fitness. This remark is reminiscent of another challenge that is another important topic in cultural and biological evolution: what phenomena may be called adaptations? Some scholars argue that the term 'adaptation' should come in degrees when it is applied to description of cultural traits. Martin Hewson points out that some cultural phenomena like cooperation or language are definitely adaptations. However, the adaptive nature of religion is still a widely discussed topic (Hewson 2013: 116). I do not discuss it here but it is worth bearing in mind that different authors in various ways define adaptation (something that must provide survival, or reproduction, or both of them). Culture, in contrast to biology, is not narrowly oriented to reproduction and even survival but includes many phenomena that are used for increasing comfort, organizing human spare time and satisfying human curiosity, just to mention a few. Of course, one can try to explain all of them in terms of sexual selection but I assume that sexual selection's explanation of culture at least in some cases may not be very suitable. I treat the above mentioned cases as examples of the mismatching of the Darwinian account to the explanation of many cultural phenomena. This remark introduces the challenge of distinction on functional and symbolic design features. The changes in functional features are connected with chances for survival and they should work in other ways and in some sense independently of changes in symbolic traits. This distinction should be applied to the study of religion. Are religious components a domain of functional or symbolic design features? If they are functional features, they may be explained in evolutionary terms. If functional features that affect fitness change more slowly than symbolic traits, it may suggest that they are affected more by non-random natural selection than by random innovations. Their adaptive potential is preserved and conserved by negative purifying selection (Rogers and Ehrlich 2008). In the mentioned case of technique of boat building, the adaptive function of culture has purely biological and technological sense, and it is necessary for survival. Much more symbolical and abstract cultural features including religious ones may not play such direct biological role. This remark may work as a general rule that accepts many exemptions. One possible adaptive function of symbolic traits that may be favored by natural selection is the promoting of coordinated behaviors among mutually interested individuals because cooperation often

depends on commonly shared symbols (Alvard 2003). However, as it is known, a majority of cultural traits does not work for this purpose, and the question still remains as to whether we may find for them any other adaptive functions.

Another key topic is the question of levels and units of selection. This is a great challenge for philosophy of biology, however, probably greater for philosophers than biologists. I am not going to discuss it here in detail but I assume that it is definitely a crucial methodological and conceptual issue for the discussed subject matter. Definitely, this topic enjoys special attention when applied to the study of culture because cultural evolution introduces many new levels (besides biological levels and units we should discuss benefits for many cultural units and levels with or without connection to the genetic background of their vehicles). Phenotypic plasticity and no rigid genetic system may suggest that natural selection does not act only on genes (Burian 2010: 152). Samir Okasha points out that the idea of natural selection is abstract and is not limited to one level in the hierarchy of entities. The basic criterion is heritable variation in fitness (Okasha 2008). It may work on various levels and various kinds of entities. Charles Darwin accepted, at least in some cases, between group selection (Darwin 1998). Nevertheless, Richard Dawkins (1976), George Williams, and William Hamilton propose the gene's eye view. Hamilton argues that the basic criterion is in providing benefits for the gene, not for the organism. An organism may experience disadvantages but his 'altruistic' behaviors can be beneficial for the genes in his relatives (Hamilton 1964). Williams argues that group fitness is the product of individual fitness of group members. The level of parents and offspring works here as the unique explanatory level. There is a distinction between the population of adapted individuals and the adapted population of individuals. Group behavior is a statistic summary of individual adaptations. The criterion of adaptation is its functional design, not its alleged results.

Williams' remark provides important conclusions for the study of religion. Scholars are trying to explain some religious components in adaptive terms. They may fall into the trap of focusing on observed results instead of looking for possible functional design of religious features. For this reason, it is not clear what is the functional design of religious components: is their adaptive function like social cohesion or promoting reproduction, or is it internal religious worship? The following famous example provided by Williams works as an useful metaphor for all interested in applying the Darwinian approach to the study of religion. Williams noted that a group of animals huddling together in cold winter provides not only mutual heating but also channels for the spread of diseases. If every religious component is used for worship (and usually it is the case of religious components including behaviors, rituals, and beliefs), perhaps

that is its unique plausible explanation. If it is true, no one should look for adaptive explanation of observed results that sometimes may be provided by religious components. Groups live longer than individuals, and group's modifications are overcome by faster and more frequent individual changes. For Williams, apparent group behaviors are not group functions but they work as summation of individual functions and individual behaviors. According to Williams, adaptations are designed by natural selection only for the purpose of fitness maximization of individuals that possess these adaptations. Apparent population level effects of a given adaptation are only a 'statistical by-product' (Williams 1966: 211–212, 237). Adaptationist explanation of religion fails because it explains religion in Darwinian terms as a group level adaptation. Religion works at the level of a group, while believers work at the level of an individual. The believer decides on possible usefulness of religion that may contain wide and undetermined spectrum of various kinds of applications. For this reason, there is no sense to talk about stable, general, abstract function of religion or particular religious component because the unit of religious selection is an individual believer and his personal attitude to religion. This conclusion is compatible with Williams' theory of the gene and individual as the unit of selection. Furthermore, the Darwinian account of culture (including religion) fails in many cases because not only genes but also many environmental and behavioral factors are at work that substantially modify individuals and groups (and, consequently, their culture) without parallel genetic modifications. Apparent correlations between genes and behavioral patterns may be the result of such factors like 'assortative mating, spatial autocorrelation, and a shared environment' as noted by Creanza *et al.* (2017: 7784). They argue that many models discuss the ways of transmission of cultural traits but they do not refer them to their possible genetic background and fitness (*Ibid.*: 7787). This remark is important for the proponents of the adaptationist explanation of religion who are looking for the impact of religious components on fitness. This point is definitely noted by Joseph Bulbulia (2008: 104) who wrote that 'though not always adaptive, religiosity evolved as a powerful fuel for biological success'. Nevertheless, some religious components seem to fit the criteria of Darwinian adaptation, if there is some correlation between the level of religiosity and reproductive rate.

