## **Title**

# 1. Introduction

Following the growing number of nonreligious people and decrease in belief in God in the Western world, atheists and other nonbelievers have started to receive substantial attention. This is reflected in rapidly increased scientific and media interest, in the new terms such as baby nones, agnostic millennials, and militant atheists, and in discussions about the routes that lead to nonbelief. But what makes a nonbeliever? Although several routes are possible, one of the most prominent themes in scientific discussion has been analytic cognition. It has been argued, and often found, that analytically thinking people are less religious than other people.

Analytic cognition is a complex and broad phenomenon, comprising beliefs, knowledge, intelligence, the ability and motivation to reject misleading cognitive biases, and preferred ways of thinking and reasoning in everyday life. In addition, the relationship between analytic cognition and religious unbelief can be properly understood only in association with environmental factors affecting analytic thinking or religiosity, for example family, education, and culture. Understood in this comprehensive way, the role of analytic cognition in shaping religious unbelief is unclear. The existent findings have not been theoretically integrated, empirical evidence is not conclusive, and little is known about what happens when the individual and environmental factors change and interact with one another, and how the factors and their interactions predict the path to atheism over time.

In the present study, we intend to respond to these challenges by presenting a theoretical base for analytic atheism and by testing the model by computer simulation. With computer simulation, it is possible to formalize the arguments made, simulate the key factors and their relationships, represent their cumulating and countervailing effects, and thus specify the causal mechanisms whereby the factors promote atheism and conversion from religion to atheism or vice versa across time. With computer simulation we can also experiment with variables that would otherwise be difficult to manipulate, for example traumas and other critical life events. Computer simulation is thus an optimal tool to scrutinize the relationship between analytic thinking and religious nonbelief in a comprehensive way.

Following Bullivant and Lee (2016), we define atheism as a belief in the non-existence of a God or gods. Defining atheism in positive terms, as a belief rather than the absence of a belief per se, allows us to explore the relative strength of nonbelief. In other words, just as individuals vary terms of their strength of belief in God, they can also vary in the strength or their nonbelief. By analytic atheism we mean atheism which has resulted from analytic cognition. Recent studies suggest that analytic atheists are an important group of all unbelievers. Of the three God unbeliever groups found, those who were strongest analytic thinkers and who endorsed least cognitive biases formed the majority in Finland (88%), in Denmark (85%), and in the Netherlands (51%) {Table S1 \Lindeman, 2019 #4496}. Similarly, when identifying subtypes of atheists based on their reported interests, Silver, Coleman, Hood, and Holcombe (2014) found that the “intellectual atheist” type was the largest (37.6%) of six nonbeliever groups among US participants. Together with the central role analytic thinking has in human rationality, and the widespread interest in religious unbelief, these findings make analytic atheism an important topic to study. We begin with broader theoretical considerations and then review previous studies in the field.

## 1.1. The tripartite theory of mind

Our initial starting point is Stanovich’s tripartite theory of mind (e.g., Stanovich, 2009). The tripartite theory of mind helps us to build the computer model by expanding on the relevant constructs in the model, and by integrating the scattered findings in the field of analytic cognition and religious unbelief.

The tripartite theory is an extension of the dual process theories of cognition. Whereas dual process theories distinguish two forms of thinking, Type 1 and Type 2 (a review: Evans & Stanovich, 2009), the tripartite theory partitions Type 2 processes into two levels of processes, algorithmic and reflective processes. The theory can be described as follows (Evans & Stanovich, 2013; Stanovich, 2009; Stanovich & West, 2008): The defining characteristic of Type 1 processes, called autonomous processes, is that they do not require controlled attention. They operate automatically in response to their own triggering stimuli, and they encompass evolutionarily-compiled knowledge bases and processes, and experiential associations that have been learned to the point of automaticity. Autonomous processes yield default responses, unless algorithmic or reflective processes intervene with these judgments and correct them. Algorithmic-level processes refer to variations in maximal performance, especially fluid intelligence and unconscious inhibition of irrelevant information from working memory. The algorithmic level is subordinate to the higher-level reflective processes which reflect intentional epistemic regulation, knowledge, opinions, value priorities, and habitual thinking styles. Individual differences in thinking and beliefs can arise because of individual differences in algorithmic processes or in reflective processes, the latter being more teachable and more prone to environmental impacts.

The frame of the tripartite theory is described in Figure 1. In a nutshell, we test a model that given an environment supporting analytic thinking, analytic atheism arises from reflective and algorithmic processes which turn down religious beliefs and arguments, and which overrule cognitive biases making supernatural agents like God believable.

*How and where could we say that Stanovich is not to blame if we (=I) have written something nonsense in his name?*

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Insert Figure 1 here

*Figure caption: Predictors of analytic atheism included in the present study (lowercase letters). The diagram is modified after Stanovich's tripartite theory of mind {e.g., Stanovich, 2009).* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## 1.2. Previous studies

*1.2.1. Cognitive biases*

One of the main arguments in the cognitive science of religion is that universal cognitive biases, which emerge early in the childhood, give rise to religious beliefs. Several of such biases have been proposed. These include assigning human attributes to non-humans (i.e., anthropomorphism, Barrett & Keil, 1996; Guthrie, 1993), dualistic thinking of bodies and mind as distinct (Bering, 2006; Bloom, 2007), the teleological bias to believe that objects and events exist for a purpose (Kelemen, 2004), the tendency to detect intentional agents even when there are none (Barrett, 2000), violations of some default expectations about such concepts as a person, living thing, and a man-made object (Boyer, 2003), and confusions of core knowledge about physical, psychological and biological phenomena, for example believing that stars are alive (Lindeman, Svedholm-Häkkinen, & Lipsanen, 2015).

