



Analytic atheism: Valuing epistemic rationality strengthens the association between analytic thinking and religious disbelief[☆]

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ABSTRACT

Analytic thinking has been put forth as one of the processes through which people may become atheists. According to this view, people who are more (vs. less) analytically inclined should be more likely to reject the existence of deities because they rely less on the various intuitive cognitive processes that support supernatural beliefs. Consistent with this “analytic atheism” hypothesis, studies have found a negative association between analytic thinking and religious belief. In the present article we expand on this literature and argue that analytic thinking should be more strongly associated with religious disbelief when coupled with motivation to be epistemically rational. Consistent with this hypothesis, we show that the association between analytic thinking and weaker religious faith (Study 1), as well as between analytic thinking and disbelief (vs. belief) in God, and related supernatural phenomena (Study 2–3) is stronger among people who ascribe more (vs. less) value to epistemic rationality.

1. Introduction

As the number of religiously unaffiliated has risen in the U.S. in recent years (Pew, 2014), increased attention has been directed to the psychological processes that promote disbelief in the existence of deities and other supernatural agents (Norenzayan & Gervais, 2013). One of the possible paths to disbelief in God that has been put forth is analytic thinking. Based on dual-process models of cognition (Evans, 2003), it has been argued that religious beliefs are supported by various intuitive cognitive processes (Atran & Norenzayan, 2004; Bloom, 2007; Boyer, 2008). To the extent that people rely more on an analytic rather than intuitive mode of thinking, they may therefore be less inclined to adopt or maintain religious beliefs.

Consistent with the analytic atheism hypothesis, a number of studies have found that analytic thinking is negatively associated with religious belief, as well as with belief in various other supernatural phenomena (e.g., Gervais & Norenzayan, 2012; Pennycook, Cheyne, Seli, Koehler, &

Fugelsang, 2012; Pennycook, Ross, Koehler, & Fugelsang, 2016; Shenhav, Rand, & Greene, 2012). In addition, a few studies suggest that subtle manipulations to promote analytic thinking can reduce religious belief (Gervais & Norenzayan, 2012; Shenhav et al., 2012), although those experimental findings have been more difficult to replicate (Sanchez, Sundermeier, Gray, & Calin-Jageman, 2017; Yonker, Edman, Cresswell, & Barrett, 2016; but see Yilmaz, Karadöller, & Sofuoğlu, 2016).

In the present article we expand on this literature by examining the boundary conditions for the relationship between analytic thinking and religious disbelief. Based on dual-process models of persuasion (e.g., Chaiken, Liberman, & Eagly, 1989; Petty & Cacioppo, 1986), as well as recent research on belief in paranormal phenomena (Adam-Troian, Caroti, Arciszewski, & Ståhl, 2019; Ståhl & Van Prooijen, 2018), we propose that analytic thinking should be more strongly associated with religious disbelief when coupled with motivation to adopt epistemically rational beliefs.¹ We report the results of three studies that support this

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¹ Epistemic rationality concerns the extent to which one's beliefs accurately map onto the actual structure of the world. It should not be confused with the broader concept of instrumental rationality, which concerns whether or not one's beliefs and actions increase the likelihood of attaining one's goals, more generally (e.g., Stanovich, Toplak, & West, 2008).

prediction.

1.1. Dual-process models of cognition and supernatural beliefs

Dual-process models of cognition hold that humans have two modes of processing information (Evans, 2003). On the one hand people rely on intuitive, associative, effortless, and largely automatic cognitive processes (System 1). On the other hand, people can engage in more analytic, serial, effortful, and deliberate modes of processing information (System 2). Although System 1 is conceived of as the default way of processing information, both systems can operate in parallel, and System 2 processes have the capacity to override System 1 processes when needed (Kahneman, 2011).

Cognitive scientists and developmental psychologists studying religion have argued that one of the reasons that religious beliefs are so ubiquitous is that they are supported by a number of intuitive (System 1) processes (e.g., Atran & Norenzayan, 2004; Bloom, 2007). For example, people intuitively see agency and purpose in natural processes (Kelemen, 2004; Wagner-Egger, Delouvé, Gauvrit, & Dieguez, 2018), as well as meaningful patterns in randomly generated data (Van Prooijen, Douglas, & De Inocencio, 2018). People also intuitively think of minds as separate from bodies, and infer minds in objects (e.g., Bloom, 2007). All of these intuitions have been proposed to promote the adoption and maintenance of various supernatural beliefs.

To the extent that religious beliefs are supported by various intuitive processes, it stands to reason that a stronger inclination to override one's intuitive processes with more analytic reasoning may prevent the development and/or maintenance of religious beliefs. In 2012, three research teams independently tested this hypothesis. Consistent with the analytic atheism hypothesis, higher scores on analytic (vs. intuitive) thinking, as measured with the Cognitive Reflection Test (CRT, Frederick, 2005), were associated with weaker religious beliefs (Gervais & Norenzayan, 2012; Pennycook et al., 2012; Shenhav et al., 2012). Since then, a meta-analysis ($N = 15,078$, $k = 31$) has indicated that this relationship is robust, albeit relatively weak ($r = -0.18$, Pennycook et al., 2016). However, a recent cross-cultural study found that, although the relationship between analytic thinking and religious disbelief was reliable in aggregate analyses, when examined separately, it was only robust in 3 out of 13 countries (Gervais et al., 2018; but see Bahçekapili & Yilmaz, 2017; Stagnaro, Ross, Pennycook, & Rand, 2019). The study by Gervais et al. (2018) also indicated that the relationship between analytic thinking and religious disbelief may be stronger in countries where the average level of religious belief is relatively high.

In summary, the literature suggests that analytic thinking is associated with religious disbelief. However, this relationship appears to be relatively weak, and dependent on cultural factors. Below we argue that a relatively weak and fragile link between analytic thinking and religious disbelief is not all that surprising. However, we also propose that the analytic atheism hypothesis can be sharpened by taking motivation to be epistemically rational into account.