If someone is going to apply these distinctions to the study of religion, one should identify an entity or a group of entities that are beneficiaries of adaptive features. Then one should find such an adaptive feature among religious components that could be under selective pressure (Sober 1993: 89). The scholars should carefully apply the concept of adaptation to cultural studies including the study of religion. Stephen Jay Gould and Richard C. Lewontin argue that function should not be identified with adaptation (Nielsen 2009: 2487). It is diffi-

cult to test if a given feature is the result of natural selection or genetic drift (Orzack 2008: 89). A search for the function may introduce the concept of normativity to biology. John Searle points out that a function is the product of the human mind, not a domain of a given trait, and it depends on an observer (Cummins and Roth 2009: 50). For this reason, the better approach to the study of religion is a systematic, not a selectionist account. The systematic approach assumes that the function should be analyzed in terms of its current impact on survival of organism, not in terms of its past benefits favored by natural selection (*Ibid.*). The selectionist account states that subsistence of a given trait is affected by its function that provided and provides reproductive success (Perlman 2009: 66). The systematic account separates having function from having results. Its function is normative and assumes that a given trait is supposed to provide some results. The systematic approach is trying to explain the effects of a given trait without assuming any normative function (Cummins and Roth 2009: 73). It offers an evolutionary non-Darwinian conceptual framework for the study of religion. Definitely, it is the case for religion and religious components that various broad spectrum effects are caused: from direct impact on survival and reproduction to definitely non-reproductive mystical and spiritual experience.

Cultural Evolution without Darwinian Natural Selection

Cultural evolution is supposed to be able to explain the processes and mechanisms of transmission of cultural traits (Brewer *et al.* 2017). Cultural evolution is understood here as a mechanism totally separated from genetic evolution because genetic evolution works more slowly than cultural transmission. Michael Tomasello (1999) points out that evolution of some cognitive achievements of modern humans is too rapid to fit the criteria of natural selection. Liane Gabora is one of the authors who reject the applicability of the Darwinian account to the study of culture and proposes alternative evolutionary frameworks. She develops the concept of communal exchange that is an alternative to the Darwinian approach. Gabora (2018) points out that the Darwinian account does not explain cultural evolution because cultural traits are acquired, not inherited, and they are generated in a non-random way, by strategy and intuition. Darwinian selection explains the transmission of inherited traits but does not explain the transmission of acquired traits and non-random variation including novelty and creativity (*Idem* 2013a). Some critics point out that Gabora's approach is too broad and too radical because some cultural traits definitely may be the subjects of natural selection (Madsen and Lipo 2013: 150). Gabora adds that evolution by natural selection is a rare process in natural world. Natural selection does not work in the domain of culture in which the most important changes introduced by novelties are specially designed by humans (Gabora 2013b: 163).

It is worth mentioning some conceptual differences. For Gabora, innovations are the result of non-random processes. However, many other scholars assume that innovations are the products of random processes like mutation. Gabora (2013a: 120) argues that thoughts and ideas work as genotype, while actions and artifacts work as phenotype. The selectionist account does not explain creative factors in evolution of culture; Darwinism itself explains these transmission biases. However, some critics suggest that novelty and inventions may be explained as a result of the historically long process of accumulation, blind variation, and incremental improvements (Brown and Richerson 2014: 117–118). Ross and Richerson (2014: 103) argue that there are some genetic-like processes in cultural evolution like 'random errors in teaching or acquiring items of culture (akin to mutation), statistical effects in small populations (akin to drift), and the effect of using different cultural variants on an individual's survival and reproduction (akin to natural selection)'.

Nevertheless, the evolutionary approach, especially evolutionary psychology cannot explain ultimately the uniqueness of humanity. The Darwinian account finds and explains the similarities between humans and non-human animals in such fields like 'fight, fear, forage and fornicate'. It finds homologous mechanisms that affect such patterns but fails to explain the origin of human uniqueness as a species (Barrett, Henzi, and Lusseau 2012: 2108). Animal populations were not affected by culture, especially not by such specific and complex cultural traits like religious components. Taylor Davis criticizes an idea of explaining uniquely human phenomena by biological principles that are commonly shared among various animal species. This point refers especially to religion and to human altruism that is affected by culturally inherited religious beliefs and practices (Davis 2015: 250–251). Independently on the real impact of religion on evolution of altruism, various religious texts offer examples and patterns of altruistic and self-sacrifice behaviors. This cultural coincidence is responsible for the common idea that religion and morality are linked with each other.

Cultural evolution theory rejects the concept of many domain-specific mechanisms that is the key idea of evolutionary psychology, and instead is focused on domain-general mechanisms that enable fast adaptation to the new environmental stimuli. It assumes that the environment of Pleistocene was too irregular for the evolution of domain-specific modules. Natural selection made pressure for evolution of several general rules (Brown and Richerson 2014: 113). Religious components are one of the many possible traits that are enabled by domain-general mechanisms. Cultural transmission works differently from the genetic one. Evolution of a given cultural trait determines its mode of transmission that is the consequence of the nature of this trait (Claidière and Jean-Baptiste 2012).

Biological and Cultural Evolution are Guided by Different Rules

One of the individual level adaptation's theory of religion, costly signaling theory assumes that strangeness and costliness of some religious components is used to develop in-group trust and cooperation (Sosis 2004: 168). This approach fails to explain origin of religion in general, and could be applied only to a few examples of religious practices. Religious components had and continue to have various functions, and they definitely did not evolve only for providing exclusive in-group signs. This function of in-group marker for a given population could be co-opted to religion and to every other unique, in-group cultural phenomenon.