The scholars in the field also agree that the biases have been produced by the evolutionary mechanism of minimizing risks and maximizing benefits (see also Haselton & Nettle, 2006) and that the biases are still rooted in our unconscious, that is, in our autonomous mind. Like any other output of autonomous processes, the biases can be blocked before they become consciously more accessible, or they can pop into the conscious mind, creating an intuition of knowing something instinctively. It may be the case that these intuitions are partly responsible for the development of religious beliefs because several studies suggest that the above-mentioned cognitive biases increase when religiosity increases (Banerjee & Bloom, 2014; Barlev, Mermelstein, & German, 2017; Demertzi et al., 2009; Lindeman & Svedholm-Häkkinen, 2016; Lindeman et al., 2015; Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2015; Willard & Norenzayan, 2013). However, the associations are not usually very strong, and some findings have failed to support this association, in part or overall (Barber, 2014; Kelemen & Rosset, 2009; Rottman et al., 2017; Shtulman, 2006; Willard & Norenzayan, 2013; Willard & Norenzayan, 2017). One reason for the conflicting findings is probably the far-reaching definitions and operationalizations of the biases: It is not surprising that agreeing that water condenses to moisten the air (teleological bias), that mental states are not physical states (dualism), or that cows have intentions (anthropomorphism) does not predict individual religiosity.

In this paper, we are working under the assumptions that only some rudimentary forms of the above biases are related to religious beliefs, and that these basic forms of those beliefs are all expressions of one bias type. These are biases in knowledge that children begin to learn universally roughly at the same age, mainly without instruction, and which provide a basis for further conceptual development (Carey, 1985; Goldberg & Thompson-Schill, 2009; Wellman & Gelman, 1998). More specifically, in these biases the core attributes of mental phenomena (e.g., a mind, intentionality), biological processes (e.g., life) and physical phenomena (e.g., independent existence in space) are confused. Thus, whereas the dualistic idea that mental states are not physical states is not expected to predict religiosity, the idea that a mind can live without a biological body is. We call these biases ontological confusions of core knowledge (hereafter, ontological confusions) as distinct from the other, weaker thinking biases. Based on earlier findings (e.g., Lindeman et al., 2015; Lindeman et al., 2019; Pennycook et al., 2015) we expect that the confusions decrease alongside an increase in nonbelief.

Atheists may not endorse ontological confusions because the confusions have somehow been overruled in their mind. In their article about the pathways leading to atheism, Norenzayan and Gervais (2013, p.23) defined this as the essential characteristic of analytic atheism: Analytic atheism arises “from habitual or situationally salient analytic thinking that blocks or overrides intuitions supporting religious beliefs and encourages religious skepticism”. A key problem with much of the literature is that we don’t know how this blockage happens. In terms of the tripartite theory of mind, blocking may mean any of the three processes discussed next: cognitive inhibition, fluid intelligence, or reflective processes.

## 1.2.2. Cognitive inhibition and intelligence

One of our premises is that strong cognitive inhibition decreases ontological confusions. Although inhibition (overruling, overriding, blocking) of intuitive biases is often discussed in cognitive studies on religiosity, it has not been specified whether inhibition is assumed to be voluntary or automatic. In the present paper, we delimit the meaning of voluntary and deliberative overruling to thinking styles (see below). In turn, the term cognitive inhibition is used here to refer to the involuntary and implicit executive process which occurs prior to conscious awareness and which automatically suppress non-pertinent ideation and inappropriate responses (Aron, Robbins, & Poldrack, 2004; Jahanshahi, Obeso, Rothwell, & Obeso, 2015; Nigg, 2000).

For the present, evidence showing that cognitive inhibition decreases those cognitive biases that may generate religious beliefs is scarce, existing only for teleological bias (Järnefelt, Canfield, & Kelemen, 2015; Kelemen & Rosset, 2009). Still, some studies have shown that strong cognitive inhibition is related to fewer supernatural beliefs and experiences (Barlev et al., 2017; Lindeman, Riekki, & Hood, 2011; Svedholm & Lindeman, 2013; but see Farias et al., 2017), providing indirect evidence for the link between cognitive inhibition and atheism. Moreover, mystical experiences are common among people with lesions in the brain areas associated with inhibition (Cristofori et al., 2016). These inhibition-related brain areas were also activated among skeptics, but not among supernatural believers, when they read stories about critical life situations (e.g., risk for a prison sentence) while looking at supernatural sign like pictures, such as a brick wall (Lindeman, Svedholm, Riekki, Raij, & Hari, 2013).

Besides individual differences, cognitive inhibition varies also with contextual factors. For example, decreased cognitive inhibition has been observed after traumatic life events and in post-traumatic stress disorder (e.g., Aupperle et al., 2012; Clausen et al., 2017). This may partly explain why religiosity sometimes increases after traumatic events (Morris, Jong, Bluemke, & Halberstadt, 2019; ter Kuile & Ehring, 2014; Ullman, 1982; but see Falsetti, Resick, & Davis, 2003; Fontana & Rosenheck, 2004). We therefore examine if cognitive inhibition decreases following traumas.

Another algorithmic process that we expect to block ontological confusions is fluid intelligence. Several studies have shown that religiosity and general intelligence are inversely related. While correlations as high as -.50 - -.60 have been obtained (Lynn, Harvey, & Nyborg, 2009; Reeve & Basalik, 2011), a meta-analysis with 63 studies shows that the correlation between intelligence and religious beliefs varies typically between −.20 and −.25 (Zuckerman, Silberman, & Hall, 2013). The reasons for the negative association are not well understood. One possibility is that fluid intelligence, the part of general intelligence that consists the ability to solve novel problems, explains the relationship. Although intelligence and other abilities do not necessarily protect from thinking biases, the organism must have enough fluid intelligence to notice the need to override a misleading but tempting intuitive response (for details, see Stanovich, 2009). Another possibility is that more intelligent people tend to think analytically and that it is the analytic thinking style (discussed below) which leads to lower religiosity, as Zuckerman et al. (2013) suggest.

