Cell PRESS

The origins of religion : evolved adaptation or by-product?

Ilkka Pyysiäinen[1] and Marc Hauser[2]

[1] Helsinki Collegium for Advanced Studies, P.O. Box 4, FIN-00014 University of Helsinki, Finland
[2] Departments of Psychology and Human Evolutionary Biology, Harvard University, Cambridge, MA 02138, USA

Considerable debate has surrounded the question of the origins and evolution of religion. One proposal views religion as an adaptation for cooperation, whereas an alternative proposal views religion as a by-product of evolved, non-religious, cognitive functions. We critically evaluate each approach, explore the link between religion and morality in particular, and argue that recent empirical work in moral psychology provides stronger support for the by-product approach. Specifically, despite differences in religious background, individuals show no difference in the pattern of their moral judgments for unfamiliar moral scenarios. These findings suggest that religion evolved from pre-existing cognitive functions, but that it may then have been subject to selection, creating an adaptively designed system for solving the problem of cooperation.

Adaptation or by-product?

Religious beliefs are ubiquitous across cultures and time, and understanding the origins and evolution of religion is a question that has attracted significant attention and debate. Some scholars claim that religion evolved as an adaptation to solve the problem of cooperation among genetically unrelated others [1,2]. Others propose that religion emerged as a by-product of pre-existing cognitive capacities [3–5], but then, through both biological and cultural evolution, might have evolved into a system that is well-designed to solve problems of cooperation (see [6,7]). Here, we review these alternative proposals, and then introduce a moral psychological perspective that, we argue, provides novel insight into this debate. Specifically, recent work in moral psychology supports the view that religion evolved as a cognitive by-product of pre-existing capacities that evolved for non-religious functions.

From an evolutionary perspective, the fact that individuals often make sacrifices for the benefit of genetically unrelated others is a problem that calls for an explanation (see [8–11]). Given the extraordinary sacrifices that humans often make in the service of religion, several authors have argued that religion, especially god beliefs, has emerged as an adaptation designed to facilitate intra-group cooperation. This argument is presented in several slightly different forms (for a review, see [12]) and we discuss some of these below. Our central thesis is that the specific, high level of cooperation observed among human populations is only possible because we evolved moral intuitions about norm-consistent and inconsistent actions, and thus, intuitive judgments of right and wrong. This view forces a distinction between intuitive and explicit moral processes, in the same way that we must distinguish between intuitive religious beliefs and explicit ones. Thus, the question of how religion might have contributed to the evolution of cooperation can be asked at two different levels: intuitive beliefs about right and wrong and explicit norms and values of individuals and legal institutions, on the one hand, and intuitive religious beliefs and explicit doctrines and religious affiliations, on the other.

Religion as originally evolved adaptation

Bering [13] argues that there is a cognitive system, dedicated to form illusory representations of psychological immortality and symbolic meaning, which evolved as a response to the unique selective pressures of the human social environment. Although specific afterlife beliefs are not direct products of natural selection, "an intuitive pattern of reasoning" that does not hinge on the presence of explicit religious concepts has been selected for. Thus, "the general idea of an afterlife is not so much implanted in people's heads by way of 'exposure' to counterintuitive tales, as it is *already present*" in human cognitive structures ([14], p. 269]). Religion is a set of ideas that survives in cultural transmission because it effectively parasitizes other evolved cognitive structures. A "representational bias for envisioning personal immortality" has "impacted the net genetic fitness of individual humans in ancestral environments" ([13], p. 456). Thus, beliefs about ghosts and afterlife are generated by a mechanism producing illusory but adaptive beliefs. Although Bering [13,14] presents his view as an alternative for epidemiological by-product theories [3–5], it remains somewhat unclear where the difference actually lies (see [3]).

A second line of reasoning for religion as an evolved adaptation suggests that religious beliefs and rituals serve as costly signals of commitment to the group [15–17]; free-riders that try to exploit others' willingness to cooperate can be recognized because free-riders do not engage in costly displays of commitment using such hard-to-fake signals as giving money, devoting considerable time to religious activities, or willingly undergoing physical pain in rituals. Religious rituals and taboos, as costly signals, thus promote intra-group cooperation and are based on cultural selection [15–18].

In behavioral economic games, anonymous Christians in New Zealand gave significantly more to Canadian

Corresponding author: Pyysiäinen, I. (ilkka.pyysiainen@helsinki.fi).