In the Darwinian approach to religion, religious components are often explained as factors that were used to enhance cooperation. Of course, this function – if really supported by religious background – is successfully explained by non-Darwinian perspectives including the Durkheimian theory of religion. The human ability for large scale cooperation may be understood as the combined result of social norms and norm-psychology (Chudek and Henrich 2011: 218). Evolution of religion is a feedback with social evolution. Religious beliefs and behaviors have affected but also were affected by social changes like division of labor, development of new modes of political organization, or development of money and writing, just to mention a few (Bellah 1964: 13065). The Darwinian approach may explain only selected cultural changes. Similarity between cultural and biological evolution is stronger in technology than art or religion. One can imagine that works of art are not correlated with increasing fitness. However, it is much more difficult to imagine that technological improvements will decrease fitness. They may do it as an unintended by-product but they are definitely invented and are used to improve our comfort, safety, health, *etc.* Laland (2017: 8) points out that cultural artefacts are the products of refinement and reworking, and they build cumulative culture. Cumulative culture is usually considered as a unique human feature. However, some authors treat it as a kind of social learning common at least for humans and chimpanzees (Caldwell and Millen 2008: 3530).

The difference between cultural and biological changes is seen in the way of transmission and acquisition of cultural changes. Cultural traits may be acquired and transmitted by social learning including teaching and imitation, invention, or mental simulation. Mental simulation enables anticipation of future benefits and disadvantages of implementation of a given cultural trait. It seems that there is no genetic equivalent of the function of anticipating of possible future adaptations like humans may do towards beliefs, practices, or tools. This fact shows that human culture is specially designed for a planned purpose. Biological adaptation is also specially designed but in a different way when com-

pared to human cultural artefacts. Biological design is the result of variation that excludes and lead to extinction of the worst and the weakest forms. But variation itself is not designed for anything and by anyone except for genetic mutations and recombination. In the case of culture, humans may intentionally produce the best forms, and human cultural variation may include only the best, the fittest forms. Humans do not produce intentionally both weak and fit forms. Cultural evolution's computer modelling conducted by Gabora shows that invention maximizes fitness more than imitation. Culture includes phenomena that do not have any biological equivalent. Cultural evolution is the combined result of the properties of the world and of the agents (Gabora 2008). For this reason, the concept of natural selection may not be applied to the field of human culture because the causal agent of cultural evolution is conscious and intentional human agent who intentionally plans and invents the best options. We may look for other than humans, causal agents of cultural evolutionary changes and assume that human invention is always affected by environmental – natural and social as well – challenges. But, finally, human is the last agent of cultural 'natural selection' and he does not produce intentionally variation of artefacts including weak and fit forms like it is in the case of biological random genetic variation. As Gabora points out, cultural variation is a non-random variation, in contrast to genetic random variation.

There is a strong isolation between biological lineages in contrast to cultural traits. Separated cultural lineages mix often and easily, while various biological lineages usually do not mix (Gould 1987). Stephen Gould argues that in biological evolution divergence does not lead to subsequent joining of divergent lineages. Biological lineage, once diverged, does not combine again. Divergence and branching is a basic biological process that excludes again connection of various separated genetic lineages. In cultural evolution, divergent lineages often combine and join, and it is one of the basic phenomena in cultural evolution (*Idem* 1991). One can speak about transmission and joining between various cultures but we can almost never find it between species. Biological evolution is a branching tree-like process. Cultural evolution works as blending process and is based on reticulation and hybridization like, for instance, the mixing of various languages or religious syncretism. However, as Gray, Greenhill, and Ross (2007: 365–366) suggest, hybridization occurs also in biology among plant and animal species. Independently on possible cases of hybridization in biology, cultural phylogeny is rather a blending process in which various cultural lineages merge into one, rather than the branching process in which one lineage branches into several new lineages (tree-like concept of phylogeny) (Reisman 2013: 434).

Evolution of cultural traits is strongly context and subject dependent. Not all cultural factors evolve in the same way. Language is an exceptional cultural phenomenon in the sense of its evolutionary stability. Language is inherited in

early childhood from parents to their offspring without modifications. This vertical transmission is very precise and is supported by strategic usefulness of language for communication. Evolution of language is a very slow process in contrast to the rapid evolution of many other cultural traits. The speed and easiness of modification of a given cultural trait depends on its strategic usefulness and social importance. Language is much more important for survival and reproduction than other traits. Its possible modifications at least partially should fit the criteria of biological adaptation. It means that evolution of language is regulated by its impact on survival and reproduction more than other cultural traits that do not have to be connected with fitness maximization. Not all cultural traits including language may be modified quickly and in a revolutionary way.

Religion is also modification-resistant but sharing common religious beliefs and rituals does not provide the same adaptive value for individuals in the same way that sharing the same language and cognitive ability helps to develop early language skills. There are at work various causal agents of evolutionary change. In the case of religion, modifications often have been caused by official authorities. However, evolutionary change sometimes has been affected by believers. This latter kind of modifications could be compatible with the concept of theological (in)correctness developed by CSR. Evolution of religion is slower than other cultural traits like habits, ethical norms or legal rules. Religious ethical systems do not accept or accept late changes that are introduced by secular systems.

The Darwinian account is too narrow to explain complexity and capacity of human mind. If natural selection is a non-random process of production of the best adaptations in the current environment, it is not clear why it generates such highly advanced mind that possesses creating culture abilities. Humans need much simpler mind to survive. Evolution of human mind went beyond requirements of the ancestral environment. Many cultural and social traits that were affected by this highly advanced mind, were and are disadvantageous. Many cultural traits are maladaptive. According to Tim Ingold (2004: 211–212, 217), reduction of biology to genetics is responsible for possible explanatory difficulties in the explanation of cultural evolution by biological evolution. The Darwinian account does not explain acquired and culturally transmitted traits that make humans special. Acquired traits have replaced instinct-like innate traits (Wunn, Urban, and Klein 2012).