*1.2.3. Thinking styles*

Perhaps the best studied cognitive predictors of atheism and religiosity are thinking styles. Thinking styles are dispositions that are usually stable across time and context and they are responsible for the way an individual deals with knowledge, arguments, intuitions, and the forming and changing of beliefs (e.g., Phillips, Fletcher, Marks, & Hine, 2015; Stanovich, 2012). Whereas intelligence reflects individual’s maximal ability, styles thus embody habitual ways of thinking in everyday life. Two types of thinking styles are relevant in the study of analytic atheism, analytic style and intuitive style.

Analytic thinking style can appear at least in three forms: need for cognition, open-minded cognition or cognitive reflection. While analytic style has often been equated with only one of these styles, we model them separately because the variance they share has been less than 10% (e.g., Campitelli & Gerrans, 2014; Haran, Ritov, & Mellers, 2013; Liberali, Reyna, Furlan, Stein, & Pardo, 2012; Pennycook, Cheyne, Koehler, & Fugelsang, 2016).

Need for cognition refers to engagement in and enjoyment of complex problems and effortful cognitive activity (Cacioppo, Petty, Feinstein, & Jarvis, 1996; Epstein, Pacini, Denes Raj, & Heier, 1996). It is negatively associated with religiosity, the correlations ranging from -.14 to -.32 (Lindeman & Svedholm-Häkkinen, 2016; Lindeman et al., 2019; Pennycook et al., 2014; Razmyar & Reeve, 2013). However, zero-associations have also been observed (Gauthier, Christopher, Walter, Mourad, & Marek, 2006; Heintzelman & King, 2016).

Open-minded cognition has several facets, and it can target to people, to knowledge, or to both. Based on previous findings (Stanovich & West, 2007; Svedholm-Häkkinen & Lindeman, 2017), we expect that especially openness to change one's mind in the face of conflicting evidence and arguments, ‘belief revision’ for short, predicts atheism . In studies on religiosity, open-minded cognition has been measured with the Actively Open-Minded Thinking scale (AOT, Sá, West, & Stanovich, 1999). The associations between AOT scores and religiosity have been strong (*r*s = ca. -.50 to -.60, Baron, Scott, Fincher, & Metz, 2015; Pennycook et al., 2014; Piazza & Landy, 2013), possibly because people may have mistakenly interpreted the word ‘belief’ in some of the AOT items as referring to their religious beliefs. When this source of error was controlled, the association between belief revision and religiosity dropped to -.20 to -.30 (Stanovich & Toplak, 2019).

The concept of cognitive reflection was coined by Kagan, Rosman, Day, Albert, and Phillips (1964) who defined it as a thinking disposition that includes inhibition of impulsive and potentially incorrect answers and consideration of alternative solution hypotheses when many alternatives are available. In studies on religiosity, the most common measure for cognitive reflection, and analytic thinking in general, has been the Cognitive Reflection Test (CRT, Frederick, 2005). Correlations between correct responses on the CRT and religious beliefs have ranged between -.21 and -.16 (a meta-analysis: Pennycook, Ross, Koehler, & Fugelsang, 2016). Recent evidence shows that CRT measures mathematical ability, cognitive inhibition, as well as analytic thinking style and ability (Campitelli & Gerrans, 2014; Campitelli & Labollita, 2010; Travers, Rolison, & Feeney, 2016). Although in many ways ingenious test, such diversity of processes involved in solving the CRT tasks renders definite conclusions difficult to make. Most importantly, as a test of momentary test performance, CRT fails to measure habitual thinking style purely.

In this study, we follow Kagan et al. (1964) and define cognitive reflection as a permanent thinking style which covers resistance to rely on the intuitive response that first comes to one’s mind and reflecting the adequacy of alternative solutions. As such, cognitive reflection refers here to the conscious process of overriding (overruling, blocking, revising) intuitive thinking biases, as distinct from the above mentioned automatic and more unconscious cognitive inhibition. However, cognitive reflection can also become habitual and automatic through repeated experience and learning. Because actively resisting every tempting impulse is costly and effortful, the brain generates automatic inhibition through repeated experience (Jahanshahi et al., 2015; Verbruggen, Best, Bowditch, Stevens, & McLaren, 2014). Accordingly, we expect that cognitive inhibition increases with cognitive reflection.

In contrast to analytic thinking style, intuitive style has received much less research attention. This is surprising, considering the essential role of intuition and intuitive biases in discussions about religious beliefs. Intuitive style can be defined as trusting initial feelings and relying on intuitive responses and impressions in everyday thinking (Norris & Epstein, 2011; Phillips et al., 2015). Given that religious people are suggested to rely on intuitive thinking and be misled by intuitions that make supernatural concepts plausible (Bering, 2006; Bloom, 2007; Gervais & Norenzayan, 2012; Kelemen, Rottman, & Seston, 2013; Norenzayan & Gervais, 2013; Pennycook et al., 2012), one would expect that the amount of research would be higher. One reason for this inattention may be that high analytic style has been interpreted to axiomatically reflect low intuitive style, possibly because a momentary test performance (e.g., a response to CRT) cannot be analytic and intuitive at the same time. However, intuitive and analytic thinking, as habitual styles, are independent both by definition (Norris & Epstein, 2011; Phillips et al., 2015) and by empirical findings (Liberali et al., 2012; Majima, 2015; Norris & Epstein, 2011; Pennycook, Cheyne, et al., 2016). While it is probable that when thinking about one specific domain (e.g., religious statements), one thinking style is more dominant than the other, the two styles cannot be regarded as ends of the same dimension.

