Trends in Cognitive Sciences

The origins of religious disbelief

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Although most people are religious, there are hundreds of millions of religious disbelievers in the world. What is religious disbelief and how does it arise? Recent developments in the scientific study of religious beliefs and behaviors point to the conclusion that religious disbelief arises from multiple interacting pathways, traceable to cognitive, motivational, and cultural learning mechanisms. We identify four such pathways, leading to four distinct forms of atheism, which we term mindblind atheism, apatheism, inCREDulous atheism, and analytic atheism. Religious belief and disbelief share the same underlying pathways and can be explained within a single evolutionary framework that is grounded in both genetic and cultural evolution.

The existence and prevalence of disbelief

Most people on the planet are deeply religious. Nonetheless, there is considerable individual and population variability in both commitment to gods and in behaviors that support belief in them [1,2]. Moreover, religious beliefs fluctuate across situations [3], across the lifespan [4], and across historical periods [5]. The worldwide prevalence of atheists is nontrivial, numbering over half a billion or possibly more (Box 1). Religious disbelief has not received adequate scientific attention and poses an interesting puzzle to evolutionary explanations that see religious beliefs and behaviors as integral components of human nature [6,7]. If human minds gravitate towards religion because of innate perceptual, cognitive, and motivational biases, how can the existence and prevalence of widespread disbelief be explained? Disbelief can thus be seen as a crucial and useful test for evaluating the explanatory power of evolutionary accounts of religion.

Beyond these scientific reasons for studying atheism and nonbelief, the topic is of considerable social importance. Recent years have seen high profile popular debates concerning atheism [8–10] and there is considerable evidence that atheists are a strongly stigmatized group in communities with religious majorities [11,12]. Sharper and more nuanced understanding of the origins of atheism may moderate conflicts, inform debates surrounding nonbelief, and stimulate greater dialogue between scientists and scholars in the humanities [13].

Here, we explore the origins of disbelief in supernatural agents, asking a number of specific questions. How do some individuals come to lose their religious beliefs or not have any in the first place? Why is disbelief more prevalent in some societies and historical periods than in others? How

could current evolutionary and cognitive explanations of religion accommodate and explain religious disbelief? Our theoretical synthesis builds on current advances and highlights several distinct but often converging mechanisms that promote religious disbelief. We argue that disbelief arises from a combination of cognitive, motivational, and cultural learning processes traceable to both the genetic and cultural inheritance systems that are hallmarks of human evolution [14]. As such, both religious belief and disbelief share the same underlying pathways.

Intuitive theism, unintuitive atheism: one common account

Cognitive and evolutionary theories of religious belief highlight the evolved cognitive biases that predispose people towards religion [15–17] (see 'Cognitive Mechanisms' in Table 1). Although there is considerable and lively scientific debate, one widely discussed view holds that disbelief, when it arises, results from significant cognitive effort against these powerful biases. According to this view, if the mind-perceiving and purpose-seeking brains of human beings effortlessly infer the existence of invisible agents with intentions, beliefs, and wishes, then disbelief lacks intuitive support. Therefore, atheism is possible, but requires some hard cognitive work to reject or override the intuitions that nourish religious beliefs [18–22].

We build on this approach and propose a broader framework that encompasses several distinct but interacting mechanisms underlying religious disbelief. We argue that atheism is more prevalent and enduring than would be expected if it was solely driven by effortful rejection of intuitive theism, that disbelief does not always require hard or explicit cognitive effort, and that rational deliberation is only one of several routes to disbelief. Our framework integrates insights from three classes of naturalistic explanations for religious beliefs and behaviors: cognition, motivation, and cultural learning (Table 1). Religious beliefs and behaviors arise from multiple interacting sources and therefore reflect an over-determined complex of tendencies. Nonetheless, the same pathways that encourage religious beliefs, if altered or disrupted, yield disbelief instead.

We begin by considering the predisposing conditions that give rise to religious belief. For a given person to believe in a given deity, he or she must (i) be able to form intuitive mental representations of supernatural agents; (ii) be motivated to commit to supernatural agents as real and relevant sources of meaning, comfort, and control; (iii) have received specific cultural inputs that – of all the

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Box 1. Atheism: definitions, measurement issues, and worldwide numbers

Definitions. The term 'atheism' in its most straightforward (dictionary) sense refers simply to the lack of belief in God or gods. However, the term is controversial and hotly debated. Some, for example, associate atheism with anti-theism, or fervent and absolute rejection of religion [8]. However, this definition describes only a vociferous subset of self-described atheists. Atheism is related to, but distinct from, secularity [5], which refers to beliefs, practices, and institutions that are unrelated to religion, but often coexist with it. There is also agnosticism, which is a stance regarding the unknowability of the existence of gods, not a stance about belief in their (non)existence. There may be other stances as well [69]. The degree to which these labels reflect real psychological differences is an interesting open question [37,38,70]. Psychological researchers often sidestep these semantic issues by measuring participants' degrees of particular religious beliefs, commitments, attitudes, and practices, rather than asking people to self-report based on semantically 'sticky' dictionary labels.