1.2. The role of motivation to be epistemically rational

Research on attitude change has demonstrated that having a high analytic capacity does not ensure that people will process new information in a thorough manner. Unless people are highly motivated to do so, they will typically rely on more superficial processing (e.g., Chaiken et al., 1989; Petty & Cacioppo, 1986). Notably, however, although scores on the CRT are often moderately related to indices of cognitive ability (e.g., Pennycook et al., 2016; Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2014; Ståhl & Van Prooijen, 2018; Toplak, West, & Stanovich, 2011), the CRT is not primarily a measure of individual differences in cognitive ability. Rather, the CRT was designed to measure individual differences in the inclination to *rely on* analytic (vs. intuitive) thinking. Thus, when exposed to new information, people who score high (vs. low) on the CRT should be more inclined to process that

information in an analytic manner.

However, religious beliefs can be supported by various powerful motives, such as to manage death anxiety (Norenzayan & Hansen, 2006; Osarchuk & Tatz, 1973), loneliness (Epley, Akalis, Waytz, & Cacioppo, 2008), and a sense of control (Kay, Gaucher, McGregor, & Nash, 2010). This is important, because research has shown that people are frequently biased in their reasoning when they have strong motives to reach a particular conclusion (e.g., Kunda, 1990; Nickerson, 1998). Furthermore, analytic thinking can exacerbate the effects of motivated reasoning, presumably because it facilitates the generation of belief-consistent interpretations (Kahan & Peters, 2017; Kahan, Peters, Dawson, & Slovic, 2017). Taken together, these findings suggest that analytic thinking alone may frequently not be enough to promote disbelief in deities and other supernatural agents. People may also need to be motivated to use their analytic reasoning faculties in pursuit of the truth, rather than for the purpose of belief confirmation (or not using them at all).

We propose that valuing epistemic rationality can provide the motivation needed to apply one's cognitive faculties in pursuit of the truth, and thereby strengthen the link between analytic thinking and religious disbelief. Specifically, we argue that individuals who ascribe high value to epistemic rationality should be particularly likely to recruit their analytic thinking resources in an objective pursuit of the truth when they evaluate the plausibility of specific religious beliefs, or the existence of deities. Because these individuals are motivated to scrutinize arguments and evidence objectively, individual differences in analytic thinking should affect their conclusions, such that those who are more (vs. less) analytical should be less inclined to adopt or maintain epistemically suspect beliefs (Lobato, Mendoza, Sims, & Chin, 2014), such as beliefs in supernatural agents and events. By contrast, the conclusions of individuals who do not ascribe as much value to epistemic rationality should be less affected by their degree of analytic thinking when they evaluate the plausibility of epistemically suspect phenomena. After all, their analytic faculties should be more likely to either remain disengaged, or be recruited in the pursuit of belief confirmation rather than the truth.

Although we are unaware of any studies testing this prediction, there are some recent findings that are consistent with this line of reasoning. Ståhl and Van Prooijen (2018) examined whether valuing epistemic rationality moderated the relationship between analytic thinking and belief in paranormal phenomena. To assess individual differences in how much value people ascribed to epistemic rationality, they relied on the Importance of Rationality Scale (IRS), and the Moralized Rationality Scale (MRS, Ståhl, Zaal, & Skitka, 2016). The IRS assesses how important people think it is that *their own* beliefs are based on logic and evidence. By contrast, the MRS assesses to what extent people view it as a moral issue to be epistemically rational, and thus that everyone's beliefs *should* be based on logic and evidence. Results from two correlational studies demonstrated that individual differences in analytic thinking (CRT), as well as cognitive ability (numeracy, verbal ability), were negatively associated with belief in various paranormal phenomena, but only among individuals who scored high (vs. low) on the IRS. The MRS had a similar moderating effect in one of the studies. However, that relationship disappeared when controlling for the moderating role of the IRS, suggesting that it is not moralization of epistemic rationality, but the personal importance ascribed to being epistemically rational, that moderates the relationship between analytic thinking and paranormal beliefs. These results have been conceptually replicated in a study in which motivation to be epistemically rational was experimentally manipulated (Adam-Troian et al., 2019). Individual differences in cognitive ability were negatively associated with paranormal beliefs when the goal to be rational had been experimentally induced, but not in a control condition.

In the present research we adopt the same empirical approach as we investigate the boundary conditions for the analytic atheism hypothesis. Specifically, we examine whether the relationship between analytic

thinking and religious disbelief is stronger among individuals who ascribe more (vs. less) value to epistemic rationality.

1.3. Overview of studies

We have pulled together all of our (four) datasets that included a measure of analytic thinking, the IRS, the MRS, and either a measure of religious faith, or belief (vs. disbelief) in God. It should be noted that none of these studies were carried out with the intention to test the present hypothesis, and that some data from three of these studies have been previously published (Ståhl, 2021; Ståhl & Van Prooijen, 2018). However, the analyses required to test the present hypothesis have not been previously reported in the literature. In addition, we include an unpublished dataset collected by Will Gervais, Sarah Schiavone, and Maxine Najle in 2017 (Study 2).

The first three datasets contained exactly the same continuous measure of religious faith. Moreover, all three studies relied on a U.S. online sample recruited from a crowdsourcing site (Amazon Mechanical Turk or Crowdflower). For the present purposes, we combined these three datasets into one, and treat this merged dataset as Study 1. Study 2 contained more direct measures of religious beliefs, rather than religious faith. Specifically, it included a composite measure of various supernatural beliefs, as well as a dichotomous measure of belief (vs. disbelief) in God. Study 2 also improved on the previous datasets in that it consisted of a much larger U.S. sample in which individuals who did not believe in God were heavily over-sampled (83% of participants did not believe in God). In Study 3 we once again relied on a direct dichotomous measure of belief (vs. disbelief) in God. More importantly, we recruited a large cross-national sample in which 50% of participants from each national subsample believed (vs. did not believe) in God. Half of the sample was recruited from a country in which the average level of religious belief is relatively high (the U.S.), and the other half of the sample was recruited from Sweden, one of the most secular countries in the world (Zuckerman, 2009). This composition of the sample also allowed us to explore whether the link between analytic thinking and religious disbelief varied as a function of the societal level of religiosity (cf. Gervais et al., 2018).