1364-6613/$ – see front matter doi:10.1016/j.tics.2009.12.007 Available online 9 February 2010

Christians than anonymous New Zealand citizens gave to their fellow citizens [18]. In Modern Orthodox Israeli kibbutzim, collective ritual participation influences both beliefs and behavior and thus enhances the social bonds that connect its participants, unlike in secular kibbutzim where there are no collective rituals [19]. A study of 83 19th century social communes in the USA showed that costly constraints positively impacted the longevity of *only* religious communes. Increases in the level of sacrifice, imposed on members, enhance commitment in religious groups, whereas costly signaling seems to have no effect on secular commune longevity [20].

One explanation for how religion fosters cooperation is that belief in spirits or all-seeing gods, as found in larger populations, effectively blocks defection by triggering the feeling that one is being watched and subsequently rewarded for cooperative behavior and punished for cheating [1,17,21]. Thus, not only will human cooperation be promoted if people believe in supernatural punishment for moral transgressions, but the fear of such punishment is an adaptation favored by natural selection [2].

Support for such ideas comes from studies showing that commitment to the same supernatural agent could have lowered the costs of monitoring individuals' behavior in communities that span large geographical areas and include different ethnic groups. Religious prosociality might have provided the critical mechanism to support the evolution of stable levels of cooperation in large groups – a context in which reciprocity and reputational concerns are insufficient. It is thus god beliefs in particular, and not merely the communal aspect of religion, that reduce cheating and increase generosity toward strangers ([22]; see [23]). However, Norenzayan and Shariff's [22] model of how this happens is a by-product theory, not one of religion as a biological adaptation.

Religion as by-product

The view of religion as by-product is based on a two-step argument. First, 'religion' is a vague category with no clear boundaries or essence; thus, it is difficult to determine whether a particular belief or action is religious or not [24]. This poses a problem for any explanation of "religion" as an entity-like whole. The by-product view avoids this problem by using "religion" as a heuristic term that refers to a fuzzy set of beliefs and behaviors without any clear boundaries [25]. It is not an explanation of "religion" but, rather, a denial of the claim that all aspects of "religion" emerged at once at some point in history [5].

Second, although such concepts as 'God' or 'life eternal' are regarded as religious, no specifically religious cognitive mechanisms have been specified and nor would they be expected according to the by-product view [4,26,27]. For example, drawing inferences from the concept of God requires mindreading mechanisms that also mediate inferences about *all* agent concepts [28]. Thus, the concept of God is based on extending to non-embodied agents the standard capacity of attributing beliefs and desires to embodied agents [5].

According to this view, religious beliefs are a by-product of evolved cognitive mechanisms. These cognitive mechanisms enable us to reason about the intentional states of others and to recursively embed intentional states within other intentional states, and make it possible for us to think what others think, including absent or even dead persons, fictional characters, and also supernatural agents. There is no need to invoke a set of dedicated, input-restricted mechanisms *for* religion, or *for* representing God [28].

Box 1. Evolved mechanisms for cooperation [29]

- **Reputation-monitoring**: constructing databases about the reputational effects of own and others' actual behavior and inferred dispositions
- **Commitment signals**: these evolved out of hard-to-fake signals and provide information about probable future behavior
- **Coalitional psychology**: helps maintain strong associations among non-kin and manage interaction with rival coalitions
- **In-group strong reciprocity**: creates unselfish interaction
- **Ethnic signals**: help maintain in-group strong reciprocity
- **Commitment gadgets**: help people to tie their own hands in order to force non-selfish behavior
- **Moral feelings**: motivate altruistic behavior

As to cooperation, there are numerous non-religious prosocial cognitive mechanisms in humans (Box 1). All of these evolved independently of supernatural or religious beliefs and operate in similar ways in people with or without such beliefs, including young children who have yet to be inculcated into a religion [29]. Such general, evolved cognitive mechanisms make it possible for us to represent supernatural agent concepts without invoking a separate evolutionary trajectory for religion. Here again, religion stands on the shoulders of cognitive giants, psychological mechanisms that evolved *for* solving more general problems of social interactions in large, genetically unrelated groups.