Measurement issues. Psychologists and sociologists typically rely on self-reports to assess atheism and various forms of disbelief, as well as religious attendance. Disbelief can be measured as a form of self-ascribed label (atheist, agnostic, nonbeliever, religious), as well as based on Likert scales that measure degree of religious belief or

commitment. Implicit and indirect measures of disbelief are in their infancy [38,71] and could break new ground by offering new ways to examine a very old question.

Worldwide prevalence. International surveys assessing the prevalence of atheists face many methodological challenges. In deeply religious societies, such as Iran, Brazil, and the United States, there is deep distrust of atheists [11,12], which means that the reported numbers likely underestimate the prevalence of disbelievers. Conversely, in societies with government-enforced atheism, such as China and Cuba, there is the opposite problem: numbers likely overestimate the prevalence of atheism because cultural norms or fear of persecution push people to mask their religiosity. Moreover, some people do not believe in God, but nevertheless attend religious services, such as many American secular Jews and Scandinavians who consider themselves 'cultural Christians' [44]. Finally, these surveys measure explicit beliefs and identities, not implicit beliefs and underlying intuitions and motivations, which are better investigated with laboratory methods [72]. Nevertheless, a recent worldwide survey estimated that, if atheists around the world were grouped together, their global prevalence would be very large, exceeded only by Christians, Muslims, and Hindus [1].

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mentally representable supernatural agents – one or more specific deities should be believed in and committed to as real and important; and (iv) maintain this commitment without further analytic cognitive processing. This framework suggests that alterations to any of these four basic conditions could encourage disbelief. Next, we identify and describe four distinct pathways to disbelief that are characterized by different psychological qualities, which reflect different ways to alter those conditions (Table 2).

Lack of intuitive support for personal gods: mind-blind atheism

Supernatural agents are overwhelmingly described as personified beings with beliefs, desires, and intentions, who use their powers to enter into social relationships with humans, relieve existential anxieties, and monitor their social behavior. Therefore, conceptualizing a personal God or gods requires mentalizing abilities, and individuals with poor mentalizing abilities may exhibit 'mind-blind atheism', which results from difficulties to conceptualize mindful supernatural agents intuitively.

Converging evidence from cognitive neuroscience, developmental psychology, and social psychology highlights the centrality of mentalizing to the mental representation of gods [23,24]. Neuroimaging studies find that thinking about or praying to God activates brain networks known to be implicated in mentalizing [25,26]. Moreover, children's reasoning about God's mental states tracks the cognitive development of mentalizing tendencies [27,28]. Finally, mentalizing tendencies are associated with a greater tendency to personify God [29], and the same mentalizing biases that are typically found when reasoning about other peoples' minds are also found when inferences are made about God's mind [16,30,31].

If mentalizing supports the mental representation of gods, then weaker mentalizing tendencies, associated with the autistic spectrum and also commonly found in men more than in women, may undermine the intuitiveness of supernatural agents and reduce religious belief. Recent studies provide support for this hypothesis. First, the

autism spectrum is associated with lower levels of belief in a personal God [24]. Second, men tend to be less religious than women, and men are overrepresented among atheists [32]. Crucially, mentalizing tendencies statistically mediate both of these effects, controlling for a number of potentially confounding factors [24]. Taken together, these findings support the hypothesis that one path towards greater disbelief arises from comparatively weak mentalizing abilities, which render the representation of personified divine beings unintuitive.