2. Study 1

2.1. Method

2.1.1. Participants

The total sample consisted of 887 participants, taken from three independent samples described in detail below.

2.1.1.1. Dataset 1. This sample consisted of 343 participants recruited from Crowdflower, and residing in the U.S. Some analyses of this dataset have previously been published (Ståhl & Van Prooijen, 2018, Study 1), but not the analyses relevant to test the main hypothesis postulated in the present article. Sixty-two percent of participants were female, 35% male, and 3% did not report their gender ($M_{\text{age}} = 35.41$, $SD = 12.01$). Three percent had either no formal education, or only a primary level education, 36% had a high school degree, 47% had an undergraduate degree, and 14% had a graduate degree. Ten participants did not report their level of education. We did not collect information about race/ethnicity in this sample.

2.1.1.2. Dataset 2. This sample consisted of 222 participants residing in the U.S., and recruited from Amazon Mechanical Turk. Fifty-two percent of participants were male, 47% were female, and two participants reported their gender as “other” ($M_{\text{age}} = 35.69$, $SD = 10.51$). Seventy-three percent were Caucasian, 10.8% African American, 9% Hispanic/Latino, 5.9% Asian Americans, 0.5% Native Americans, and 1.4% Other. One participant had no high school degree, 9.5% had a high school

degree, 19.4% had some college education, but no degree, 58.1% had an undergraduate degree, and 12.7% had a graduate degree.

2.1.1.3. Dataset 3. This sample consisted of 322 participants residing in the U.S., and recruited from Amazon’s Mechanical Turk. Some analyses of this dataset have previously been published (Ståhl & Van Prooijen, 2018, Study 2), but not the analyses relevant to test the present hypothesis. Forty-nine percent of participants were male, 44% female, and the rest did not report their gender ($M_{\text{age}} = 34.95$, $SD = 10.86$). Seventy-four percent of participants were Caucasian, 7.8% African American, 5.3% Asian American, 5% Hispanic/Latino, 1.6% other, and 6.2% did not report their race/ethnicity. Eleven percent had a high school degree, 30.4% had some college education, but no degree, 40.7% had an undergraduate degree, 11.5% had a graduate degree, and 6.2% did not report their level of education.

2.1.2. Procedure and materials

Procedures were highly similar in all three studies. Upon completing an electronic informed consent, participants filled out an online questionnaire and were paid and thanked for their participation. The measures used to test our hypothesis were the same in all studies, whereas other contents of the questionnaires varied.² Below we describe the measures critical for the purpose of this article.

We relied on the three-item CRT (Frederick, 2005), as well as the four-item CRT-2 (Thomson & Oppenheimer, 2016) to measure analytic thinking. Correct answers to these word problems were summed up to create an 8-point measure (i.e., 0–7 correct responses) of analytic thinking (AT).

We used the 6-item IRS (Ståhl et al., 2016) to measure importance of rationality. This scale includes items such as “It is important to me personally to be skeptical about claims that are not backed up by evidence”. (1 = *Disagree completely*, 7 = *Agree completely*). Scores were averaged to create a measure of personal importance attached to epistemic rationality.

We used the 9-item MRS (Ståhl et al., 2016) to measure moralized rationality. This scale includes items such as “Holding on to beliefs when there is substantial evidence against them is immoral” (1 = *Completely disagree*, 7 = *Completely agree*). After recoding two reversed items, all items were averaged to create a measure of moralized rationality.

To measure religious faith, we used three items from the Santa Clara Strength of Religious Faith Questionnaire (Plante & Boccaccini, 1997). An example item is “My religious faith is extremely important to me” (1 = *not at all*, 7 = *very much*). Scores were averaged to create a measure of religious faith.

3. Results and discussion

All scale means, standard deviations, reliability coefficients, and zero-order correlations from all three subsamples are presented in Table 1. Because the data originated from three separate datasets, we tested our hypothesis using mixed model regression analyses, with a

² The first dataset also contained measures of conspiracy beliefs (Van Prooijen et al., 2018), conspiracy mentality (Bruder, Haffke, Neave, Nouripanah, & Imhoff, 2013), paranormal beliefs (Orenstein, 2002) and illusory pattern perception (Van Prooijen et al., 2018). These data have been reported elsewhere (Ståhl & Van Prooijen, 2018, Study 1). In addition, this dataset also included a measure of populism (Oliver & Rahn, 2016). The second dataset also included the Big Five Aspects Scale (DeYoung, Quilty, & Peterson, 2007), and brief measures of numeric (Schwartz, Woloshin, Black, & Welch, 1997), and verbal ability (Huang & Hauser, 1998). The third dataset included the same measures of conspiracy beliefs and paranormal beliefs as the first dataset. In addition, this dataset included the same brief measures of numeric and verbal ability as in the second dataset. These data have been reported elsewhere (Ståhl & Van Prooijen, 2018, Study 2).

Table 1

Means, standard deviations, Chronbach's alphas, and zero-order correlations (Study 1).

Variables	<i>M</i>	<i>SD</i>	α	1	2	3	4
Dataset 1							
1 AT	2.94	2.09	0.77	–			
2 IRS	5.30	1.03	0.85	0.19**	–		
3 MRS	3.91	1.00	0.82	–0.08	0.39***	–	
4 Religious faith	3.62	2.13	0.97	–0.22***	–0.08	–0.10	–
Dataset 2							
1 AT	3.91	2.34	0.83	–			
2 IRS	5.70	1.00	0.88	0.11	–		
3 MRS	4.16	1.17	0.83	–0.07	0.26***	–	
4 Religious faith	2.60	1.53	0.97	–0.42***	–0.03	0.07	–
Dataset 3							
1 AT	4.27	2.08	0.77	–			
2 IRS	5.61	0.98	0.85	0.28***	–		
3 MRS	4.04	1.20	0.88	–0.01	0.38***	–	
4 Religious faith	2.18	1.37	0.97	–0.14*	–0.30***	–0.13*	–

*** $p < .001$.

** $p < .01$.

* $p < .001$.

random intercept for dataset. All predictor variables were standardized. In Step 1 we entered AT, the IRS, and the MRS. In Step 2 we entered the AT \times IRS and AT \times MRS interactions relevant for our hypothesis (cf. Ståhl & Van Prooijen, 2018). In Step 3 we entered the IRS \times MRS interaction, as well as the three-way interaction.