Although limited, there is some evidence that intuitive style is more typical among religious believers than among atheists (Aarnio & Lindeman, 2007; Lindeman & Svedholm-Häkkinen, 2016; Pennycook, Ross, Koehler, & Fugelsang, 2017; Razmyar & Reeve, 2013; but see Heintzelman & King, 2016). Moreover, two studies addressing momentary responses point to the same direction. Shenhav, Rand, and Greene's (2012) study showed that participants who wrote about an experience that vindicated intuition reported stronger belief in God, compared with participants who wrote about an experience that vindicated reflection. Religious individuals also use more intuitive type of words (e.g., “know,” “feel”), whereas atheists use more analytic type of words (e.g., “thought,” “reason") in their tweets (Ritter, Preston, & Hernandez, 2014).

One further theoretically central area which has been overlooked is the relationship between thinking styles and cognitive biases. The studies available show that teleological bias decreases with cognitive reflection (Wagner-Egger, Delouvée, Gauvrit, & Dieguez, 2018) and that ontological confusions characterize people who have strong faith in intuition but low need for cognition and less open-minded cognition (Lindeman & Svedholm-Häkkinen, 2016; Svedholm & Lindeman, 2013, Study 2, no associations in Study 1). In addition, priming study participants to a momentary intuitive mode, has increased mind-body dualism (Forstmann & Burgmer, 2015). Building on these findings and our theoretical framework, we propose that when analytic style increases, ontological confusions decrease, and when intuitive style increases, ontological confusions increase.

*1.2.4. Values, education, knowledge and social influence*

Besides the cognitive variables, we also address some other variables which may boost or hinder belief in the atheism theism continuum. First, we expect that prioritizing liberal values will predict atheism and belief revision. Values – the ultimate goals, aspirations and guiding principles to best possible living – may sound a distant topic to cognitive psychology, but values often have a cognitive element. Valuing traditions and conservation, in particular, oppose independent thought and openness to change (Schwartz, 1994), and atheism, as such, can be considered a case of independent thinking and nonconformity, at least in societies where the majority is religious (Zuckerman et al., 2013). It is thus possible that analytic thinking partly explains why nonreligious individuals across different denominations and countries value traditions less and openness to change and autonomy more than religious individuals (a meta-analysis: Saroglou, Delpierre, & Dernelle, 2004).

Second, we agree with Norenzayan and Gervais (2013) in that analytic thinkers are likely to be more attracted to science education, which further encourages analytic thinking that fosters religious skepticism. Although the association between education and religiosity is somewhat inconsistent (Hungerman, 2014; Lewis, 2015; Mocan & Pogorelova, 2017), a study from more than 50 countries (N = ca. 85,000) found that religious people dominated (77 %) the lowest educational attainment whereas atheists were most likely to be found at the highest educational level (Keysar, 2017). We thus expect that atheism and belief revision increase with education.

Third, because the cognitive biases underlying religious beliefs are basically confusions where the fundamental differences between mental and physical and between living and lifeless are not honored, we expect that in-depth psychological, biological, and physical knowledge is crucial when predicting ontological confusions and analytic atheism. Just like Stanovich (2018) has noted about research on heuristics and biases, researchers have emphasized the processing requirements and have not paid enough attention to the domain knowledge needed in reasoning, or to the ways this knowledge interacts with thinking processes and styles. As far as we know, no systematic studies have been performed on the associations between religiosity and comprehensive psychological, biological, and physical knowledge. Nonetheless, some studies indicate that academic professionals in the United States from psychology, physics and biology believe in God less than other professionals do (Ecklund & Scheitle, 2007; Gross & Simmons, 2009), and that they more often disagree with the notion that colleges should be facilitating students’ spiritual development (Astin et al., 2006).

Finally, as many authors have suggested, our cognitive architecture may explain why people are receptive to religious concepts but the beliefs require social support to develop (Banerjee & Bloom, 2013; Boyer, 2003; Gervais, Willard, Norenzayan, & Henrich, 2011; Norenzayan & Gervais, 2013). We include three environmental variables in our model, parents, presence of atheists, and culture, to capture the social impact and persuasive power other people can have (Cacioppo, Petty, Kao, & Rodriguez, 1986) and the effects of cultural influences and displays of (in)credulity, such as praying people or religious hypocrisy (Lanman, 2013). While we accept without reservations that parents in specific, and one’s environment more broadly, will affect an individual’s disposition to (not) believe, how these factors interact with their analytic and intuitive thinking is poorly understood. One possibility is that such environments may regulate one’s willingness to change their mind and revise their beliefs, because social learning always contains a strong conformist bias to acquire and maintain the beliefs and values in one’s in-group (Henrich & Boyd, 1998). *(The flows 1) ‘belief revision decreases with religious culture’, 2) ‘belief revision decreases with religious family’ and 3) ‘ontological confusions increase with* *religious family’ are embedded in the preceding sentences, perhaps ok for 1 and 2 but not for 3?).*

*1.2.6. The present study*

*To ease writing the discussion could we add something like these in this chapter:*

By separating different analytic processes from each other *(and/ or anything else)*, we can better answer the fundamental question still open: The cognitive mechanisms that explains why and how analytic processing decrease religious beliefs are unclear (e.g., Gervais & Norenzayan, 2012; Pennycook et al., 2014).

\* *Perhaps also something about this:* Norenzayan and Gervais (2013) have set the questions for future research: “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?” 🡪 We also examine how the factors examined in this study relate longitudinally to the development of atheism, and to conversion from religiosity to atheism, or vice versa. Although there are least 15 theoretical orientations about religious conversion (Rambo, 1999), and a vast amount of psychological research on conversion (a review: Paloutzian 2014), the role of cognition is a neglected area in the field.