Evolutionary explanatory framework offers various approaches that provide different conclusions in cultural, ethical, or behavioral matters. One of the most basic differences lies between evolutionary psychology on the one side, and human behavioral ecology on the other side. Evolutionary psychology assumes that many behavioral patterns are maladaptive today because of their old

evolutionary history. Human behavioral ecology points out that human behavior in general is adaptive to the current ecological niches. Religious beliefs are interpreted as by-product or as adaptation including individual level adaptation – care for own reputation, or group level adaptation – when they work for social cohesion.

Individual level adaptation's theory of religion includes supernatural punishment theory, costly signaling theory, and kleptocracy theory. The first one assumes that belief in supernatural agent/agents works as a regulatory factor that is affected by the care for reputation. This concept is connected with the idea of being watched. Evolution of language and theory of mind made possible disseminating of knowledge about human actions among people who are not witnesses of given acts. The crucial idea here is the concept of reputation (Bourrat 2015: 762). Despite possible pragmatic value of some religious components possibly affected by natural selection, some scholars including Dan Sperber argue that cultural evolution should not be compared to natural selection. Cultural traits often are transformed and modified during transmission, and they do not replicate like genes. Consequently, cultural traits are the subject of frequent mutations. In biological evolution, natural selection works when the rate of mutation is very low (Sperber 1996). A low level of mutations that is required by natural selection is impossible to achieve in cultural transmission in which ideas are constructed and reconstructed (Acerbi and Mesoudi 2015: 486). Reconstruction of ideas, beliefs or behaviors is a cultural equivalent of genetic mutation. Cultural traits are often reconstructed and dynamically shaped by learners. They are not faithfully transmitted despite the fact that mechanisms of transmission in cultural evolution are based on observation. For this reason, cultural evolution is preservative and reconstructive as well (Claidière, Scott-Phillips, and Sperber 2014: 3).

Religion Still Remains Unexplained from a Darwinian Point of View

Humans have an ability to have fast adaptations because environment in Pleistocene was very flexible. This environment could reduce the number and impact of fixed behavioral patterns and could increase an ability to adopt new patterns in new and current cultural contexts. In this model, instincts should be ready to be replaced by new patterns that were and are acquired in the current context (Wunn and Grojnowski 2016: 64). As it is assumed in both evolutionary and functional approach to religion, one of the mechanisms of control of social life is formed by religious components. Benefits for the entire group requires mutual cooperation that is difficult to evolve and to maintain. For this reason, some cultural tools including religions are considered as necessary (Wilson 2002). However, some scholars like Peter J. Richerson and Morten H. Christiansen argue that various cultural fields affect survival and reproduction

in different ways. Variation in science and technology cause more important consequences for survival and reproduction than variation in language or religion (Richerson and Christiansen 2013: 12). As I pointed earlier, one could consider language as more important for fitness than religion but both of them are considered as less important than science and technology. Some cultural traits could be analyzed in Darwinian terms but others including religious components seem to be too weak and not too significant for explanation in terms of natural selection. The term 'adaptation' comes in degrees in cultural evolution, and one should not overestimate the adaptive role of cultural traits.

Evolutionary explanation of religion seems to be a great explanatory puzzle for the following reason. If natural selection eliminates traits that are costly and that do not maximize fitness, it is puzzling why natural selection did not stop development of religious components that are costly and counterintuitive (Slingerland, Henrich, and Norenzayan 2013: 336). Religious components seem at least superficially to be counter-adaptive or even maladaptive. They are costly in terms of cognition, time, energy, or emotions (Murray and Goldberg 2009: 181). They could become useful and adaptive later but at the beginning they were too costly in comparison with other possible cultural tools. Religion may be explained in terms of functionality and rationality that is affected by particular conditions of a given ecological niche (Reynolds and Tanner 1995). Evolutionary cultural account treats humans like functional units that use cultural evolution to adapt to the environment. Wilson *et al.* use the concept of group-level functional organization. They find some adaptive reasons that make religious groups more advantageous at the level of inter-group competition like high rate of genetic relatedness, social ties between unrelated peers, or strong impact of ethical system. 'Loose' culture may promote invention of novelty because individuals may freely look for new solutions of given problems and the entire group may adapt to new environmental conditions (Wilson *et al.* 2017: 136, 139, 143).

However, Wilson's concept of group-level functional organization is criticized. Some critics show discrepancies between this model and real human behaviors. Human groups do not work as functional units and they are not species-like entities because humans may belong to various cultural communities (Palmer 2017: 159–160). It is unclear how one should understand the concept of differential reproduction in regard to cultural groups. Despite these critical remarks, the capacity to acquire religious beliefs could be considered as genetically coded if the possessing of religious beliefs made believers more fit in terms of natural selection.

The Darwinian approach to religion could work if we accept the concept of cultural group as adaptive unit. As we mentioned before, one should be especially careful when talking about group adaptations and group functions. Instead one should consider such terms like the sum of individual adaptations and individual functions. However, Wilson mentions about biological transitions

from 'groups of organisms to groups as organisms'. He assumes that many traits evolved because they were beneficial for group and they provided fitness for group, not for individuals. All functional traits may be the products of blind variation and selective retention (Wilson 2009: 323–324, 332). I could accept the Darwinian account to religion, if I could prove that group selection works – because religion is a domain of a group, not individual – and then that religious components could be the subject of blind variation and natural selection. However, it is difficult because cultural evolution including religion works differently from the biological one.

A sociobiological approach (Wilson, Trivers, Dawkins) treats culture as every other non-genetic evolutionary process. It is assumed here that the proximate function of culture is to contribute to reproduction, and the ultimate function is to contribute to genetic descent. Culture works in evolutionary terms if it affects genetic descent. Religion may work as both adaptive or maladaptive niche construction. Conservative religion is adaptive if it stops development and implementation of new values and behaviors. The conservative account introduces a cautious approach to new technologies and habits. Conservative religious beliefs are maladaptive when they inhibit adaptive reactions towards changes. Genetic evolution is a very slow process. For this reason, it does not protect human populations against their wrong attitudes towards apparently beneficial cultural changes. Religion may be a deleterious niche construction that inhibits development of another niche construction like science and technology (Odling-Smee 1995: 5–6, 35–36).