As can be seen in Table 2, AT was negatively associated with religious faith. This finding is consistent with previous research suggesting that analytic thinking is associated with religious disbelief (Pennycook et al., 2016). More importantly for the present purposes, there was also a significant AT by IRS interaction. By contrast, the AT by MRS interaction was nonsignificant, as was the three-way interaction. To interpret the AT by IRS interaction, we followed up with simple slope analyses. AT was more strongly negatively associated with religious faith among people who scored high (+1SD) on the IRS, $b = -0.66$, $p < .001$ [CI: -0.83 , -0.50], than among people who scored low (–1SD) on the IRS, $b = -0.18$, $p = .03$ (CI: -0.34 , -0.02). The AT by IRS interaction is depicted in Fig. 1.³

These results suggest that analytic thinking is more strongly associated with religious disbelief among those who strongly (vs. weakly) value being epistemically rational. By contrast, the relationship between analytic thinking and religious disbelief was not moderated by individual differences in moralized rationality. Notably, these findings are consistent with previous studies showing that the IRS, but not the MRS, moderates the relationship between analytic thinking and paranormal beliefs (Ståhl & Van Prooijen, 2018).

Although the consistent results across three independent samples suggest that the present findings are relatively robust, this study had some important limitations that need to be addressed. First, all of the samples came from crowdsourcing sites. Second, rather than directly assessing belief (vs. disbelief) in God, we consistently relied on a measure of religious faith in these studies. It should be noted that religiosity and belief in God are generally very closely related in the U.S., and that both religiosity and belief in God are negatively associated with analytic thinking (e.g., Gervais & Norenzayan, 2012; Pennycook et al., 2012).

³ Analyzing the three datasets separately, using hierarchical regression analyses, produced highly similar results. The AT \times IRS interaction was significant in all three datasets (Dataset 1: $b = -0.22$, $p < .05$; Dataset 2: $b = -0.24$, $p < .05$; Dataset 3: $b = -0.26$, $p < .001$), whereas the AT \times MRS interaction was consistently nonsignificant.

Nevertheless, because religious faith is a broader concept than belief in God, it is unclear whether the patterns obtained in this study are attributable to differences in belief in God, or to some other component of religious faith. We addressed both of these issues in Study 2, by examining a considerably larger, and more diverse, U.S. sample, and by relying on a direct dichotomous measure of belief (vs. disbelief) in God, as well as a continuous measure of other supernatural beliefs.

4. Study 2

4.1. Method

4.1.1. Participants

The sample analyzed here consisted of 1747 U.S. residents (311 believers, 1446 disbelievers) from the Qualtrics online panel.⁴ Seventy percent of participants were female, 22.8% male, 1.1% nonbinary, 0.8% other, and 5.3% did not report their gender ($M_{\text{age}} = 35.66$, $SD = 16.86$). Seventy-four percent were White, 4% Asian, 3.9% Hispanic/Latino, 3.8% African American, 1.1% American Indian or Alaska native, 0.6% Middle Eastern or North African, 0.4% Native Hawaiian or Pacific Islander, 0.9% other, and 11% did not report their ethnicity. Three percent had some high school education, 20.6% had a high school degree (or equivalent), 27.4% had some college education, but no degree, 10.4% had an Associate's degree, 1.1% had a Professional degree, 18.3% had a Bachelor's degree, 2.7% had some graduate education, 8% had a Master's degree, 2.5% had a Doctoral degree, and 5.6% did not report their level of education.

4.1.2. Procedure and materials

Upon completing an electronic informed consent, participants filled out an extensive online questionnaire, and were thanked for their participation. Below we describe the measures relevant for the present purposes.⁵

Analytic thinking was measured using the 3-item CRT (Frederick, 2005), the 3-item CRT-L (Primi, Morsanyi, Chiesi, Donati, & Hamilton, 2016), and 3 items from the CRT scale developed by Toplak, West, and Stanovich (2014). Correct responses were summed up to create a 10-point analytic thinking scale (i.e., 0 to 9 correct responses).

The 6-item IRS, and the 9-item MRS were once again used to measure individual differences in the personal, and moral value ascribed to epistemic rationality (Ståhl et al., 2016).

The 10-item supernatural belief scale (SBS, Jong, Bluemke, & Halberstadt, 2013) was used to assess a number of specific supernatural beliefs. This scale includes items such as “There exists an all-powerful, all-knowing, loving God”, and “Miracles – divinely-caused events that have no natural explanation – can and do happen” (1 = *Strongly disagree*, 7 = *Strongly agree*). Scores on these items were averaged to create a measure of supernatural beliefs.

Belief (vs. disbelief) in God was assessed with the question “Do you believe in God?” (1 = Yes, 0 = No).⁶

⁴ This is a random subsample (50%) from a larger sample recruited from the Qualtrics online panel in 2017, by Will Gervais, Sarah Schiavone, and Maxine Najle. The rest of the sample is currently locked away for future confirmatory analyses unrelated to the present purposes.

⁵ Study 2 also contained the REI-40 (Pacini & Epstein, 1999), OSI 2.0 (Kahan, 2017), measures of personality traits, religious history, religiosity in the family, credibility-enhancing displays (Lanman & Buhrmester, 2017), life satisfaction, tolerance of ambiguity, existential threat, personal experiences with discrimination, belief in science (Farias, Newheiser, Kahane, & de Toledo, 2013), awe, need for closure, outgroup attitudes, and risk-taking.