Psychological experiments and behavioral measures, such as Bering's (see above), yield valuable information about the cognitive underpinnings of what is commonly regarded as "religious" belief and behavior. However, they are insufficient to support a move from function to evolutionary causes. A more plausible view, we suggest, is that most, if not all, of the psychological ingredients that enter into religion originally evolved to solve more general problems of social interaction and subsequently were co-opted for use in religious activities, including thoughts about God as well as cooperation [30]. Religious concepts and beliefs can therefore motivate and even inspire the expression and justification of morally-relevant norms and values (see [31]), but do so on the basis of cognitive mechanisms that are also used to motivate solidarity among members of any group, from those associated with team sports to the departmental members of academic disciplines. According to this view, religion was not selected for in its origins but, once in place, could have been a target of selection, assuming that the observed variation had some heritable component. Indeed, religion seems to offer such a cognitively inexpensive way of processing moral ideas, and such a powerful means of creating and enhancing group solidarity, that it is often argued that morality is impossible without religion (see [32]).

Morality without religion?

For some, there is no morality without religion (see [32]). For others, religion is merely one way of expressing and

legitimating one's moral intuitions (e.g. [31]). Religion can be linked to morality in different ways: moral principles are either decided by gods or by ancestors, or saints and holy individuals provide a model to be followed. Alternatively, gods and ancestors are regarded as interested parties that pay attention to what people do and people thus feel that their moral choices are never merely a private matter [31].

It is important to distinguish explicitly held religious beliefs and affiliations from religious intuitions (see [4,14,33,34]). Bering [14], for example, presents experimental evidence that even non-religious subjects intuitively consider some mental states and processes, such as emotions, more likely to continue after death than others, such as hunger. Bloom [35] argues that all humans are intuitive dualists in the sense that we feel our 'self' to be the owner of the body, but we are not the same as our bodies. Thus, in folk psychology, the death of the body does not mean the cessation of personhood. Furthermore, because human reasoning is characterized by a "promiscuous teleology," a capacity that causes us to see meaning and intentionality in everything that happens, we automatically postulate an agent as an explanation of various events; often this is some god -like concept [36–39].

Arguably, these tendencies make religious beliefs 'contagious' in the sense that they are easy to spread and propagate because they functionally resonate with many of the basic operations of the mind [28]. Consequently, they are also easy to use in moral reasoning. This does not mean, however, that there is a necessary link between morality and religion [32]. There is evidence that at least some religious concepts and beliefs need certain cultural input in order to become adopted and to persist. The Vezo of Madagascar, for instance, seem to have two conceptions of death. Guided by their everyday experience, they construe death in biological terms as the breakdown of all vital functions, but see it as the beginning of a different form of existence in a ritual context. These two conceptions of death are activated in different contexts, and thus the Vezo do not feel that there is a tension between them [40].

Thus, although it seems undebatable that 'religiously' colored intuitions can affect moral reasoning, and that religious primes can affect prosocial behavior, these observations do not license the conclusion that the mechanisms are specific to religion, nor that religion provides the central explanatory factor [41]. Even when the intuitive content is interpreted as religious, the mechanisms that support reasoning are more general in scope.

Linking the study of religion with the study of moral intuitions

Cooperation at the level exhibited by humans necessitates that people have a generalized, intuitive conception of right and wrong that can be applied in different contexts, punishing norm violators and rewarding norm followers. Here we turn to an experimental and theoretical literature that has had little or no impact on the study of religion as an originally evolved adaptation: experimental moral psychology. Although this research has explored many fascinating problems, here we present a set of findings that speaks to the idea that moral intuitions operate independently of religious background and, more importantly, do not require religious input. In fact, a considerable amount of work in this area shows that moral judgments are relatively immune to the explicit moral dictates of both religious and legal institutions.

Several recent studies have focused on the psychological factors that mediate our judgments of permissible harms. These studies, carried out using the web-based Moral Sense Test (http://moral.wjh.harvard.edu/), recruit thousands of male and female subjects, with educational levels that range from elementary school to graduate degrees, with political affiliations that range from liberal to conservative, and religious backgrounds that range from devout to atheist [42–45]. In each of these studies, subjects read and judged the moral permissibility of an action on a 7pt-Likert scale (where 1=forbidden, 4=permissible, 7=obligatory). Each scenario presented a contrast between a harmful action and a significant benefit in terms of lives saved. Although religious scripture often invokes some version of *thou shalt not kill*, and in different versions of Catholicism dating back to Saint Thomas Aquinas there are versions of what is known as the *doctrine of double effect* (briefly, it is permissible to harm someone as a side effect of bringing about some greater good, but forbidden to harm someone as a means to the greater good), these rules cannot account for the variation in moral judgment observed. More specifically, in dozens of dilemmas, and with thousands of subjects, the pattern of moral judgments delivered by subjects with a religious background do not differ from those who are atheists, and even in cases where we find statistically significant differences, the effect sizes are trivial. In one particularly telling case, Huebner and Hauser [43] found that people who reported having a religious background were more likely to judge that they should sacrifice their own lives in order to save the lives of a greater number of anonymous others. This effect is what one would predict given the fact that many religions praise martyrdom. What Huebner and Hauser argued, however, is that although there are significant evolutionary pressures against such acts of radical altruism, religious pressures might lead people to offer this judgment because they believe it is the morally appropriate answer. What religion can do, and what political and legal institutions can do as well, is alter local and highly specific cases. And yet, they appear to have no influence at all on the intuitive system that operates more generally, and for unfamiliar cases.