Unmotivated to find gods: apatheism

Most people can mentally represent gods with ease. Beyond mental representation, however, several other factors might motivate people to care about supernatural agents, whether benevolent or malevolent, as sources of order, emotional comfort, and meaning. The term 'apatheism' (see J. Rauch, May 2003, *The Atlantic Monthly* http://bit.ly/10GZYMU) is a useful way to characterize a stance of indifference towards religion that, we argue, arises from conditions of existential security. It has long been hypothesized that widespread human suffering and threats to human welfare encourage motivational states that make many religious beliefs and practices deeply comforting and meaningful [33,34]. In the laboratory, several interrelated existential threats have been found to increase religious motivations. Awareness of death [35–38], suffering [34], perceptions of randomness and uncertainty [39,40], perceived loss of personal control [41], and social isolation [42] intensify belief in a personal God who offers immortality, meaning, external control, social bonding, and stability. These effects have important real-world implications. One longitudinal study found that religious commitment increased among New Zealanders immediately after a severe earthquake, but only among citizens who were directly affected by it [43]. Religious engagement is far stronger in societies marked by poverty, high infant mortality, short life-spans, economic inequality, and nonexistent or unreliable government services and social safety nets [2,34]. Conversely, as social conditions become more existentially

Table 1. Key hypothesized mechanisms that give rise to or intensify religious beliefs and behaviors

Mechanisms	Description	Role in religious tendencies
Cognitive (intuitive support)		
Mentalizing, mind-perception, or Theory of Mind [75]	Thinking about and inferring the mental states of others	Intuitive grasp of the minds of gods and spirits as personified beings with intentions and mental states (what they think, want, wish, etc.), allowing simulated interactions with them [25–28,30,31,63,76,77]
Mind-body dualism [78,79]	The intuition that minds can operate independent of, and are distinct from, physical bodies	Increases the intuitive plausibility of, and belief in, bodiless intentional agents, such as spirits and gods (Willard, A. and Norenzayan, A., unpublished manuscript)
Teleology [64,80]	The intuition that even naturally occurring events and objects in the world exist for a purpose	Increases the plausibility of the idea of ''creator'' gods and spirits who have purposefully designed objects, people, and events [81]
Motivational (conditions of existential insecurity)		
Awareness of or exposure to mortality [33,82]	Environments where mortality levels are high and temporary reminders of death activate a psychological threat that leads to various reactions to overcome death, symbolically or literally	Increases the motivation to believe in a supernatural world that provides a stable, culturally-shared belief system and encourages some belief in literal immortality of the self [35–37]
Lack of control/perceptions of randomness or incongruency [60,83]	Environments and experiences reflecting suffering, loss of control, randomness, and uncertainty activate a psychological threat that leads to reactions to restore control, stability, predictability, and meaning	Increases the motivation to believe in powerful, interventionist gods and spirits who provide control, order, stability, and meaning [34,39–41,43,84]
Social isolation [85]	Feelings of social isolation or exclusion prompt the need for social contact, and increase the tendency to anthropomorphize and to restore social ties	Increases the motivation to imagine personified supernatural agents who provide companionship, care, and social contact [42,86]
Cultural learning (cultural support)		
Conformist and prestige bias [46,50,51]	Psychological tendencies to selectively imitate the beliefs and behaviors that are common (conformist bias) and seen among high-status individuals (prestige bias) in one's group	Both strategies facilitate the propagation and stabilization of religious beliefs to the extent that they are common or are endorsed by high-status individuals [45,47,87]
Credibility-enhancing displays (CREDs) [52,53]	Witnessing extravagant (often but not always costly) displays that reflect credible belief increase the likelihood of internalizing those beliefs	Observing extravagant religious displays that betray credible belief in gods and spirits (fasts, sacrifices, costly rituals) cause a cultural cascade of religious belief-behavior complexes [48,52,87]
Social surveillance [88,89]	Awareness of being under social surveillance strengthens cooperative tendencies among strangers, allowing groups to expand in size	Sincere belief in supernatural surveillance (e.g., watchful gods who always monitor and intervene) expands the scale of cooperation to ever larger groups, leading to the cultural spread of beliefs in these supernatural monitors [56,58]

secure, religious belief and attendance decline [2]. Even within the same society, religiosity declines over time as conditions become more secure [2]. Some of the least religious societies on earth are found in contemporary Northern Europe and Scandinavia; not surprisingly, these are perhaps the most existentially secure societies in the history of humanity [44]. Where life is safe and predictable, people are less motivated to turn to gods for succor.