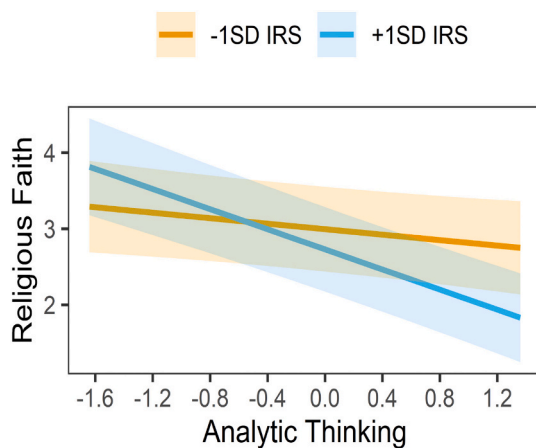
⁶ This question was also used as an eligibility screener, and to heavily oversample individuals who did not believe in God.

Table 2

Results of mixed effect regression analyses (Study 1).

Predictors	Religious faith			Religious faith			Religious faith		
	Estimates	CI	p	Estimates	CI	p	Estimates	CI	p
(Intercept)	2.81	2.28–3.35	0.002	2.86	2.32–3.40	0.002	2.86	2.31–3.40	0.002
AT	–0.43	–0.55 to –0.31	<0.001	–0.42	–0.54 to –0.30	<0.001	–0.43	–0.55 to –0.30	<0.001
MRS	–0.09	–0.21–0.03	0.131	–0.05	–0.18–0.07	0.418	–0.06	–0.19–0.08	0.396
IRS	–0.11	–0.24–0.01	0.080	–0.13	–0.26 to –0.01	0.035	–0.13	–0.26–0.00	0.055
AT * MRS				–0.10	–0.22–0.02	0.101	–0.11	–0.24–0.02	0.111
AT * IRS				–0.24	–0.35 to –0.13	<0.001	–0.24	–0.36 to –0.11	<0.001
MRS * IRS							0.01	–0.09–0.12	0.844
AT * MRS * IRS							0.01	–0.09–0.11	0.890
Random Effects (variance)									
Residual	2.81			2.72			2.72		
Intercept (Study)	0.22			0.22			0.22		
Observations	857			857			857		
Marginal R ² / Conditional R ²	0.072 / 0.138			0.100 / 0.167			0.100 / 0.167		

P-values < .05 in bold font.

**Fig. 1.** Religious faith as a function of analytic thinking and importance of rationality (IRS), with 95% confidence intervals (Study 1).

4.2. Results and discussion

All scale means, standard deviations, reliability coefficients, and zero-order correlations are presented in Table 3. For the continuous SBS, we tested our hypothesis using hierarchical regression analyses. For the dichotomous belief (vs. disbelief) in God measure, we tested our hypothesis using hierarchical logistic regression. All predictor variables were once again standardized. In Step 1 we entered AT, the IRS, and the MRS. In Step 2 we entered the AT × IRS and AT × MRS interactions relevant for our hypothesis. The results are presented in Tables 4 and 5.

4.3. Supernatural beliefs

As can be seen in Table 4, and consistent with the analytic atheism hypothesis, AT was negatively associated with scores on the SBS. More importantly for the present purposes, the MRS, but not the IRS, moderated the relationship between AT and the SBS. Simple slope analyses revealed that AT was more strongly negatively associated with the SBS among those who scored high (+1SD) on the MRS, $b = -0.44$, $p < .001$ [CI: $-0.56, -0.32$] than among those who scored low (–1SD) on the MRS, $b = -0.25$, $p < .001$ [CI: $-0.37, -0.14$]. The AT by MRS interaction is depicted in Fig. 2.

4.4. Belief (vs. disbelief) in God

As can be seen in Table 5, and again consistent with the analytic atheism hypothesis, higher scores on AT were associated with a lower

probability of believing in God. However, neither the MRS, nor the IRS, significantly moderated this relationship.

This study provided additional evidence, from a large sample, that analytic thinking is negatively associated with direct measures of supernatural beliefs, and with belief in God, in the U.S. population. More importantly, we also found some evidence that the negative association between analytic thinking and supernatural beliefs is more pronounced among individuals who strongly (vs. weakly) value epistemic rationality. However, unlike in Study 1 (see also Ståhl & Van Prooijen, 2018), it was individual differences in moralized rationality that moderated this relationship, rather than individual differences in the personal importance ascribed to being epistemically rational. We speculate that, because the concept of God is closely associated with concerns about morality in the U.S., people may feel compelled to provide a moral (rather than amoral) justification not only for their belief, but also for their disbelief, in God. We will return to this issue in the General Discussion. We also note that the interaction effects obtained in this study were substantially smaller than in the previous three studies, and that the interaction effect on the dichotomous measure of belief (vs. disbelief) in God was nonsignificant ($p = .18$). It is unclear whether the smaller effect sizes obtained here are attributable to the more direct measures of religious beliefs used in this study, or to the more diverse sample. In Study 3 we examine the robustness of these findings, as we once again assess belief (vs. disbelief) in God directly. Furthermore, we rely on an even more diverse, cross-national sample. Half of the sample was recruited from the U.S., and the other half was recruited from Sweden – one of the most secular countries in the world (Zuckerman, 2009). Unlike in Study 2, we also ensured to have 50% believers, and 50% disbelievers from each country.

5. Study 3

5.1. Method

5.1.1. Sample, procedure, and materials

Two thousand and sixty-two participants (1060 Americans, 1002 Swedes) were recruited from the online panel provided by OvationMR. Some analyses of this dataset have previously been published (Ståhl, 2021, Study 3), but not the analyses relevant to test the main hypothesis postulated in the present article. Participants were screened with the question: “Do you believe that there is a God?” (Yes, No, Don’t know). Answering “Don’t know” to this question led to exclusion from the study. This resulted in a total of 554 believers and 506 disbelievers residing in the U.S., and 502 believers and 500 disbelievers residing in Sweden. The U.S. sub-sample was more female (54.2% vs. 36.2%), and older ($M = 43.8$, $SD = 16.59$ vs. $M = 34.58$, $SD = 15.04$) than the Swedish sub-sample. In the U.S. sub-sample, 45.8% were affiliated with

Table 3

Means, standard deviations, Chronbach's alphas, and zero-order correlations (Study 2).