Religion may be understood as the product of human inventiveness like many other cultural phenomena. Pro-natalist religious approach may be explained in Darwinian terms because religious beliefs and patterns regulate conditions for conception and birth, adolescent sexuality, or marriage and divorce. These regularities fluctuate dynamically between optimization and maximization of fitness and reproduction. In various environments, cultural traits including religious ones may favor optimization or maximization of reproductive strategies. Religiously regulated reproductive rate is highly context dependent and affected by such factors like the rate of mortality and existential security. The less available energy resources and smaller incomes per capita, the more restrictive are religious pro-natalist rules that forbid contraception, abortion, and favor faster life strategies. In better economic conditions, religions encourage a slower rate of reproduction. Reynolds and Tanner (1985: 131, 134–136, 142, 149, and 151) point out that 'religions everywhere take a very close interest in human biology'. These kinds of religious components may regulate survival and reproduction but it is not clear if one should explain them in Darwinian terms. It is worth adding that in some Christian denominations, contraception is now allowed as well as homosexuality. But some others still do not al-

low it. This case makes mentioned religious impact more flexible than adaptationist account assumes in general.

As we can see, religious beliefs work sometimes as misadaptations and 'design fault' when believers adopt values and behaviors that do not support genetic fitness. Maladaptations overrule genetic compensation because cultural changes go faster than genetic ones. Another condition for applying Darwinian terms to religion is to find differential selection among values and behaviors that may be more or less useful in contact with the current resources in a given environment. Some scholars argue that selection acts directly on behaviors or on mechanisms that underline and affect behaviors. Some scholars argue that natural selection works only on structural design features like brain and neuronal structures. Only some behaviors contain structural design features. Evolutionary psychology rejects the explanation of cultural changes in terms of Darwinian adaptation because they are not genetically rooted in the environment of evolutionary adaptedness. Crook argues that 'culture influences biology through its effects on social characteristics that determine differential reproductive success and hence the inclusive fitness of individuals' (Crook 1995: 46–47, 91, 93).

Religion is a special case in cultural and biological evolution. Many scholars claim that religion is not an adaptation even if many other cultural traits may be explained in Darwinian terms. Some of them do it because they treat religion as something more than a tool that was specially designed for fitness maximization. Others including Todd Tremlin note that religion does not fit the definitional criteria of adaptation. He enumerates ten following reasons:

– there are no genes that are dedicated only for religious behaviors;

– there are no 'religious' mental mechanisms;

– religion is culturally universal but not all people share religious components;

– it is a general problem of transmission of acquired cultural traits other than social learning and imitation (the problem of inheritance);

– it is possible that religious costs are higher than religious benefits;

– many religious benefits may be replaced by non-religious ones;

– religious beliefs are the product of non-religious cognitive capacities;

– the concept of adaptation may be applied (if any) only to some given religious components;

– religiously supported adaptations may be easily replaced by other, non-religious traits;

– alleged adaptive context of religion does not explain ultimately the origin of religious thinking.

The last remark is especially important for our approach because religion in human history was and is definitely something more than a tool designed for enhancing survival and reproduction. It suggests indirectly that the Darwinian approach is not an appropriate explanatory framework for the study of religion.

Other remarks suggest that religion has not been specially designed for providing adaptive functions like social cohesion but religious components could instead be used as secondary cultural support for socially beneficial behaviors when they have been invented (Tremlin 2013: 39–40). Gene-culture coevolution explains religious beliefs as cognitive by-products or by-products of other adaptations that are originally useless. However, religious beliefs may be co-opted to other adaptive functions and then they may be favored by cultural evolution (Bulbulia *et al.* 2013: 393).

Cultural Evolution is More Complex than Genetic One

The critics of Darwinian approach to religion argue that human behaviors and culture are affected by particular social context. Society is a primary force that affects behaviors. However, humans shape society at least partially according to their biological benefits. Robin I. M. Dunbar argues that cultural transmission enables fast adapting to new environmental conditions that cannot be provided by genetic response. For this reason, long-lived human species could avoid extinction. Imitation and social learning in cultural transmission enable avoiding long and unpredictable trial-and-error method (Dunbar 1998: 73, 80).

A population that consists of well-adapted individuals may be not as well-adapted as another population because it may exploit resources too fast without a long-term perspective. A Darwinian approach to culture including religion would work if adaptation is the main power that affects function and development of culture. However, adaptation is one of many possible factors. Reproduction and transmission of cultural trait is affected by its survival and cultural value. Cultural evolution is driven also by choice and consciousness. Individuals may intentionally prefer a given trait for the reason of expected benefits (Morphy 1998: 100–101, 103–104, 111). Joseph Fracchia and Richard C. Lewontin (1999: 73) point out that cultural evolution is a domain of acquisition rather than transmission because the individual is placed in a set of many cultural traits that he acquired during his lifetime.

Kim Sterelny (2006b) discusses such mechanisms of cultural inheritance like niche construction in group selection, vertical transmission, and replication and disseminating of memes. He points out that according to dual inheritance theory, imitation learning and language, and long-term parental care affect faithful transmission of knowledge from parents to offspring. However, memetic inheritance is not genetic-like inheritance process. Cultural traits are acquired and reconstructed but they are not precisely and accurately copied like genes. Cultural traits differ in their cognitive effortlessness. Independently of unfaithful copying of cultural traits, there are phenotypic similarities among members of a given cultural group. Genetic transmission is vertical, cultural one is vertical, oblique (unrelated, non-parental adults-children) and horizontal (among peers) (Richerson and Newson 2009: 102). Cultural vertical transmission is error prone. Horizontal and oblique transmissions are more faithful but they do

not explain intact transmission of innovations between generations. Richerson and Boyd (2005) argue that trial-and-error way of acquisition of information is more reliable and expensive than acquisition by imitation and cultural learning. Sterelny suggests that human learning is hybrid because it mixes social learning and trial-and-error approach. Individual selection favors vertical transmission, group selection favors oblique one. Cultural group selection is important in hybrid learning because parents participate and use a whole environment to improve abilities and to teach their offspring. The learning environment is the product of collective effort of the whole group. Cultural evolution affects culturally transmitted cognitive adaptations (Sterelny 2006a).