A second example comes from a recent study of a small-scale, rural, Mayan population [46]. In this study, subjects responded in their native language to moral dilemmas that were similar to those administered in Moral Sense Test on the Internet, contrasting distinctions such as those captured by the doctrine of double effect (i.e. means versus side effects) and the action–omission distinction (actions are judged more harshly than omissions). Despite variation in the pattern of responses, and cross-cultural differences on the act–omission distinction when contrasted with the Internet sample, religious background played no role in this analysis. This study, together with the work cited above, suggests that moral intuitions operate independently of religious background. Thus , if the patterns of

Box 2. The linguistic analogy

Rawls [59] proposed the linguistic analogy (LA) to moral intuitions to capture an insight about one aspect of moral decision-making: often, when we are confronted by a moral situation, we spontaneously generate a judgment concerning an action's permissibility. According to this view, moral judgments, similar to grammaticality judgments in linguistics, are based on a set of unconscious computations (i.e. abstract principles) that operate automatically, universally, and independently of cultural background. What is open to cross-cultural variation is something similar to a suite of parameters, perhaps defaulting to some value in all individuals, but set by each culture early in development, enabling the ontogeny of each culture's unique, expressed moral system.

It is important to distinguish strong and weak versions of LA. On the strong analogy, there will be one-to-one mappings between the computations and representations underlying the language faculty and our moral faculty, even though each domain will have its own dedicated representations, as well as interfaces with other mind-internal and external factors. Thus, if the strong analogy is correct, our moral psychology will rely on a universal set of abstract principles that enable each child to acquire a wide range of possible moral systems; these principles are inaccessible, interface with specific conceptual resources, and force particular interpretations of morally relevant events. Acquiring a particular moral system depends on exposure to a moral input during a specific period of development, and once such exposure occurs, specific parameters (or something similar to them) are set, functionally fixing the child's interpretation of the moral domain, and thus establishing a particular moral signature that is representative of the culture's norms.

On the weak analogy, there will be many ways in which language and morality differ, but we should engage with the kinds of questions and problems that have engaged linguistics since the start of the generative tradition. Thus, is there a distinction between competence and performance? What are the innately specified capacities and representations that provide structure to the starting state of moral development? Does moral computation depend on domain-specific, dedicated circuitry? In the same way that we can be bilingual, can we be bimoral? At present, it is too early to say whether the strong or weak analogy is more appropriate, but the questions, we believe, are of interest, and should be explored.

Recently, there has been renewed interest in LA from both a theoretical and empirical perspective ([52,54–56]; see [53]) including: suggestions for constructing action trees [54]; studies exploring whether emotions are part of moral competence or performance, including experiments of clinical populations [60]; experiments targeting operative principles and the possibility of a dissociation between judgment and justification [61] and cross-cultural analyses [44,58,62].

moral judgments cannot be explained by 'religion', then what psychological factors can explain these patterns?

Although there is a long tradition of studying religious and moral development and moral psychology outside the context of religion, early work in this field (e.g. [47–50]) focused primarily on the child's path to moral maturity, and in particular, on moral behavior and rationalization. In the past ten years, however, there has been a shift in focus, with an emphasis on the role of intuition, and in particular, the cognitive and neural processes that underpin intuitive judgments of right and wrong, including emotional and mental state representations (see [51–53]). Although there are several interesting theoretical positions (e.g. [51]), we focus here on the linguistic analogy (LA) because it not only presents a specific conceptual framework for thinking about universality and cross-cultural variation, but is consistent, we believe, with the data presented thus far. As such it provides a novel entry into the debate over whether religion evolved as an adaptation or as a by-product of other cognitive faculties.