Variables	<i>M</i>	<i>SD</i>	α	1	2	3	4	5
1 AT	2.62	2.50	0.82	–				
2 IRS	5.07	1.14	0.87	0.29***	–			
3 MRS	4.13	0.84	0.72	0.06*	0.53***	–		
4 Belief (vs. disbelief)	0.18	0.38	–	–0.16***	–0.15***	–0.05	–	
5 SBS	2.91	1.66	0.95	–0.28***	–0.25***	–0.07**	0.57***	–

*** $p < .001$.** $p < .01$.* $p < .05$.**Table 4**

Results from hierarchical regression analyses predicting supernatural beliefs (Study 2).

Predictors	SBS			SBS		
	Estimates	CI	p	Estimates	CI	p
(Intercept)	2.92	2.85–3.00	<0.001	2.94	2.86–3.02	<0.001
ATI	–0.36	–0.44 to –0.28	<0.001	–0.35	–0.43 to –0.27	<0.001
MRS	0.09	0.00–0.18	0.040	0.09	0.00–0.18	0.039
IRS	–0.36	–0.45 to –0.27	<0.001	–0.37	–0.47 to –0.28	<0.001
AT * MRS				–0.09	–0.18 to –0.01	0.033
AT * IRS				–0.04	–0.13–0.05	0.375
Observations	1720			1720		
R ² / R ² adjusted	0.112 / 0.110			0.117 / 0.114		

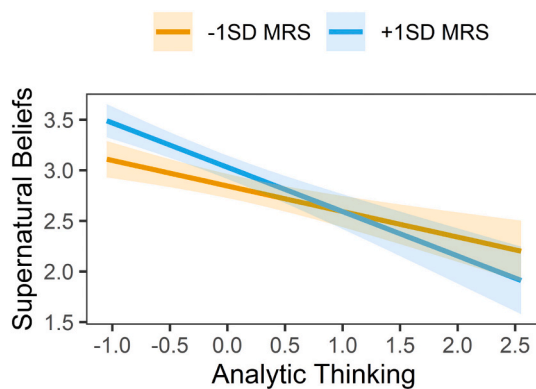
P-values < .05 in bold font.

Table 5

Results from Logistic hierarchical regression analyses predicting belief in God (Study 2).

Predictors	Belief in God			Belief in God		
	Odds Ratios	CI	p	Odds Ratios	CI	p
(Intercept)	0.19	0.17–0.22	<0.001	0.20	0.17–0.22	<0.001
AT	0.67	0.57–0.78	<0.001	0.67	0.57–0.78	<0.001
MRS	1.10	0.94–1.28	0.245	1.06	0.90–1.24	0.496
IRS	0.72	0.61–0.84	<0.001	0.71	0.60–0.83	<0.001
AT * MRS				0.88	0.74–1.06	0.176
AT * IRS				0.96	0.80–1.14	0.641
Observations	1722			1722		
R ² Tjur	0.037			0.038		

P-values < .05 in bold font.

**Fig. 2.** Supernatural beliefs as a function of analytic thinking and moralized rationality (MRS), with 95% confidence intervals (Study 2).

Christianity, 39.8% were “nones” (16.7% atheists, 8.7% agnostics, 1.2 secular humanists, 5.2 other, 8% did not report their non-religious identity), 2.6% Jewish, 1.2% Muslims, 5.4% other, and 5.1% did not report their religious affiliation. In the Swedish sub-sample, 47.7% were affiliated with Christianity, 36.1% were “nones” (19.2% atheists, 3% agnostics, 1.9% secular humanists, 3.4% other, 8.6% did not report their

non-religious identity), 7.6% Muslims, 2.3% Jewish, 5.9% other, and 0.4% did not report their religious affiliation. The U.S. sub-sample was 70.1% Caucasian, 8.1% African American, 6.3% Hispanic/Latino, 6% Asian American, 1.5% Native American, 2.7% other, and 5.3% did not report their race/ethnicity. Data on race/ethnicity were not collected in the Swedish sub-sample, as it is not customary to do so in Sweden.

Upon giving their electronic informed consent, participants filled out the survey online, and were thanked for their participation. We used the dichotomous screener of belief (vs. disbelief) in God as the dependent measure. As in the previous studies, we used the IRS and MRS to assess personal and moral value ascribed to epistemic rationality, and we relied on the CRT, and CRT-2, to measure analytic thinking.⁷ We dropped one item from the CRT-2, because it does not translate properly to the Swedish language (i.e., the Swedish names of the months of April [april] and June [juni] are not common first names in Sweden). Thus, the analytic thinking scale ranged from 0 to 6 in this study.

⁷ Study 3 also contained measures of the moral foundations (Graham et al., 2011), utilitarian reasoning (Piazza, Russell, & Sousa, 2013), mentalizing (Wakabayashi et al., 2006), and credibility-enhancing displays (Lanman & Buhrmester, 2017). These data have been published elsewhere (Ståhl, 2021).

5.2. Results and discussion

All scale means, standard deviations, reliability coefficients, and zero-order correlations are presented in Table 6.

We used hierarchical logistic regression to test our hypothesis.⁸ We entered AT, the IRS, the MRS, and country of residence (US vs. Sweden) as predictors in Step 1. The AT \times IRS interaction, and the AT \times MRS interaction were entered in Step 2. The results are presented in Table 7. Consistent with previous work on analytic atheism, as well as with the results from Study 2, higher scores on AT were associated with a lower probability of believing in God. Moreover, and as was the case with supernatural beliefs in Study 4, the negative relationship between AT and belief in God was moderated by scores on the MRS, but not on the IRS. The negative association between AT and belief in God was stronger among people who scored high on the MRS (+1SD), $b = -0.70$, $p < .001$, $OR = 0.50$ [CI: 0.43, 0.58], than among people who scored low on the MRS (-1SD), $b = -0.34$, $p < .001$, $OR = 0.70$ [CI: 0.61, 0.79]. The predicted probabilities of believing in God as a function of AT and MRS scores are depicted in Fig. 3.