Sterelny argues that individual selection favors differentiation within a culture, while niche construction favors a homogenous group. Cultural trait is not a faithful copy of a given version of this trait. It is better to talk about construction and reconstruction of ideas from various sources instead of copying. Artifacts and skills may be transmitted by copying (*Ibid.*: 153, 155–156). Dawkins suggests that religions are transmitted as cognitive viruses. Religions are transmitted mostly in a horizontal way. However, as Sterelny argues in the case of horizontally transmitted trait, the success of replication is not measured by fitness of hosts. The criterion is to spread successfully among a given population, and fitness of hosts (vehicles) of horizontally transmitted traits does not matter. As I argued, this interpretation is not Darwinian selection because the main criterion for Darwinian approach is fitness of individuals that are vehicles for the genes. Humans' survival depends on culture and learning. Culture means accumulation of knowledge of others. Human cultural abilities are better than other animals, and human transmission of cultural traits is more faithful. Humans use symbols to transmit not only material, sensually cognizable contents, and build cumulative culture. They combine old and new cultural traits.

Natural selection acts on populations of individuals, cultural groups, and memes. It also works on individuals when children inherit traits from parents. This selection favors biologically adaptive traits like diet habits or survival skills. Natural selection acts on cultural group if we assume – against mentioned Williams' approach – that group is not only a combination and the sum of individual adaptations but provides new qualities like social cohesion. However, as was shown, the concept of group selection is criticized and it is unclear if one should describe in adaptive terms any group effects. Perhaps all of them may be reduced to the level of the sum of individual adaptations. Selection acts on memes/cultural units that are transmitted by imitation like behaviors, beliefs or ideas, or by template copying like artefacts or skills. The concept of meme is criticized because culture does not contain separated units like genes. However, it may be useful as technical terms analogical to cultural trait. DNA has syntax, memes have semantics. It is unclear if cultural traits are the results of descent with modification or convergence (Levinson 2006: 8). Cultural traits do not

reproduce themselves but they are transmitted through social learning and imitation by effort of learners. For this reason, cultural evolution is explained better in Lamarckian terms because acquired cultural traits are inherited with high fidelity, and cultural transmission is usually focused on transmission of the most adaptive traits (in this sense, we talk about progress that does not work in Darwinian natural selection). This progress does not exclude mentioned transmission of maladaptive or selectively neutral traits. Natural selection that may be applied only to some cultural traits is one of many mechanisms of cultural changes that require replication. Other mechanisms include individual learning, migration, or drift (Reisman 2013). The Darwinian account assumes that information gathered by somatic cells is lost at each generation. In the Lamarckian approach it may be transmitted (Combes 2006: 50). Some traits are transmitted because of their obvious utility but they are not selected. In some cases, there is no transmission bias and no selection (Linquist 2010: 27). For this reason, some scholars including Fracchia and Lewontin argue that analogy between cultural and natural selection does not work because cultural traits are not the subjects of blind variation and selection (Fracchia and Lewontin 1999).

Conclusion

Evolutionary terms are commonly applied to the study of culture including religion. One should remember that the Darwinian account, like every other explanatory approach, has its conceptual and definitional limits. When we apply Darwinian approach to religion, we have to look for adaptations and for possible connections between religious beliefs and fitness maximization. One can find some cultural traits that maximize fitness. They may be a subject of selective pressure for a given design that is preserved in population because it provides better reproduction than other traits.

When we talk about Darwinian approach to religion, one should take into account two levels of fitness maximization: fitness of cultural units, and fitness of their vehicles. In the first case, some cultural traits have better fitness than others. In the latter case, one can see only accidental and apparent correlation between fitness of cultural units and their vehicles. For this reason, one can apply Darwinian terms more to describe processes of cultural transmission of religious components than to the rate of survival and reproduction of people who possess these traits. But it is not Darwinian in a strict sense.

References

Acerbi A., and Mesoudi A. 2015. If We Are All Cultural Darwinians What's the Fuss About? Clarifying Recent Disagreements in the Field of Cultural Evolution. *Biol Philos* 30(4): 481–503.

Alvard M. S. 2003. The Adaptive Nature of Culture. *Evolutionary Anthropology* 12(3): 136–139.

Barrett L., Henzi S. P., and Lusseau D. 2012. Taking Sociality Seriously: The Structure of Multidimensional Social Networks as a Source of Information for Individuals. *Phil. Trans. R. Soc. B* 367(1599): 2108–2118.

Bellah R. N. 1964. *Religion: Evolution and Development.* *American Sociological Review* 29 (3): 358–374.

Bourrat P. 2015. Origins and Evolution of Religion from a Darwinian Point of View: Synthesis of Different Theories. *Handbook of Evolutionary Thinking in the Sciences* / Ed. by T. Heams, P. Huneman, G. Lecointre, and M. Silberstein, pp. 481–503. Dordrecht: Springer.

Boyd R., and Silk. J. B. 2015. *How Humans Evolved*. New York – London: W. W. Norton & Company.

Brewer J., Gelfand M., Jackson J. C., MacDonald I. F., Peregrine P. N., Richerson P. J., Turchin P., Whitehouse H., and Wilson D. S. 2017. Grand Challenges for the Study of Cultural Evolution. *Nature Ecology & Evolution* 1(0070): 1–3. DOI: 10.1038/s41559-017-0070.