*+ of course, something about SDM here. Could Justin or LeRon write it (Note Tommy’s important argument: “We need to acknowledge that although we focus on analytic atheism, how we conceptualize belief as a continuum (and its relationship to our variables) means this paper is by necessity also a model of intuitive theism.*

**2. Method**

# 3. Results

# 4. Discussion

**References** *(not edited)*

Aarnio, K., & Lindeman, M. (2007). Religious people and paranormal believers. Alike or different? *Journal of Individual Differences, 28*, 1-9. doi:10.1027/1614-0001.28.1.1

Aron, A. R., Robbins, T. W., & Poldrack, R. A. (2004). Inhibition and the right inferior frontal cortex. *Trends in Cognitive Science, 8*, 170-177. doi:10.1016/j.tics.2004.02.010

Astin, A. W., Astin, H. S., Lindholm, J. A., Bryant, A. N., Calderone, S., & Szelenyi, K. (Eds.). (2006). *Spirituality and the professoriate: A national study of faculty beliefs, attitudes, and behaviors*: Higher Education Research Institute

Aupperle, R. L., Allard, C. B., Grimes, E. M., Simmons, A. N., Flagan, T., Behrooznia, M., . . . Norman, S. B. (2012). Dorsolateral prefrontal cortex activation during emotional anticipation and neuropsychological performance in posttraumatic stress disorder. *Archives of general psychiatry, 69*, 360-371. doi:10.1001/archgenpsychiatry.2011.1539

Banerjee, K., & Bloom, P. (2013). Would Tarzan believe in God? Conditions for the emergence of religious belief. *Trends in Cognitive Sciences, 17*, 7-8.

Banerjee, K., & Bloom, P. (2014). Why did this happen to me? Religious believers’ and non-believers’ teleological reasoning about life events. *Cognition, 133*, 277-303. doi:10.1016/j.cognition.2014.06.017

Barber, J. (2014). Believing in a purpose of events: Cross-cultural evidence of confusions in core knowledge. *Applied Cognitive Psychology, 28*, 432-437. doi:10.1002/acp.3003

Barlev, M., Mermelstein, S., & German, T. C. (2017). Core intuitions about persons coexist and interfere with acquired Christian beliefs about God. *Cognitive Science, 41*, 425-454. doi:10.1111/cogs.12435

Baron, J., Scott, S., Fincher, K., & Metz, S. E. (2015). campi. *Journal of Applied Research in Memory and Cognition, 4*, 265-284. doi:10.1016/j.jarmac.2014.09.003

Barrett, J. L. (2000). Exploring the natural foundations of religion. *Trends in Cognitive Sciences, 4*, 29-34. doi:10.1016/S1364-6613(99)01419-9

Barrett, J. L., & Keil, F. C. (1996). Conceptualizing a nonnatural entity: Anthropomorphism in God concepts. *Cognitive Psychology, 31*, 219-247. doi:10.1006/cogp.1996.0017

Bering, J. M. (2006). The folk psychology of souls. *Behavioral and Brain Sciences, 29*, 453-462. doi:10.1017/S0140525X06009101

Bloom, P. (2007). Religion is natural. *Developmental Science, 10*, 147-151. doi:10.1111/j.1467-7687.2007.00577.x

Boyer, P. (2003). Religious thought and behaviour as by-products of brain function. *Trends in Cognitive Sciences, 7*, 119-124. doi:10.1016/S1364-6613(03)00031-7

Bullivant, S., & Lee, L. (2016). *A Dictionary of Atheism*. <http://www.oxfordreference.com/view/10.1093/acref/9780191816819.001.0001/acref-9780191816819>

Cacioppo, J. T., Petty, R. E., Feinstein, J. A., & Jarvis, W. B. G. (1996). Dispositional differences in cognitive motivation: The life and times of individuals varying in need for cognition. *PSYCHOLOGICAL BULLETIN, 119*, 197-253. doi:10.1037/0033-2909.119.2.197

Campitelli, G., & Gerrans, P. (2014). Does the cognitive reflection test measure cognitive reflection? A mathematical modeling approach. *Memory & cognition, 42*, 434-447. doi:10.3758/s13421-013-0367-9

Campitelli, G., & Labollita, M. (2010). Correlations of cognitive reflection with judgments and choices. *Judgment and Decision Making, 5*, 182-191.

Carey, S. (1985). *Conceptual change in childhood*. London: MIT Press.

Carter, C. S., & Van Veen, V. (2007). Anterior cingulate cortex and conflict detection: an update of theory and data. *Cognitive, Affective, & Behavioral Neuroscience, 7*, 367-379. doi: 10.3758/CABN.7.4.367

Clausen, A. N., Francisco, A. J., Thelen, J., Bruce, J., Martin, L. E., McDowd, J., . . . Aupperle, R. L. (2017). PTSD and cognitive symptoms relate to inhibition‐related prefrontal activation and functional connectivity. *Depression and anxiety, 34*, 427-436. doi:10.1002/da.22613

Cristofori, I., Bulbulia, J., Shaver, J. H., Wilson, M., Krueger, F., & Grafman, J. (2016). Neural correlates of mystical experience. *Neuropsychologia, 80*, 212-220. doi:10.1016/j.neuropsychologia.2015.11.021

De Neys, W. (2014). Conflict detection, dual processes, and logical intuitions: Some clarifications. *Thinking & Reasoning, 20*, 169-187. doi:10.1080/13546783.2013.854725

Demertzi, A., Liew, C., Ledoux, D., Bruno, M. A., Sharpe, M., Laureys, S., & Zeman, A. (2009). Dualism persists in the science of mind. *Annals of the New York Academy of Sciences, 1157*, 1-9.

Ecklund, E. H., & Scheitle, C. P. (2007). Religion among academic scientists: Distinctions, disciplines, and demographics. *Social Problems, 54*, 289-307. doi:10.1525/sp.2007.54.2.289

Epstein, S., Pacini, R., Denes Raj, V., & Heier, H. (1996). Individual differences in intuitive-experiential and analytical-rational thinking styles. *Journal of Personality and Social Psychology, 71*, 390-405. doi:10.1037/0022-3514.71.2.390

Evans, J. S. B., & Stanovich, K. E. (2013). Dual-process theories of higher cognition: Advancing the debate. *Perspectives on Psychological Science, 8*, 223-241. doi:10.1177/1745691612460685

Evans, J. S. B., & Stanovich, K. E. (Eds.). (2009). *In two minds. Dual processes and beyond.* . Oxford: Oxford University Press.