We also examined whether any of these relationships differed between the two countries. As can be seen in Table 7, the negative association between AT and belief in God was moderated by country of residence. Surprisingly, the association between AT and belief in God was stronger among Swedes, $b = -0.66$, $p < .001$, $OR = 0.51$ [CI: 0.44–0.59], than among Americans, $b = -0.38$, $p < .001$, $OR = 0.68$ [CI: 0.58–0.78]. This is noteworthy, because previous data have suggested that the association between analytic thinking and disbelief may be stronger in countries where the average level of religious belief is relatively high (Gervais et al., 2018). We found the opposite pattern here, with a *stronger* association in one of the most secular countries in the world than in the U.S. More importantly for the present purposes, however, the AT by MRS interaction was not moderated by country of residence ($p = .76$). Thus, the MRS served the same moderating role for the relationship between AT and belief in God among Americans and Swedes.

6. General discussion

We set out to examine the boundary conditions for the relationship between analytic thinking and religious disbelief. We argued that, because religious beliefs are frequently supported by powerful existential motives, people are unlikely to engage their analytic faculties in an objective pursuit of the truth when evaluating the plausibility of deities and other supernatural agents. Instead, people are likely to either

Table 6
Means, standard deviations, Chronbach's alphas, and zero-order correlations (Study 3).

Variables	<i>M</i>	<i>SD</i>	α	1	2	3	4
1 AT	1.71	1.63	0.72	–			
2 IRS	5.13	1.27	0.89	0.14***	–		
3 MRS	4.26	0.96	0.72	–0.03	0.53***	–	
4 Belief (vs. disbelief)	0.51	0.50	–	–0.25***	–0.10***	–0.07**	–

*** $p < .001$.

** $p < .01$.

⁸ Because the data were nested within two different countries in this study, it may seem more appropriate to perform mixed model analyses with a random intercept for country of residence. However, because we had recruited an almost identical number of believers and disbelievers from each country, a mixed model with a random intercept produces nearly zero variance. We therefore opted for logistic regression analyses in which we controlled for country of residence, and its interactions with other factors.

engage their analytic faculties in an attempt to confirm their preferred conclusions, or not to engage them at all. As a consequence, we argued that it is not surprising that the association between analytic thinking and religious disbelief is generally relatively weak. However, we also proposed that this association should be stronger among people who are highly *motivated* to develop and maintain epistemically rational beliefs.

Consistent with this line of reasoning, Study 1 showed that individual differences in analytic thinking were more strongly negatively associated with religious faith among those who ascribed high (vs. low) personal value to being epistemically rational. In Study 2 we tested the same hypothesis in a much larger U.S. sample, and using more direct measures of various supernatural beliefs, as well as belief (vs. disbelief) in God. We once again found support for our hypothesis on the continuous supernatural beliefs scale, but not on the dichotomous measure of belief (vs. disbelief) in God. This time, however, the relationship between analytic thinking and supernatural belief was moderated by individual differences in the moral – rather than personal – value ascribed to epistemic rationality. Notably, this pattern of results was conceptually replicated in Study 3, in which we relied on a large cross-national sample (U.S. and Sweden). As was the case with supernatural beliefs in Study 2, the negative relationship between analytic thinking and belief (vs. disbelief) in God was stronger among those who strongly (vs. weakly) moralized epistemic rationality, and this was true for the American as well as the Swedish sample. By contrast, the personal value people attached to being epistemically rational did not moderate the relationship between analytic thinking and belief in God, in any of the two national samples.

Taken together, these three studies indicate that the empirical support for the analytic atheism hypothesis can be bolstered by taking people's motivation to be epistemically rational into account. Notably, these findings are highly consistent with previous studies on belief in paranormal phenomena, and conspiracy beliefs (Adam-Troian et al., 2019; Ståhl & Van Prooijen, 2018), suggesting that our “analytic thinking coupled with epistemic motivation framework” is relevant for a wide range of epistemically suspect beliefs.

Our findings are also relevant to the question of how cultural factors affect the relationship between analytic thinking and religious disbelief. Previous cross-cultural data (Gervais et al., 2018) have suggested that the relationship between analytic thinking and religious disbelief is relatively fickle across cultures, and that it may primarily emerge in countries where the average level of religious belief is relatively high. In fact, Gervais et al. (2018) even found a *positive* relationship between analytic thinking and religious belief in their sample from the (highly secular) UK, suggesting that analytic thinking may promote nonnormative beliefs, rather than religious disbelief. However, other data (Stagnaro et al., 2019), from a considerably larger UK sample, yielded a reliable negative relationship between analytic thinking and religious belief. In the present research (Study 5), the relationship between analytic thinking and religious disbelief was somewhat stronger in the sample recruited from one of the most secular countries in the world (Sweden), than in the U.S. sample. Thus, our findings are consistent with results reported by Stagnaro et al. (2019), and speak against the notion that analytic thinking promotes nonnormative beliefs rather than religious disbelief. More studies are needed to explain the cultural differences that have been observed in the relationship between analytic thinking and religious disbelief (Gervais et al., 2018), but the present findings suggest that they are unlikely to be due to cultural differences in levels of religious belief.