Brown G. R., and Richerson P. J. 2014. Applying Evolutionary Theory to Human Behaviour: Past Differences and Current Debates. *J Bioecon* 16(2): 105–128.

Bulbulia J. 2008. Meme Infection or Religious Niche Construction? An Adaptationist Alternative to the Cultural Maladaptationist Hypothesis. *Method & Theory in the Study of Religion* 20(1): 67–107.

Bulbulia J. *et al.* 2013. The Cultural Evolution of Religion. *Cultural Evolution* / Ed. by P. J. Richerson, and M. H. Christiansen, pp. 381–404. Cambridge, Massachusetts: MIT.

Burian R. M. 2010. Selection Does Not Operate Primarily on Genes. *Contemporary Debates in Philosophy of Biology* / Ed. by F. J. Ayala, and R. Arp, pp. 1–53. Oxford: Wiley-Blackwell.

Caldwell Ch. A., and Millen A. E. 2008. Studying Cumulative Cultural Evolution in the Laboratory. *Phil. Trans. R. Soc. B* 363(1509): 3529–3539.

Chudek M., and Henrich J. 2011. Culture-Gene Coevolution, Norm-Psychology and the Emergence of Human Prosociality. *Trends in Cognitive Sciences* 15(5): 218–226.

Claidiere N., Scott-Phillips T. C., and Sperber D. 2014. How Darwinian is Cultural Evolution? *Phil. Trans. R. Soc. B* 369: 20130368. URL: http://dx.doi.org/10.1098/rstb.2013.0368.

Claidière N, and Jean-Batiste A. 2012. The Transmission of Genes and Culture: A Questionable Analogy. *Evol Biol* 39: 12–24.

Combes C. 2006. Quantum Leaps in Evolution. *Evolution and Culture* / Ed. by S. C. Levinson, and P. Jaisson, pp. 45–52. Cambridge – London: MIT Press.

Creanza N. O., Kolodny O., and Feldman M. W. 2017. Cultural Evolutionary Theory: How Culture Evolves and Why It Matters. *PNAS* July 25, 114(30): 7782–7789.

Crook J. H. 1995. Psychological Processes in Cultural and Genetic Coevolution. *Survival and Religion. Biological Evolution and Cultural Change* / Ed. by E. Jones, and V. Reynolds, pp. 45–110. John Wiley and Sons.

Cummins R., and Roth M. 2009. Traits Have not Evolved to Function the Way They Do Because of a Past Advantage. *Contemporary Debates in Philosophy of Biology* / Ed. by F. J. Ayala, and R. Arp, pp. 72–85. Oxford: Wiley-Blackwell.

Darwin Ch. 1998. *The Descent of Man*. New York: Prometheus books.

Davis T. 2015. Group Selection in the Evolution of Religion: Genetic Evolution or Cultural Evolution? *Journal of Cognition and Culture* 15(3–4): 235–253.

Dawkins R. 1976. *The Selfish Gene*. Oxford: Oxford University Press.

Dunbar R. I. M. 1998. Behavioural Adaptation. *Human Adaptation* / Ed. by G. A. Harrison, and H. Morphy, pp.73–98. Oxford – New York: Berg.

Fracchia J., and Lewontin R. 1999. Does Culture Evolve? *History and Theory* 38(4): 52–78. URL: http://www.jstor.org/stable/2678058.

Gabora L. 2008. Modeling Cultural Dynamics. *Proceedings of the Association for the Advancement of Artificial Intelligence (AAAI) Fall Symposium.* November 7–9. Arlington, VA, pp. 18–25. Menlo Park, CA: AAAI Press.

Gabora L. 2018. The Creative Process of Cultural Evolution. *Handbook of Culture and Creativity: Basic Processes and Applied Innovations* / Ed. by A. Leung, L. Kwan, and S. Liou, pp. 2–26. Oxford: Oxford University Press.

Gabora L. 2013a. An Evolutionary Framework for Cultural Change: Selectionism Versus Communal Exchange. *Physics of Life Reviews* 10: 117–145.

Gabora L. 2013b. Reply to the Commentaries on 'An Evolutionary Framework for Cultural Change: Selectionism Versus Communal Exchange'. *Physics of Life Reviews* 10: 2–8.

Gould S. J. 1987. *An Urchin in the Storm*. New York: W. W. Norton.

Gould S. J. 1991. *Bully for Brontosaurus*. New York: Norton.

Gray R. D., Greenhill S. J., and Ross R. M. 2007. The Pleasures and Perils of Darwinizing Culture (With Phylogenies). *Biological Theory* 2(4): 360–375.

Hamilton W. 1964. The Genetical Evolution of Social Behavior II. *Journal of Theoretical Biology* 7: 17–52.

Hewson M. 2013. Consensus and Dissensus on Cultural Evolution: A Commentary on David Sloan Wilson. Social Evolution Forum, D. S. Wilson, Human Cultures are Primarily Adaptive at the Group Level. *Cliodynamics: The Journal of Theoretical and Mathematical History* 4: 102–138.

Ingold T. 2004. Beyond Biology and Culture. The Meaning of Evolution in a Relational World. *Social Anthropology* 12(2): 209–221.

Kirkpatrick L. A. 2006. Religion is Not an Adaptation. Vol. 1. *Where God and Science Meet. How Brain and Evolutionary Studies Alter Our Understanding of Religion* / Ed. by P. McNamara, pp. 159–180. London: Praeger.

Laland K. 2017. *Darwin's Unfinished Symphony. How Culture Made the Human Mind*. Princeton, N.J. – Oxford: Princeton University Press.

Levinson S. C. 2006. Introduction: The Evolution of Culture in a Microcosm. *Evolution and Culture* / Ed. by S. C. Levinson, and P. Jaisson, pp. 1–42. Cambridge – London: MIT Press.

Linquist S. (Ed.) 2010. *Introduction. The Evolution of Culture.* Vol. IV. Ashgate: Farnham Surrey.