Little cultural support for faith in gods: inCREDulous atheism

'InCREDulous atheism' results from people simply not receiving cultural inputs that encourage the belief that any god(s) are potent, relevant, or even real [45]. Similar to apatheism, this path is characterized by indifference to religion rather than opposition to it. Cultural learning strategies enable learners to acquire beliefs and behaviors from models through imitation and instruction [46], and religious beliefs are no exception [47,48]. People rely on a wide variety of different cultural learning strategies [49],

and supernatural agents supported by these strategies are more compelling. This leads to a cultural evolutionary process wherein some variants of beliefs propagate at the expense of others. People preferentially imitate beliefs and behaviors perceived to be normative or common [50] and that are displayed by prestigious members of one's group [51]. Moreover, cultural learners – even young children – preferentially imitate cultural models whose expressed beliefs are backed by 'credibility enhancing displays' of that belief (henceforth CREDs) [48,52,53]. The idea is that 'actions speak louder than words.' Therefore, religious beliefs that are backed up by displays that would be costly to an individual not holding the underlying belief [54] (e.g., frequent religious attendance, religious prosocial acts, and extravagant rituals) are more likely to be propagated than those that are not [47]. People come to passionately commit to those supernatural agents supported by CREDs in their local environment, while being skeptical of those agents unsupported by CREDs. Hence, a cultural learner growing up in the devoutly Christian areas of the

Table 2. Four distinct origins of religious disbelief

Pathway	Characteristics
Mind-blind atheism	Intuitive difficulties in understanding religious agents; arises from deficits in mentalizing that erode the intuitive foundations of belief in a personal God, spirits, and other religious agents with rich mental states who are believed to interact with humans and respond to their wishes and concerns (such as in prayer)
Apatheism	Indifference to religious agents and practices found among individuals, as well as in contexts and cultures, that are characterized by existential security, such as longevity, physical and social safety, stability and controllability; closely related to inCREDulous atheism
InCREDulous atheism	Indifference towards religious agents and practices found in cultural or subcultural contexts where there is a relative absence of exposure to credible displays of faith in God or gods, such as frequent religious attendance, costly ritual participation, religious prosociality and religious sacrifice, typically in societies with strong secular institutions and effective governance that take on the prosocial functions of religion; closely related to apatheism
Analytic atheism	Explicit and implicit rejection of religious beliefs. Arises from habitual or situationally salient analytic thinking that blocks or overrides intuitions supporting religious beliefs and encourages religious skepticism

southern United States known as the 'Bible Belt' will be more likely to endorse the Christian God than a culturally foreign deity such as Zeus or Shiva [55]. By the same logic, if an individual grows up in a cultural context comparatively devoid of cues that others believe in any gods at all, religious belief might not take root [45,56]. Tellingly, even children of religious parents in Scandinavia are likely to become nonbelievers if they do not witness credibility enhancing displays of their parents' faith [57].

A second cultural evolutionary force promoting atheism stems from credible secular alternatives to the cooperation-facilitating functions of religion. Belief in watchful gods who monitor and intervene in human affairs may culturally spread by encouraging cooperative tendencies that allow anonymous groups of strangers to expand in size [56,58,59]. However, reliable secular institutions such as governments, courts, and the police can supplant religion in many societies. People perceive God and government as interchangeable sources of external control and stability [60,61]. Belief in God, commitment to supernatural monitoring, and distrust of atheists all decline as societies develop strong secular alternatives to religion (Norenzayan, A. and Gervais, W.M., unpublished manuscript). These beliefs also decline situationally, when reminders of these institutions are made salient [62]. Therefore, strong, reliable governments might be another potent factor underlying inCREDulous atheism. Combined with conditions of existential security and relative absence of sincere religious displays, effective secular institutions undermine religion and its place in society. As religion plays a less prominent role in society, it declines further still, because there is simply less opportunity for religious CREDs to influence cultural learners.

Overcoming intuition: analytic atheism

Finally, some people become atheists also because they turn against the intuitive biases that make some supernatural concepts intuitive. If – as much recent research suggests [3,15–17,21,63–66] – belief in gods and spirits is supported by core intuitive biases, then atheism can emerge when such intuitions are revised or overruled by more analytic processes. We term this 'analytic atheism'. Religious beliefs receive support from many intuitive processes, and reliance on intuitive thinking predicts stronger belief in God and in related supernatural concepts [3,65,66]. Conversely, analytic thinkers show weaker religious belief and tend to lose their religious fervor, even if they were initially raised in a religious environment [65]. Moreover, analytic thinkers, when they do endorse religious beliefs, favor less anthropomorphic and more intellectualized religious concepts, such as belief in a distant, non-intervening God (Deism), and belief that the universe and God are identical (Pantheism) [66]. Experimental work accords with these correlational findings, providing causal evidence that analytic thinking erodes religious belief. Experimental inductions that activate analytic processing, such as perceptual disfluency (e.g, reading a hard-to-read font), incidental visual exposure to a thinking pose (seeing Rodin's 'Thinker'), implicit priming of analytic thinking concepts ('think', 'ponder', 'reflect'), and recalling a decision made analytically promote religious disbelief [3,65]. Analytic overriding of intuitions can, but need not, involve effortful processing, because even subtle prods towards analytic thinking (disfluent fonts and implicit primes) encourage religious disbelief. These findings suggest that analytic cognitive strategies, available habitually or situationally, can overrule or block the intuitions that support religious belief, leading to religious skepticism.