In brief, LA is a theory about the structure of our moral psychology, and in particular the (unconsciously operative) knowledge that mature members of a community bring to bear on moral problems, and the mechanisms by which all children come to acquire such moral competence (reviewed in [52,54–56]; see Box 2). According to this view, we are endowed with a set of abstract principles that operate over the causal and intentional psychology of agents with respect to the welfare of others – a capacity that some have likened to our universal grammar. LA makes the strong prediction that certain principles will be shared across all members of our species, whereas the content is open to variation, perhaps established by the setting of something akin to a parameter in linguistics. Thus, for example, in a wide variety of studies, using different methods and populations, subjects consistently judge actions that cause harm as worse than omissions causing the same harm – a distinction referred to as the omission bias [57]. In some studies, and in some populations, specific examples might not reveal the omission bias, but rarely does one observe a reversal such that omissions are judged more harshly than actions. For example, although the Netherlands passed a bill in 2001 making both active euthanasia (administering an overdose to an individual who is suffering) and passive euthanasia (allowing to die by terminating life support) legally permissible, the Dutch show as strong an omission bias as American subjects, despite the fact that in the USA, active euthanasia is illegal [58]. This reveals that the law, as a formal moral system, can only provide specific guidelines for specific actions, but such knowledge fails to penetrate or alter our folk moral intuitions. According to this view, and as noted above, explicit religious commitment seems to be comparable to law, providing specific guidelines for specific actions, but dissociated from the system that mediates moral intuitions.

Concluding remarks

To the extent that explicit religiosity cannot penetrate moral intuitions underlying the ability to cooperate, religion cannot be the ultimate source of intra-group cooperation. Cooperation is made possible by a suite of mental

Box 3. Outstanding questions

- Which cognitive mechanisms underlying religious thought and behavior are specific to religion (if any) and which are shared with other domains of knowledge?
- How are the cognitive mechanisms that mediate religious thought and behavior neurally implemented?
- To what extent does religious background impact upon morally relevant behavior (as opposed to judgments over hypothetical situations)?
- How do children acquire religion, including the nature and timing of the input? Does the acquisition of a first religion differ from the acquisition of a subsequent, different religion?
- Might particular religious behaviors be heritable?
- How did genetic and cultural contributions to religion co-evolve? How can the adaptationist and by-product views be synthesized?

mechanisms that are not specific to religion. Moral judgments depend on these mechanisms and appear to operate independently of one's religious background. However, although religion did not originally emerge as a biological adaptation, it can play a role in both facilitating and stabilizing cooperation within groups, and as such, could be the target of cultural selection. Religious groups seem to last longer than non-religious groups, for example [20].

In the future, more experimental research is needed to probe the actual relationship between folk moral intuitions and intuitive beliefs about afterlife, gods and ancestors (Box 3). It seems that in many cultures religious concepts and beliefs have become the standard way of conceptualizing moral intuitions. Although, as we have discussed, this link is not a necessary one, many people have become so accustomed to using it, that criticism targeted at religion is experienced as a fundamental threat to our moral existence.

Acknowledgements

Pyysiäinen's research was supported by the Academy of Finland (project 1129812); Hauser's research was supported by an NSF grant from the directorate on Human Social Decisions.