Falsetti, S. A., Resick, P. A., & Davis, J. L. (2003). Changes in religious beliefs following trauma. J*ournal of Traumatic Stress, 16,* 391-398. doi:10.1023/A:1024422220163

Farias, M., Mulukom, V., Kahane, G., Kreplin, U., Joyce, A., Soares, P., . . . Savulescu, J. (2017). Supernatural belief is not modulated by intuitive thinking style or cognitive inhibition. *Scientific Reports, 7*, 15100.

Forstmann, M., & Burgmer, P. (2015). Adults are intuitive mind-body dualists. *Journal of Experimental Psychology: General, 144*, 222-235. doi:10.1037/xge0000045

Frederick, S. (2005). Cognitive reflection and decision making. *The Journal of Economic Perspectives, 19*, 25-42. doi:10.1257/089533005775196732

Gauthier, K. J., Christopher, A. N., Walter, M. I., Mourad, R., & Marek, P. (2006). Religiosity, religious doubt, and the need for cognition: Their interactive relationship with life satisfaction. *Journal of Happiness Studies, 7*, 139-154. doi:10.1007/s10902-005-1916-0

Gervais, W. M., & Norenzayan, A. (2012). Analytic thinking promotes religious disbelief. *Science, 336*, 493-496. doi:10.1126/science.1215647

Gervais, W. M., Willard, A. K., Norenzayan, A., & Henrich, J. (2011). The cultural transmission of faith: Why innate intuitions are necessary, but insufficient, to explain religious belief. *Religion, 41*, 389-410.

Goldberg, R. F., & Thompson-Schill, S. L. (2009). Developmental “roots” in mature biological knowledge. *Psychological Science, 20*, 480-487. doi:10.1111/j.1467-9280.2009.02320.x

Gross, N., & Simmons, S. (2009). The religiosity of American college and university professors. *Sociology of Religion, 70*, 101-129. doi:10.1093/socrel/srp026

Guthrie, S. (1993). *Faces in the clouds*. New York: Oxford University Press.

Haran, U., Ritov, I., & Mellers, B. A. (2013). The role of actively open-minded thinking in information acquisition, accuracy, and calibration. *Judgment and Decision Making, 8*, 188-201.

Haselton, M., & Nettle, D. (2006). The paranoid optimist: An integrative evolutionary model of cognitive biases. *Personality and Social Psychology Review, 10*, 47-66. doi:10.1207/s15327957pspr1001\_3

Heintzelman, S. J., & King, L. A. (2016). Meaning in life and intuition. *Journal of Personality and Social Psychology, 110*, 477. doi:10.1037/pspp0000062

Henrich, J., & Boyd, R. (1998). The evolution of conformist transmission and the emergence of between-group differences. *Evolution and Human Behavior, 19*, 215-241. doi:10.1016/S1090-5138(98)00018-X

Hungerman, D. M. (2014). The effect of education on religion: Evidence from compulsory schooling laws. J*ournal of Economic Behavior & Organization, 104,* 52-63. doi:10.1016/j.jebo.2013.09.004

Jahanshahi, M., Obeso, I., Rothwell, J. C., & Obeso, J. A. (2015). A fronto–striato–subthalamic–pallidal network for goal-directed and habitual inhibition. *Nature Reviews Neuroscience, 16*, 719-732. doi:10.1038/nrn4038

Järnefelt, E., Canfield, C. F., & Kelemen, D. (2015). The divided mind of a disbeliever: Intuitive beliefs about nature as purposefully created among different groups of non-religious adults. *Cognition, 140*, 72-88. doi:10.1016/j.cognition.2015.02.005

Kagan, J., Rosman, B. L., Day, D., Albert, J., & Phillips, W. (1964). Information processing in the child: Significance of analytic and reflective attitudes. *Psychological Monographs: General and Applied, 78*, 1-37. doi:10.1037/h0093830

Kelemen, D. (2004). Are children "intuitive theists"? *Psychological Science, 15*, 295-301. doi:10.1111/j.0956-7976.2004.00672.x

Kelemen, D., & Rosset, E. (2009). The human function compunction: Teleological explanation in adults. *Cognition, 111*, 138-143. doi:10.1016/j.cognition.2009.01.001

Kelemen, D., Rottman, J., & Seston, R. (2013). Professional physical scientists display tenacious teleological tendencies: Purpose-based reasoning as a cognitive default. *Journal of Experimental Psychology: General, 42*, 1074-1083. doi:10.1037/a0030399

Keysar, A. (2017). Religious/nonreligious demography and religion versus science: A global perspective. In P. Zuckerman & J. Shook (Eds.), The Oxford handbook of secularism (Oxford Handbooks Online). doi:10.1093/oxfordhb/9780199988457.013.3

Lanman, J. (2013). Atheism and cognitive science. In *Oxford Handbook of Atheism*.