Bringing the various atheisms together: scientists and Scandinavians

In summary, religious disbelief is not a unitary phenomenon that results from a single process. It can arise from multiple pathways and, as a result, can have different qualities. We have identified four such pathways, although there could be others that future research may discover. Whereas mind-blind atheism does not 'get' religion, apatheism and inCREDulous atheism are indifferent towards religion, and analytic atheism is skeptical of and rejects religion. These four paths to atheism are theoretically distinct, but are often intertwined in the real world. We consider two examples.

As a first example, why are scientists less religious than the general population [67]? To begin with, analytic thinkers are likely to be more attracted to science than are intuitive thinkers. The scientific enterprise selects for and encourages a materialistic understanding of the world that in many ways is counterintuitive [68]. Scientific training further cultivates habitual use of analytic thinking, possibly rendering it less cognitively effortful with practice. Moreover, we speculate that scientific subcultures enjoy high levels of existential security and generally operate in the context of societies with strong secular institutions, where religious displays are less normative. In scientific communities, disbelief is common and more pronounced

among the most prestigious members [67]; therefore, conformity and prestige-driven cultural learning processes might further encourage disbelief. These various pathways converge in creating a subculture of majority nonbelievers.

As a second example, why are Scandinavian societies some of the least religious on Earth [2,44]? Whereas the intuitions that support theistic beliefs may have stayed intact, these societies of apatheists and inCREDulous atheists enjoy high levels of existential security, strong and stable governments with social safety nets, and they no longer witness passionate displays of religiosity in the public sphere. These factors were likely mutually reinforcing: increases in existential security reduced motivations to attend religious services, in turn causing further declines of religious belief, leading to a cascade of irreligion. Furthermore, these societies have gradually and successfully replaced religion with effective secular institutions that encourage cooperation and enjoy very high levels of science education [44], which further encourages and reinforces analytic thinking that fosters religious skepticism.

So is atheism a 'hard sell', as many evolutionary and cognitive theorists of religion have argued? The answer, as is often the case when asking a complex question about a complex phenomenon, is that it depends. Religious beliefs make good intuitive fits for human brains [15–21], and in this regard religion has a head start over atheism. However, this does not necessarily imply that all atheism is psychologically superficial, effortfully maintained, or culturally unsustainable. There are many open questions for future research (Box 2), but once the theoretical scope is broadened to accommodate the many mutually reinforcing paths to disbelief, it becomes evident that, under the right conditions, atheism can flourish and reach a viable cultural equilibrium. We might be witnessing the beginnings of a novel transition in human history – the existence of religious disbelief and societies without belief in gods.