Madsen M. M., and Lipo C. P. 2013. Saving Culture from Selection. Comment on 'An Evolutionary Framework for Cultural Change: Selectionism Versus Communal Exchange' by L. Gabora. *Physics of Life Reviews* 10: 150.

Morphy H. 1998. Cultural Adaptation. *Human Adaptation* / Ed. by G. A. Harrison, and H. Morphy, pp. 99–150. Oxford – New York: Berg.

Murray M. J., and Goldberg A. 2009. Evolutionary Accounts of Religion: Explaining and Explaining Away. *The Believing Primate* / Ed. by J. Schloss, and M. J. Murray, pp. 179–199. Oxford: Oxford University Press.

Nielsen R. 2009. Adaptationism – 30 Years after Gould and Lewontin. *Evolution* 63(10): 2487–2490.

Odling-Smee J. 1995. Biological Evolution and Cultural Change. *Survival and Religion. Biological Evolution and Cultural Change* / Ed. by E. Jones, and V. Reynolds, pp. 1–43. New York: John Wiley and Sons.

Okasha S. 2008. The Units and Levels of Selection. *A Companion to the Philosophy of Biology* / Ed. by S. Sarkar, and A. Plutynski, pp. 138–156. Hoboken, New Jersey: Blackwell Publishing.

Orzack S. H. 2008. Testing Adaptive Hypotheses, Optimality Models, and Adaptationism. *The Oxford Handbook of Philosophy of Biology* / Ed. by M. Ruse, pp. 87–112. Oxford: Oxford University Press.

Palmer C. T. 2017. Don't Worry, Be Funded! *Religion, Brain & Behavior* 7(2): 159–160.

Perlman M. 2009. Traits Have Evolved to Function the Way They Do Because of a Past Advantage. *Contemporary Debates in Philosophy of Biology* / Ed. by F. J. Ayala, and R. Arp, pp. 53–71. Oxford: Wiley-Blackwell.

Reisman K. 2013. Cultural Evolution. *The Cambridge Encyclopedia of Darwin and Evolutionary Thought* / Ed. by M. Ruse, pp. 428–435. Cambridge: Cambridge University Press.

Reynolds V., and Tanner R. 1985. The Effects of Religion on Human Biology. *Darwinism and Divinity. Essays on Evolution and Religious Belief* / Ed. by J. Durant. Oxford: Basil Blackwell.

Reynolds V., and Tanner R. 1995. *The Social Ecology of Religion*. Oxford: Oxford University Press.

Richerson P. J., and Boyd R. 2005. *Not By Genes Alone. How Culture Transformed Human Evolution.* The University of Chicago Press.

Richerson P. J., and Newson L. 2009. Is Religion Adaptive? Yes, No, Neutral. But Mostly We Don't Know. *The Believing Primate* / Ed. by J. Schloss, and M. J. Murray, pp. 100–117. Oxford: Oxford University Press.

Richerson P. J., and Christiansen M. H. 2013. Introduction. *Cultural Evolution* / Ed. by P. J. Richerson, and M. H. Christiansen, pp. 1–21. Cambridge, Massachusetts: MIT.

Rogers D. S., and Ehrlich P. R. 2008. *Natural Selection and Cultural Rates of Change.* PNAS, March 4, 105(9): 3417–3419.

Ross C. T., and Richerson P. J. 2014. New Frontiers in the Study of Human Cultural and Genetic Evolution. *Current Opinion in Genetics & Development* 29: 103–109.

Slingerland E., Henrich J., and Norenzayan A. 2013. The Evolution of Prosocial Religions. *Cultural Evolution: Society, Technology, Language and Religion* / Ed. by P. J. Richerson, and M. H. Christiansen, pp. 331–344. Cambridge, Massachusetts: MIT.

Sober E. 1993. *Philosophy of Biology*. Boulder, San Francisco: Westview Press.

Sosis R. 2004. The Adaptive Value of Religious Ritual. *American Scientist* 92 (March-April): 166–172.

Sperber D. 1996. *Explaining Culture: A Naturalistic Approach*. Oxford: Blackwell.

Sterelny K. 2006a. The Evolution and Evolvability of Culture. *Mind & Language* 21: 137–165.

Sterelny K. 2006b. Memes Revisited. *British Journal of Philosophy of Science* 57: 145–165.

Tomasello M. 1999. *The Cultural Origins of Human Cognition*. Cambridge, MA: Harvard University Press.

Tremlin T. 2013. Evolutionary Religious Studies. Notes on a Unified Science of Religion. *A New Science of Religion* / Ed. by G. W. Dawes, and J. MacLaurin, pp. 26–42. New York: Routledge.

Whiten A., Ayala F. J., Feldman M. W., and Laland K. N. 2017. The Extension of Biology Through Culture. *PNAS* 114(30): 7775–7781.

Williams G. 1966. *Adaptation and Natural Selection*: *A Critique of Some Current Evolutionary Thought*. Princeton, N.J.: Princeton University Press.

Wilson D. S. 2002. *Darwin's Cathedral*. Chicago: University of Chicago Press.

Wilson D. S. 2009. Evolutionary Social Constructivism: Narrowing (But not Yet Bridging) the Gap. *The Believing Primate* / Ed. by J. Schloss, and M. J. Murray, pp. 318–338. Oxford: Oxford University Press.

Wilson D. S., Hartberg Y., MacDonald I., Lanman J. A., and Whitehouse H. 2017. The Nature of Religious Diversity: A Cultural Ecosystem Approach. Religion, Brain & Behavior 7(2): 134–153.

Wunn I., and Grojnowski D. 2016. Ancestors, Territoriality, and Gods. Berlin – Heidenberg: Springer-Verlag.

Wunn I., Urban P., and Klein C. 2012. The Ethology of Religion: The Biological Roots of Religious Behavior. Conference: EASR Annual Conference, IAHR Special Conference. Stockholm: Södertörn University.