Lewis, J. R. (2015). Education, irreligion, and non-religion: Evidence from select anglophone census data. *Journal of Contemporary Religion, 30*, 265-272. doi:10.1080/13537903.2015.1025556

Liberali, J. M., Reyna, V. F., Furlan, S., Stein, L. M., & Pardo, S. T. (2012). Individual differences in numeracy and cognitive reflection, with implications for biases and fallacies in probability judgment. *Journal of Behavioral Decision Making, 25*, 361-381. doi:10.1002/bdm.752

Lindeman, M., Riekki, T., & Hood, B. M. (2011). Is weaker inhibition associated with supernatural beliefs? *Journal of Cognition and Culture, 11* 231–239. doi:10.1163/156853711X570038

Lindeman, M., & Svedholm-Häkkinen, A. M. (2016). Does poor understanding of physical world predict religious and paranormal beliefs? *Applied Cognitive Psychology, 30*, 736-742. doi:10.1002/acp.3248

Lindeman, M., Svedholm-Häkkinen, A. M., & Lipsanen, J. (2015). Ontological confusions but not mentalizing abilities predict religious belief, paranormal belief, and belief in supernatural purpose. *Cognition, 134*, 63-76. doi:10.1016/j.cognition.2014.09.008

Lindeman, M., Svedholm, A. M., Riekki, T., Raij, T., & Hari, R. (2013). Is it just a brick wall or a sign from the universe? An fMRI study of supernatural believers and skeptics. *Social Cognitive and Affective Neuroscience, 8*, 943-949. doi:10.1093/scan/nss096

Lindeman, M., van Elk, M., Lipsanen, J., Marin, P., & Schjødt, U. (2019). Religious unbelief in three Western European countries: Identifying and characterizing unbeliever types using latent class analysis. *International Journal for the Psychology of Religion, 29,* 184-203. doi:10.1080/10508619.2019.1591140

Lynn, R., Harvey, J., & Nyborg, H. (2009). Average intelligence predicts atheism rates across 137 nations. *Intelligence, 37*, 11-15. doi:10.1016/j.intell.2008.03.004

Majima, Y. (2015). Belief in pseudoscience, cognitive style and science literacy. *Applied Cognitive Psychology, 29*, 552-559. doi:10.1002/acp.3136

Mocan, N., & Pogorelova, L. (2017). Compulsory schooling laws and formation of beliefs: Education, religion and superstition. *Journal of Economic Behavior & Organization, 142*, 509-539. doi:10.1016/j.jebo.2017.07.005

Morris, Z. T., Jong, J., Bluemke, M., & Halberstadt, J. (2019). Death salience moderates the effect of trauma on religiosity. *Psychological trauma: Theory, research, practice and policy. Advance online publication.* doi:10.1037/tra0000430

Nigg, J. (2000). On inhibition/disinhibition in developmental psychopathology: Views from cognitive and personality psychology and a working inhibition taxonomy. *PSYCHOLOGICAL BULLETIN, 126*, 220–246. doi:10.1037/0033-2909.126.2.220

Norenzayan, A., & Gervais, W. M. (2013). The origins of religious disbelief. *Trends in Cognitive Sciences, 17*, 20–25. doi:10.1016/j.tics.2012.11.006

Norris, P., & Epstein, S. (2011). An experiential thinking style: Its facets and relations with objective and subjective criterion measures. *Journal of Personality, 79*, 1043-1080. doi:10.1111/j.1467-6494.2011.00718.x

Paloutzian , R. (2014). Psychology of religious conversion and spiritual transformation. In L. Rambo & C. Farhadian (Eds.), The Oxford handbook of religious conversion (Oxford Handbooks Online) Oxford University Press. doi:10.1093/oxfordhb/9780195338522.013.009

Pennycook, G., Cheyne, J. A., Barr, N., Koehler, D. J., & Fugelsang, J. A. (2014). Cognitive style and religiosity: The role of conflict detection. *Memory & cognition, 42*, 1-10. doi:10.3758/s13421-013-0340-7

Pennycook, G., Cheyne, J. A., Barr, N., Koehler, D. J., & Fugelsang, J. A. (2015). On the reception and detection of pseudo-profound bullshit. *Judgment and Decision Making, 10*, 549-563.

Pennycook, G., Cheyne, J. A., Koehler, D. J., & Fugelsang, J. A. (2016). Is the cognitive reflection test a measure of both reflection and intuition? *Behavior Research Methods, 48*, 341-348. doi:10.3758/s13428-015-0576-1

Pennycook, G., Cheyne, J. A., Seli, P., Koehler, D. J., & Fugelsang, J. A. (2012). Analytic cognitive style predicts religious and paranormal belief. *Cognition, 123*, 335–346. doi:10.1016/j.cognition.2012.03.003

Pennycook, G., Ross, R. M., Koehler, D. J., & Fugelsang, J. A. (2016). Atheists and agnostics are more reflective than religious believers: Four empirical studies and a meta-analysis. *PloS one, 11*, e0153039. doi:10.1371/journal.pone.0153039

Pennycook, G., Ross, R. M., Koehler, D. J., & Fugelsang, J. A. (2017). Correction: Atheists and Agnostics Are More Reflective than Religious Believers: Four Empirical Studies and a Meta-Analysis. *PloS one, 12*, e0176586. doi:10.1371/journal.pone.0176586

Phillips, W. J., Fletcher, J. M., Marks, A. D., & Hine, D. W. (2015). Thinking styles and decision making: A meta-analysis. *PSYCHOLOGICAL BULLETIN, 142*, 269-290. doi:10.1037/bul0000027

Piazza, J., & Landy, J. (2013). " Lean not on your own understanding": belief that morality is founded on divine authority and non-utilitarian moral thinking. *Judgment and Decision Making, 8*, 639-661.

Rambo, L. R. (1999). Theories of conversion: Understanding and interpreting religious change. *Social Compass, 46*, 259-271. doi:10.1177/003776899046003003

Razmyar, S., & Reeve, C. L. (2013). Individual differences in religiosity as a function of cognitive ability and cognitive style. *Intelligence, 41*, 667-673. doi:10.1016/j.intell.2013.09.003

Reeve, C. L., & Basalik, D. (2011). A state level investigation of the associations among intellectual capital, religiosity and reproductive health. *Intelligence, 39*, 64-73.