References

1 Zuckerman, P. (2007) Atheism: contemporary numbers and patterns. In *The Cambridge Companion to Atheism* (Martin, M., ed.), pp. 47–65, Cambridge University Press
2 Norris, P. and Inglehart, R. (2004) *Sacred and Secular: Religion and Politics Worldwide*, Cambridge University Press
3 Gervais, W.M. and Norenzayan, A. (2012) Analytic thinking promotes religious disbelief. *Science* 336, 493–496
4 McCullough, M.E. *et al.* (2005) The varieties of religious development in adulthood: a longtitudinal investigation of religion and rational choice. *J. Pers. Soc. Psychol.* 89, 78–89
5 Taylor, C. (2007) *A Secular Age*, Belknap Harvard
6 Johnson, D. (2012) What are atheists for? Hypotheses on the functions of non-belief in the evolution of religion. *Religion Brain Behav.* 2, 48–70
7 Geertz, A.W. and Markusson, G.I. (2010) Religion is natural, atheism is not: on why everybody is both right and wrong. *Religion* 40, 152–165
8 Dawkins, R. (2008) *The God Delusion*, Houghton Mifflin Harcourt
9 Hedges, C. (2008) *I Don't Believe in Atheists*, Free Press
10 Haidt, J. (2012) *The Righteous Mind: Why Good People are Divided by Politics and Religion*, Pantheon Books
11 Gervais, W.M. *et al.* (2011) Do you believe in atheists? Distrust is central to anti-atheist prejudice. *J. Pers. Soc. Psychol.* 101, 1189–1206
12 Edgell, P. *et al.* (2006) Atheists as 'other': moral boundaries and cultural membership in American society. *Am. Sociol. Rev.* 71, 211–234
13 Slingerland, E. and Collard, M., eds (2012) *Creating Consilience: Integrating Science and the Humanities*, Oxford University Press
14 Boyd, R. *et al.* (2011) The cultural niche: why social learning is essential for human adaptation. *Proc. Natl. Acad. Sci. U.S.A.* 108, 10918–10925
15 Boyer, P. (2001) *Religion Explained*, Basic Books
16 Barrett, J.L. (2000) Exploring the natural foundations of religion. *Trends Cogn. Sci.* 4, 29–34
17 Atran, S. and Norenzayan, A. (2004) Religion's evolutionary landscape: counterintuition, commitment, compassion, communion. *Behav. Brain Sci.* 27, 713–770
18 Bloom, P. (2007) Religion is natural. *Dev. Sci.* 10, 147–151
19 Boyer, P. (2008) Religion: bound to believe? *Nature* 455, 1038–1039
20 Bering, J. (2002) The existential theory of mind. *Rev. Gen. Psychol.* 6, 3–24
21 Bering, J. (2011) *The Belief Instinct: The Psychology of Souls, Destiny, and the Meaning of Life*, W.W. Norton
22 Slingerland, E. (2008) *What Science Offers the Humanities: Integrating Body and Mind*, Cambridge University Press
23 Gervais, W.M. Religious cognition. In *Religion, Personality, and Social Behavior* (Saroglou, V., ed.), Psychology Press (in press)
24 Norenzayan, A. *et al.* (2012) Mentalizing deficits constrain belief in a personal God. *PLoS ONE* 7, e36880
25 Schjoedt, U. *et al.* (2009) Highly religious participants recruit areas of social cognition in personal prayer. *Soc. Cogn. Affect. Neurosci.* 4, 199–207
26 Kapogiannis, D. *et al.* (2009) Cognitive and neural foundations of religious belief. *Proc. Natl. Acad. Sci. U.S.A.* 106, 4876–4881
27 Lane, J.D. *et al.* (2010) Children's understanding of ordinary and extraordinary minds. *Child Dev.* 81, 1475–1489
28 Taylor, M. and Carlson, S.M. (1997) The relation between individual differences in fantasy and theory of mind. *Child Dev.* 68, 436–455
29 Gray, K. *et al.* (2010) Distortions of mind perception in psychopathology. *Proc. Natl. Acad. Sci. U.S.A.* 108, 477–479
30 Epley, N. *et al.* (2009) Believers' estimates of God's beliefs are more egocentric than estimates of other people's beliefs. *Proc. Natl. Acad. Sci. U.S.A.* 106, 21533–21538
31 Gervais, W.M. and Norenzayan, A. (2012) Like a camera in the sky? Thinking about God increases public self-awareness and socially desirable responding. *J. Exp. Soc. Psychol.* 48, 298–302
32 Stark, R. (2002) Physiology and faith: addressing the 'universal' gender difference in religious commitment. *J. Sci. Study Religion* 41, 495–507
33 Atran, S. (2002) *In Gods we Trust: The Evolutionary Landscape of Religion*, Oxford University Press

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Box 2. Questions for future research

- Are 'theistic' intuitions (e.g., that mental life is distinct from physical events [18], that some events are "fated" to happen [73], or that one's life has a meaning and purpose [74]) commonly found among nonbelievers? Might these intuitions result in paranormal and superstitious beliefs? In what ways might there be other such intuitions, values, and behaviors that are found among nonbelievers?
- Are there psychological differences between 'lifetime atheists', who were raised without religion, and "atheist converts", who were raised religious, but abandoned religion later in life? What cognitive, motivational, and cultural learning processes explain these differences?
- How do children come to adopt belief in supernatural agents, such as God, ghosts, and Santa Claus, and how is it that over time they maintain belief in some, but abandon belief in others?
- How do the four types of atheism presented in this article interactively affect religious disbelief?
- How might explicit and implicit religious cognitions converge and diverge in these four pathways to atheism?
- Does analytic thinking inhibit intuitions that make religious cognition attractive or merely allow people to override theistic beliefs encouraged by these intuitions?
- Does suffering sometimes lead to loss of faith (called the problem of theodicy)? For whom and under what circumstances?
- Do believers have different reactions to different types of atheism? Is a lifelong atheist more or less threatening than an apostate?
- In considering atheism around the world, how much do these four pathways explain?