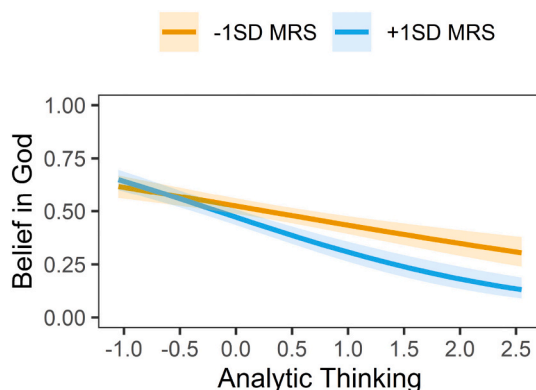
The present studies also leave a number of important questions unanswered that should be addressed in future studies. First, it is not clear why the link between analytic thinking and religious faith was moderated by the *personal* value ascribed to epistemic rationality (IRS, Study 1), whereas the link between analytic thinking and belief in God (Study 3), and other supernatural beliefs (Study 2), was moderated by the *moral* value ascribed to epistemic rationality (MRS). One possibility is that this inconsistency is attributable to differences between the

Table 7

Results from logistic hierarchical regression analyses (Study 3).

Predictors	Belief in God			Belief in God			Belief in God		
	Odds Ratios	CI	p	Odds Ratios	CI	p	Odds Ratios	CI	p
(Intercept)	1.06	0.92–1.21	0.425	1.05	0.92–1.20	0.496	1.08	0.94–1.25	0.270
AT	0.60	0.54–0.66	<0.001	0.59	0.53–0.65	<0.001	0.51	0.44–0.59	<0.001
MRS	0.86	0.77–0.97	0.012	0.90	0.80–1.01	0.072	0.87	0.71–1.05	0.150
IRS	0.95	0.85–1.06	0.377	0.91	0.81–1.02	0.102	0.97	0.81–1.16	0.713
Country	0.90	0.74–1.09	0.290	0.90	0.74–1.09	0.267	0.90	0.74–1.09	0.280
AT * MRS				0.85	0.76–0.94	0.001	0.85	0.73–1.00	0.044
AT * IRS				0.95	0.85–1.07	0.407	0.87	0.73–1.03	0.112
AT * Country							1.33	1.08–1.64	0.007
MRS * Country							1.06	0.83–1.36	0.616
IRS * Country							0.90	0.70–1.14	0.363
AT * MRS * Country							1.03	0.84–1.27	0.758
AT * IRS * Country							1.11	0.88–1.40	0.360

P-values < .05 in bold font.

**Fig. 3.** Predicted probability of believing in God as a function of analytic thinking (CRT) and moralized rationality (MRS), with 95% confidence intervals (Study 3).

dependent measures. The measures used in Studies 2 and 3 assessed belief in God directly, along with various other specific supernatural beliefs (e.g., belief in miracles, angels). Because God is generally seen as a moralizing agent in the cultures we investigated, with keen interest in the rightness and wrongness of human thoughts and actions (e.g., Shariff, Norenzayan, & Henrich, 2010), it is possible that belief or disbelief in God may be more closely tied to moral motives than is religious faith more generally. Notably, the supernatural monitoring that many people ascribe to God has been associated with an increased concern for morality and prosocial behavior (e.g., Norenzayan et al., 2016; Norenzayan & Shariff, 2008; Shariff & Norenzayan, 2007). Because of the close link between God and morality in these cultures, people may feel compelled to rely on a moral, rather than amoral, justification for their belief (or disbelief) in God.

Another possibility is that these inconsistencies instead have to do with differences between the samples. Although all samples seem comparable in their scores on the IRS and MRS, it is noteworthy that the overlap between these two measures was substantially larger in the two larger, and demographically more diverse samples ($r = 0.53$) than in the three samples from crowdsourcing sites ($r_s = 0.26$ – 0.39). The fact that the two measures had more shared variance in Studies 2–3 may help explain why the IRS was not a reliable moderator in these studies, when controlling for scores on the MRS. Indeed, when we remove the MRS from the equation, the IRS emerged as a reliable moderator of supernatural beliefs in Study 2 ($b = -0.09$, $p = .017$), as well as of belief in God in Study 3 ($b = -0.13$, $p = .012$, $OR = 0.88$). Additional studies are needed to determine whether the moderating role of the personal (vs. moral) value ascribed to epistemic rationality varies as a function of sample characteristics, or as a function of what measure is used to assess

religious disbelief. However, all five studies reported here support the broader argument made in this article, that the value (personal or moral) people ascribe to epistemic rationality moderates the relationship between analytic thinking and religious disbelief.

Another important question left unanswered by the present studies concerns causal relationships. The correlational nature of these studies does not allow for any conclusions about causality. Notably, Adam-Troian et al. (2019) were able to moderate the association between analytic thinking and paranormal beliefs, using a subtle manipulation of motivation to be epistemically rational. However, to the best of our knowledge, no studies have manipulated motivation to be epistemically rational, and analytic thinking, simultaneously to study their causal effects on epistemically suspect beliefs. Such a study could be especially informative because early studies reporting effects of subtle analytic thinking manipulations on disbelief in God (Gervais & Norenzayan, 2012; Shenhav et al., 2012) have been difficult to replicate (Sanchez et al., 2017; Yonker et al., 2016; but see Yilmaz et al., 2016).

7. Conclusion

Religious belief is thought to be supported by a host of intuitive cognitive processes, as well as by various powerful motivations known to generate motivated reasoning. As a consequence, we have argued in this article that analytic thinking alone may frequently be insufficient to promote religious disbelief. More specifically, we have proposed that analytic thinking should promote disbelief in deities, and the rejection of various other epistemically suspect beliefs, more strongly when people are motivated to recruit their analytic faculties in an objective pursuit of the truth. The three studies reported here provided support for this line of reasoning, by demonstrating that analytic thinking is more strongly associated with religious disbelief among those who ascribe high (vs. low) value to epistemic rationality. Future studies are needed to establish the causal relationships presumed to account for the associations documented in the studies reported here, and to determine to what extent they are moderated by cultural factors. Based on the present findings, however, we conclude that the analytic atheism hypothesis receives particularly strong support among people who ascribe high (vs. low) value to epistemic rationality.

CRedit authorship contribution statement

Tomas Ståhl: Conceptualization, Methodology, Investigation, Formal analysis, Writing – original draft, Visualization, Project administration, Funding acquisition. **Jan-Willem van Prooijen:** Methodology, Investigation, Writing – review & editing.

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