References

1 Johnson, D. and Bering, J. (2006) Hand of God, mind of man : Punishment and cognition in the evolution of cooperation. *Evol. Psy.* 4, 219–233
2 Johnson, D. and Krüger, O. (2004) The good of wrath: Supernatural punishment and the evolution of cooperation. *Polit. Theol.* 5, 159–176
3 Boyer, P. (2003) Are ghost concepts "intuitive," "endemic" and "innate"? *J. Cogn. Cult.* 3, 233–243
4 Boyer, P. (1994) *The Naturalness of Religious Ideas: A Cognitive Theory of Religion*, University of California Press
5 Boyer, P. (2001) *Religion Explained: The Evolutionary Origins of Religious Thought*, Basic Books
6 Richerson, P. and Boyd, R. (2005) *Not by Genes Alone: How Culture Transformed Human Evolution*, University of Chicago Press
7 Pyysiäinen, I. (2006) Amazing grace: Religion and the evolution of the human mind. In *Where God and Science Meet: How Brain and Evolutionary Studies Alter our Understanding of Religion* (I–III (Vol. I)) (McNamara, P., ed.), pp. 209–225, Praeger
8 Hamilton, W.D. (1964) The genetic evolution of social behaviour I, II. *J. Theor. Biol.* 7, 1–16 17–52
9 Axelrod, R. (1990/1984) *The Evolution of Co-Operation*, Penguin
10 Trivers, R. (2002) *Natural Selection and Social Theory: Selected Papers of Robert Trivers*, Oxford University Press
11 Henrich, N. and Henrich, J. (2007) *Why Humans Cooperate: A Cultural and Evolutionary explanation*, Oxford University Press
12 Boyer, P. and Bergstrom, B. (2008) Evolutionary perspectives on religion. *Annu. Rev. Anthropol.* 37, 111–130
13 Bering, J.M. (2006) The folk psychology of souls. *Behav. Brain. Sci.* 29, 453–462
14 Bering, J.M. (2002) Intuitive conceptions of dead agents' minds: The natural foundations of afterlife beliefs as phenomenological boundary. *J. Cogn. Cult.* 2, 263–308
15 Wilson, D.S. (2002) *Darwin's Cathedral: Evolution, Religion and the Nature of Society*, University of Chicago Press
16 Sosis, R. (2006) Religious behaviors, badges, and bans: Signaling theory and the evolution of religion. In *Where God and Science Meet: How Brain and Evolutionary Studies Alter our Understanding of Religion* (I–III (Vol. I)) (McNamara, P., ed.), pp. 61–86, Praeger
17 Bulbulia, J. Why "costly-signalling" models of religion require cognitive psychology . In *Origins of Religion, Cognition and Culture* (Geertz, A., ed.), Equinox (in press)
18 Bulbulia, J. and Mahoney, A. (2008) Religious solidarity: The hand grenade experiment. *J. Cogn. Cult.* 8, 295–320
19 Sosis, R. and Ruffle, B. (2003) Religious ritual and cooperation: Testing for a relationship of Israeli religious and secular kibbutzim. *Curr. Anthropol.* 44, 713–722
20 Sosis, R. and Bressler, E.R. (2003) Cooperation and commune longevity: A test of the costly signaling theory of religion. *Cross-Cultural Res.* 37, 211–239
21 Bering, J.M. and Johnson, D.D.P. (2005) Oh Lord . . . you perceive my thoughts from afar": Recursivenes and the evolution of supernatural agency. *J. Cogn. Cult.* 5, 118–142
22 Norenzayan, A. and Shariff, A.F. (2008) The origin and evolution of religious prosociality. *Science* 322, 58–62
23 Sanderson, S.K. and Roberts, W.W. (2008) The evolutionary forms of religious life: A cross-cultural, quantitative analysis. *Am. Anthropol.* 110, 454–466
24 Kirkpatrick, L.A. (2006) Religion is not an adaptation. In *Where God and Science Meet: How Brain and Evolutionary Studies Alter our Understanding of Religion* (I–III (Vol. I)) (McNamara, P., ed.), pp. 159–180, Praeger
25 Saler, B. (2000/1993) *Conceptualizing Religion: Immanent Anthropologists, Transcendent Natives, and Unbound Categories (with a new preface)*, Berghahn Books
26 Boyer, P. (2003) Religious thought and behaviour as by-products of brain function. *Trends Cogn. Sci.* 7, 119–124
27 Atran, S. (2002) *Gods We Trust: The Evolutionary Landscape of Religion*, Oxford University Press
28 Pyysiäinen, I. (2009) *Supernatural Agents: Why We Believe in Souls, Gods, and Buddhas*, Oxford University Press
29 Boyer, P. (2006) Prosocial aspects of afterlife beliefs: Maybe another by-product. A commentary on Bering. *Behav. Brain Sci.* 29, 466
30 Wilson, D.S. (2008) Evolution and religion: The transformation of the obvious. In *The Evolution of Religion: Studies, Theories, & Critiques* (Bulbulia, J. *et al.*, eds), pp. 23–29, Collins Family Foundation
31 Boyer, P. (2002) Why do gods and spirits matter at all? In *Current Approaches in the Cognitive Science of Religion* (Pyysiäinen, I. and Anttonen, V., eds), pp. 68–92, Continuum
32 Sinnott-Armstrong, W. (2009) *Morality without God*, Oxford University Press
33 Barrett, J.L. (1998) Cognitive constraints on Hindu concepts of the divine. *J. Sci. Study Relig.* 37, 608–619
34 Barrett, J.L. and Keil, F. (1996) Conceptualizing a nonnatural entity: Anthropomorphism in God concepts. *Cogn. Psychol.* 31, 219–247
35 Bloom, P. (2004) *Descartes' Baby: How the Science of Child Development Explains What Makes us Human*, Basic Books
36 Kelemen, D. (1999) Why are rocks pointy? Children's preference for teleological explanations of the natural world. *Dev. Psychol.* 35, 1440–1453
37 Kelemen, D. (2004) Are children "intuitive theists"? Reasoning about purpose and design in nature. *Psychol. Sci.* 15, 295–301
38 Kelemen, D. and DiYanni, C. (2005) Intuitions about origins: Purpose and intelligent design in children's reasoning about nature. *J. Cogn. Dev.* 6, 3–31
39 Diesendruck, G. and Haber, L. (2009) God's categories: The effect of religiosity on children's teleological and essentialist beliefs about categories. *Cognition* 110, 100–114
40 Astuti, R. and Harris, P.L. (2008) Understanding mortality and the life of the ancestors in rural Madagaskar. *Cogn. Sci.* 32, 713–740.
41 McKay, R.T. and Dennett, D.C. The evolution of misbelief. *Behav. Brain. Sci.* (in press)
42 Huebner, B. *et al*. How the source, inevitability, and means of brining about harm interact with folk-moral judgments. *Mind & Lang.*
43 Huebner, B. and Hauser, M.D. Moral judgments about altruistic self-sacrifice: When philosophical and folk intuitions clash. *Philos. Psychol.* (in press)
44 Hauser, M.D. *et al.* (2007) A dissociation between moral judgments and justifications. *Mind & Lang.* 22, 1–21
45 Banerjee, K. *et al*. Intuitive moral judgments are robust across demographic variation in gender, education, politics, and religion: a large-scale web-based study. *J. Cogn. Cult.* (in review)
46 Abarbanell, L. and Hauser, M.D. Mayan morality: An exploration of permissible harms. *Cognition* (in press)
47 Piaget, J. (1932/1965) *The Moral Judgment of the Child*, Free Press
48 Kohlberg, L. (1981) *Essays on Moral Development, Volume 1: The Philosophy of Moral Development*, Harper Row
49 Turiel, E. (1998) The development of morality. In *Handbook of Child Psychology* (Damon, W., ed.), pp. 863–932, Wiley Press