34 Gray, K. and Wegner, D.M. (2010) Blaming god for our pain: human suffering and the divine mind. *Pers. Soc. Psychol. Rev.* 14, 7–16

35 Norenzayan, A. and Hansen, I.G. (2006) Belief in supernatural agents in the face of death. *Pers. Soc. Psychol. Bull.* 32, 174–187

36 Dechesne, M. *et al.* (2003) Literal and symbolic immortality: the effect of evidence of literal immortality on self-esteem striving in response to mortality salience. *J. Pers. Soc. Psychol.* 84, 722–737

37 Vail, K.E., III *et al.* (2012) Exploring the existential function of religion and supernatural agent beliefs among Christians, Muslims, Atheists, and Agnostics. *Pers. Soc. Psychol. Bull.* 38, 1288–1300

38 Jong, J. *et al.* (2012) Foxhole athetism, revisted: the effects of mortality salience on explicit and implicit religious belief. *J. Exp. Soc. Psychol.* 48, 983–989

39 Kay, A.C. *et al.* (2010) Randomness, attributions of arousal, and belief in God. *Psychol. Sci.* 21, 216–218

40 Rutjens, B.T. *et al.* (2010) Deus or Darwin: randomness and belief in theories about the origin of life. *J. Exp. Soc. Psychol.* 46, 1078–1080

41 Kay, A.C. *et al.* (2010) Religion conviction as compensatory control. *Pers. Soc. Psychol. Rev.* 14, 37–48

42 Epley, N. *et al.* (2008) Creating social connection through inferential reproduction: loneliness and perceived agency in gadgets, gods, and greyhounds. *Psychol. Sci.* 19, 114–120

43 Sibley, C.G. and Bulbulia, J. (2012) Faith after an earthquake: A longitudinal study of religion and perceived health before and after the 2011 Christchurch New Zealand earthquake. *PLoS ONE* 7, e49648 http://dx.doi.org/10.1371/journal.pone.0049648/

44 Zuckerman, P. (2008) *Society without God*, New York University Press

45 Gervais, W.M. *et al.* (2011) The cultural transmission of faith: why innate intuitions are necessary, but insufficient, to explain religious belief. *Religion* 41, 389–410

46 Tomasello, M. *et al.* (1993) Cultural learning. *Behav. Brain Sci.* 16, 495–552

47 Astuti, R. and Harris, P.L. (2008) Understanding mortality and the life of the ancestors in rural Madagascar. *Cogn. Sci.* 32, 713–740

48 Harris, P.L. and Koenig, M.A. (2006) Trust in testimony: how children learn about science and religion. *Child Dev.* 77, 505–524

49 Rendell, L. *et al.* (2011) Cognitive culture: theoretical and empirical insights into social learning strategies. *Trends Cogn. Sci.* 15, 68–76

50 Henrich, J. and Boyd, R. (1998) The evolution of conformist transmission and the emergence of between-group differences. *Evol. Hum. Behav.* 19, 215–241

51 Henrich, J. and Gil-White, F. (2001) The evolution of prestige: freely conferred status as a mechanism for enhancing the benefits of cultural transmission. *Evol. Hum. Behav.* 22, 1–32

52 Henrich, J. (2009) The evolution of costly displays, cooperation and religion: credibility enhancing displays and their implications for cultural evolution. *Evol. Hum. Behav.* 30, 244–260

53 Birch, S.A. *et al.* (2010) Two-year-olds are vigilant of others' non-verbal cues to credibility. *Dev. Sci.* 13, 363–369

54 Sosis, R. and Alcorta, C. (2003) Signaling, solidarity, and the sacred: the evolution of religious behavior. *Evol. Anthropol.* 12, 264–274

55 Gervais, W.M. and Henrich, J. (2010) The Zeus problem: why representational content biases cannot explain faith in gods. *J. Cogn. Cult.* 10, 383–389

56 Norenzayan, A. *Big Gods: How Religion Transformed Cooperation and Conflict*, Princeton University Press (in press)

57 Lanman, J. (2012) The importance of religious displays for belief acquisition and secularization. *J. Contemp. Religion* 27, 49–65

58 Norenzayan, A. and Shariff, A.F. (2008) The origin and evolution of religious prosociality. *Science* 322, 58–62

59 Atran, S. and Henrich, J. (2010) The evolution of religion: how cognitive by-products, adaptive learning heuristics, ritual displays, and group competition generate deep commitments to prosocial religions. *Biol. Theory* 5, 18–30