Ritter, R. S., Preston, J. L., & Hernandez, I. (2014). Happy tweets: Christians are happier, more socially connected, and less analytical than atheists on Twitter. *Social Psychological and Personality Science, 5*, 243-249. doi:10.1177/1948550613492345

Rottman, J., Zhu, L., Wang, W., Seston Schillaci, R., Clark, K. J., & Kelemen, D. (2017). Cultural influences on the teleological stance: Evidence from China. *Religion, Brain & Behavior, 7*, 17-26. doi:10.1080/2153599X.2015.1118402

Sá, W. C., West, R. F., & Stanovich, K. E. (1999). The domain specificity and generality of belief bias: Searching for a generalizable critical thinking skill. *Journal of Educational Psychology, 91*, 497-510. doi:10.1037/0022-0663.91.3.497

Saroglou, V., Delpierre, V., & Dernelle, R. (2004). Values and religiosity: A meta-analysis of studies using Schwartz's model. *Personality and Individual Differences, 37*, 721-734. doi:10.1016/j.paid.2003.10.005

Schwartz, S. H. (1994). Are there universal aspects in the structure and contents of human values. *Journal of Social Issues, 50*, 19-45. doi: 10.1111/j.1540-4560.1994.tb01196.x

Shenhav, A., Rand, D. G., & Greene, J. D. (2012). Divine intuition: Cognitive style influences belief in God. *Journal of Experimental Psychology: General, 141*, 423-428. doi:10.1037/a0025391

Shtulman, A. (2006). Qualitative differences between naïve and scientific theories of evolution. *Cognitive Psychology, 52*, 170-194. doi:10.1016/j.cogpsych.2005.10.001

Silver, C. F., Coleman III, T. J., Hood Jr, R. W., & Holcombe, J. M. (2014). The six types of nonbelief: A qualitative and quantitative study of type and narrative. *Mental Health, Religion & Culture, 17*, 990-1001. doi:10.1080/13674676.2014.987743

Stanovich, K. E. (2009). Distinguishing the reflective, algorithmic, and autonomous minds: Is it time for a tri-process theory? In J. S. B. T. Evans & K. Frankish (Eds.), *In two minds. Dual processes and beyond* (pp. 55-88). Oxford: Oxford University Press.

Stanovich, K. E. (2012). On the distinction between rationality and intelligence: Implications for understanding individual differences in reasoning. In K. J. Holyoak & R. G. Morrison (Eds.), *The Oxford handbook of thinking and reasoning* (pp. 343-365). New York: Oxford University Press.

Stanovich, K. E. (2018). Miserliness in human cognition: the interaction of detection, override and mindware. *Thinking & Reasoning, 24*, 423-444. doi:10.1080/13546783.2018.1459314

Stanovich, K. E., & Toplak, M. E. (2019). The need for intellectual diversity in psychological science: Our own studies of actively open-minded thinking as a case study. *Cognition, 187*, 156-166. doi:10.1016/j.cognition.2019.03.006

Stanovich, K. E., & West, R. F. (2007). Natural myside bias is independent of cognitive ability. *Thinking & Reasoning, 13*, 225-247. doi:10.1080/13546780600780796

Stanovich, K. E., & West, R. F. (2008). On the relative independence of thinking biases and cognitive ability. *Journal of Personality and Social Psychology, 94*, 672-695. doi:10.1037/0022-3514.94.4.672

Svedholm, A. M., & Lindeman, M. (2013). The separate roles of the reflective mind and involuntary inhibitory control in gatekeeping paranormal beliefs and the underlying intuitive confusions. *British Journal of Psychology, 104*, 303-319. doi:10.1111/j.2044-8295.2012.02118.x

Svedholm-Häkkinen, A. M., & Lindeman, M. (2017). Actively open-minded thinking: Development of a shortened scale and disentangling attitudes towards knowledge and people. *Thinking & Reasoning, 24*, 21-40. doi:10.1080/13546783.2017.1378723

ter Kuile, H., & Ehring, T. (2014). Predictors of changes in religiosity after trauma: Trauma, religiosity, and posttraumatic stress disorder. *Psychological Trauma: Theory, Research, Practice, and Policy, 6*, 353-360. doi:10.1037/a0034880

Toplak, M. E., & Stanovich, K. E. (2003). Associations between myside bias on an informal reasoning task and amount of post‐secondary education. *Applied Cognitive Psychology, 17*, 851-860. doi:10.1002/acp.915

Travers, E., Rolison, J. J., & Feeney, A. (2016). The time course of conflict on the Cognitive Reflection Test. *Cognition, 150*, 109-118. doi:10.1016/j.cognition.2016.01.015

Ullman, C. (1982). Cognitive and emotional antecedents of religious conversion. *Journal of Personality and Social Psychology, 43*, 183-192. doi:10.1037/0022-3514.43.1.183

Wagner-Egger, P., Delouvée, S., Gauvrit, N., & Dieguez, S. (2018). Creationism and conspiracism share a common teleological bias. *Current biology, 28*, 867-868. doi:10.1016/j.cub.2018.06.072

Wellman, H. M., & Gelman, S. A. (1998). Knowledge acquisition in foundational domains. In W. Damon (Ed.), *Handbook of child psychology. Cognition, perception, and language* (Vol. 2, pp. 523-573). New York: Wiley.

Verbruggen, F., Best, M., Bowditch, W. A., Stevens, T., & McLaren, I. P. (2014). The inhibitory control reflex. *Neuropsychologia, 65*, 263-278. doi:10.1016/j.neuropsychologia.2014.08.014

Willard, A. K., & Norenzayan, A. (2013). Cognitive biases explain religious belief, paranormal belief, and belief in life’s purpose. *Cognition, 129*, 379-391. doi:10.1016/j.cognition.2013.07.016

Willard, A. K., & Norenzayan, A. (2017). “Spiritual but not religious”: Cognition, schizotypy, and conversion in alternative beliefs. *Cognition, 165*, 137-146. doi:10.1016/j.cognition.2017.05.018

Zuckerman, M., Silberman, J., & Hall, J. A. (2013). The relation between intelligence and religiosity: A meta-analysis and some proposed explanations. *Personality and Social Psychology Review, 17*, 325-354. doi:10.1177/1088868313497266