50 Batson, C.D. *et al.* (1999) And who is my neighbor?: Intrinsic religion as a source of universal compassion. *J. Sci. Study Relig.* 38, 445–457
51 Haidt, J. (2001) The emotional dog and its rational tail: A social intuitionist approach to moral judgment. *Psychol. Rev.* 108, 814–834
52 Hauser, M.D. (2006) *Moral Minds: How Nature Designed our Universal Sense of Right and Wrong*, Ecco/Harper Collins
53 Sinnott-Armstrong, W. (ed.) (2008) *Moral Psychology 1-3*, MIT Press
54 Mikhail, J. (2007) Universal moral grammar: Theory, evidence and the future. *Trends Cogn. Sci.* 11, 143–152
55 Mikhail, J. *Elements of Moral Cognition: Rawls' Linguistic Analogy and the Cognitive Science of Moral and Legal Judgment*, Cambridge University Press (in press)
56 Dwyer, S. *et al*. The linguistic analogy: motivations, results and speculations. *Topics in Cognitive Science* (in press)
57 Baron, J. and Ritov, I. (2004) Omission bias, individual differences, and normality. *Organizational Behav. Hum. Decision Processes* 94, 74–85
58 Hauser, M.D. *et al.* (2009) When moral intuitions are immune to the law: A case study of euthanasia and the act-omission distinction in the Netherlands. *J. Cogn. Cult.* 9, 149–169
59 Rawls, J. (1971) *A Theory of Justice*, Harvard University Press
60 Koenigs, M. *et al.* (2007) Damage to the prefrontal cortex increases utilitarian moral judgments. *Nature* 446, 908–911
61 Cushman, F. *et al.* (2006) The role of conscious reasoning and intuition in moral judgments: testing three principles of harm. *Psychol. Sci.* 17, 1082–1089
62 Fraser, B. and Hauser, M.D. The argument from disagreement and the role of cross-cultural empirical data. *Mind & Lang.* (in press)