60 Kay, A.C. *et al.* (2009) Compensatory control: in the mind, in our institutions, in the heavens. *Curr. Dir. Psychol. Sci.* 18, 264–268

61 Kay, A.C. *et al.* (2008) God and the government: testing a compensatory control mechanism for the support of external systems. *J. Pers. Soc. Psychol.* 95, 18–35

62 Gervais, W.M. and Norenzayan, A. (2012) Reminders of secular authority reduce believers' distrust of atheists. *Psychol. Sci.* 23, 483–491

63 Barrett, J.L. and Keil, F.C. (1996) Conceptualizing a nonnatural entity: anthropomorphism in God concepts. *Cogn. Psychol.* 31, 219–247

64 Kelemen, D. (2004) Are children 'intuitive theists'? *Psychol. Sci.* 15, 295–301

65 Shenhav, A. *et al.* (2012) Divine intuition: cognitive style influences belief in God. *J. Exp. Psychol. Gen.* 141, 423–428

66 Pennycook, G. *et al.* (2012) Analytic cognitive style predicts religious and paranormal belief. *Cognition* 123, 335–346

67 Larson, E.J. and Witham, L. (1998) Leading scientists still reject God. *Nature* 394, 313–314

68 McCauley, R. (2011) *Why Religion is Natural and Science is Not*, Oxford University Press

69 Bulbulia, J. (2012) Ennuitheism. In *Science and the World's Religions Volume III: Religion and Controversies* (Wildman, W. and McNamara, P., eds), pp. 43–64, Praeger

70 Norenzayan, A. *et al.* (2010) The evolution of religious misbelief. *Behav. Brain Sci.* 32, 531

71 Shariff, A.F. *et al.* (2008) The Devil's advocate: secular arguments diminish both implicit and explicit religious belief. *J. Cogn. Cult.* 8, 417–423

72 Bering, J. (2010) Atheism is only skin deep: Geertz and Markússon rely mistakenly on sociodemographic data as meaningful indicators or underlying cognition. *Religion* 40, 166–168

73 Norenzayan, A. and Lee, A. (2010) It was meant to happen: explaining cultural variations in fate attributions. *J. Pers. Soc. Psychol.* 98, 702–720

74 Bering, J. (2010) The nonexistent purpose of people. *Psychologist* 23, 290–293

75 Waytz, A. *et al.* (2010) Causes and consequences of mind perception. *Trends Cogn. Sci.* 14, 383–388

76 Epley, N. *et al.* (2007) On seeing human: a three-factor theory of anthropomorphism. *Psychol. Rev.* 114, 864–886

77 Guthrie, S. (1993) *Faces in the Clouds*, Oxford University Press

78 Bloom, P.U. (2004) *Descartes' Baby*, Basic Books

79 Astuti, R. (2001) Are we all natural dualists? A cognitive developmental approach. *J. R. Anthropol. Inst.* 7, 429–447

80 Kelemen, D. and Rosset, E. (2009) The human function compunction: teleological explanation in adults. *Cognition* 111, 138–143

81 Evans, E.M. (2001) Cognitive and contextual factors in the emergence of diverse belief systems: creation versus evolution. *Cogn. Psychol.* 42, 217–266

82 Greenberg, J. *et al.* (1997) Terror management theory of self-esteem and cultural worldviews: empirical assessments and conceptual refinements. *Adv. Exp. Soc. Psychol.* 29, 61–139

83 Proulx, T. *et al.* (2012) Understanding all inconsistency compensation as a palliative response to violated expectations. *Trends Cogn. Sci.* 16, 285–291

84 Inzlicht, M. and Tullett, A.M. (2010) Reflecting on God: religious primes can reduce neuropsychological response to errors. *Psychol. Sci.* 21, 1181–1190

85 Eisenberger, N.I. and Lieberman, M.D. (2004) Why rejection hurts: a common neural alarm system for physical and social pain. *Trends Cogn. Sci.* 8, 294–300

86 Kirkpatrick, L.A. *et al.* (1999) Loneliness, social support, and perceived relationships with God. *J. Soc. Pers. Relat.* 16, 513–522

87 Harris, P.L. (2012) *Trusting What We're Told: How Children Learn from Others*, Harvard University Press

88 Zhong, C.B. *et al.* (2010) A good lamp is the best police: darkness increases dishonesty and self-interested behavior. *Psychol. Sci.* 21, 311–314

89 Bateson, M. *et al.* (2006) Cues of being watched enhance cooperation in a real-world setting. *Biol. Lett.* 2, 412–414