



Analytic cognitive style predicts religious and paranormal belief

Gordon Pennycook*, James Allan Cheyne, Paul Seli, Derek J. Koehler, Jonathan A. Fugelsang

Department of Psychology, University of Waterloo, Canada

ARTICLE INFO

Article history:

Received 21 September 2011

Revised 6 March 2012

Accepted 8 March 2012

Available online 4 April 2012

Keywords:

Religiosity

Paranormal beliefs

Supernatural beliefs

Cognitive ability

Cognitive style

Intuition

Dual-process theories

ABSTRACT

An analytic cognitive style denotes a propensity to set aside highly salient intuitions when engaging in problem solving. We assess the hypothesis that an analytic cognitive style is associated with a history of questioning, altering, and rejecting (i.e., unbelieving) supernatural claims, both religious and paranormal. In two studies, we examined associations of God beliefs, religious engagement (attendance at religious services, praying, etc.), conventional religious beliefs (heaven, miracles, etc.) and paranormal beliefs (extrasensory perception, levitation, etc.) with performance measures of cognitive ability and analytic cognitive style. An analytic cognitive style negatively predicted both religious and paranormal beliefs when controlling for cognitive ability as well as religious engagement, sex, age, political ideology, and education. Participants more willing to engage in analytic reasoning were less likely to endorse supernatural beliefs. Further, an association between analytic cognitive style and religious engagement was mediated by religious beliefs, suggesting that an analytic cognitive style negatively affects religious engagement via lower acceptance of conventional religious beliefs. Results for types of God belief indicate that the association between an analytic cognitive style and God beliefs is more nuanced than mere acceptance and rejection, but also includes adopting less conventional God beliefs, such as Pantheism or Deism. Our data are consistent with the idea that two people who share the same cognitive ability, education, political ideology, sex, age and level of religious engagement can acquire very different sets of beliefs about the world if they differ in their propensity to think analytically.

© 2012 Elsevier B.V. All rights reserved.

“It is the heart which perceives God and not the reason.
That is what faith is: God perceived by the heart, not by
the reason.”

Blaise Pascal (1623–1662)

1. Introduction

Belief in beings, forces, or powers that are non-material, or otherwise with features outside the daily experience of most people, is found in all human cultures. Zuckerman

(2007), for example, has estimated that roughly 90% of the world's population believes in some form of deity. Theistic beliefs are universally accompanied by a variety of additional specific supernatural beliefs as well as various religious rituals and practices. Other kinds of supernatural belief, commonly referred to as “paranormal”, are also common. For example, more than 40% of Americans believe in ghosts, spiritual healing, and extra sensory perception (National Science Foundation, 2002; Rice, 2003). Recent accounts of the origins of religiosity and religion have emphasized the intuitive and sometimes “minimally counterintuitive” nature of religious beliefs, generally making the case that such beliefs are a natural by-product of normal human cognition (Atran, 2002; Barrett, 2000; Boyer, 1994; Frey, 2009; Guthrie, 1993; Lawson, 2000; Pyysiäinen, 2001). On the other hand, increasing numbers of individuals in modern societies find religious and para-

* Corresponding author. Address: Department of Psychology, University of Waterloo, 200 University Avenue West, Waterloo, ON, Canada N2L 3G1.

E-mail address: gpennyco@uwaterloo.ca (G. Pennycook).

normal beliefs not only counterintuitive, but quite incredible (Beit-Hallahmi, 2006; Zuckerman, 2007). Why do some people hold very strong religious beliefs while others are quite dubious of them? Answers to this question will almost certainly involve many factors at many levels including affective, experiential, family, institutional, developmental, and cultural variables, among others. The rather ambiguous connection between intuition and the supernatural does, however, link cognitive theories of religiosity with decades of decision-making literature that suggests intuition plays a fundamental role in reasoning processes.

1.1. Intuitive and analytic cognitive styles

Considerable research in recent decades has focused on two contrasting styles of problem-solving and decision-making, often formalized as distinct reasoning types or systems (e.g., Epstein, 1994; Evans, 2008; Kahneman, 2003; Sloman, 1996; Stanovich, 2009). The first, sometimes referred to as Type 1 processing, is characterized as intuitive, fast, unconscious, associative, and heuristic. Alternatively, problem solving and decision-making sometimes proceeds in a more analytic manner, sometimes called Type 2 processing, which tends to be more time-consuming, deliberative, and effortful. An analytic cognitive style will typically involve a broader assessment of problem elements as well as an examination and critical evaluation of intuitions. Initial intuitions arising in the context of problem-solving tend to be readily accessible conventional beliefs (Morewedge & Kahneman, 2010) that are associated with a metacognitive feeling of rightness (Thompson, Prowse Turner, & Pennycook, 2011) and appear to require few cognitive resources (De Neys, 2006). Given the foregoing properties, initial intuitions during problem solving often pre-empt further analysis (Evans, 2008). Researchers have constructed a number of tasks that present problematic scenarios in which putatively objective information conflicts with highly salient intuitions. Important for present purposes, there appear to be substantial individual differences in cognitive style (sometimes referred to as thinking disposition), that is, the tendency to critically evaluate initial misleading intuitions and persist in analytic processing (Stanovich, 2004). Focusing on individual differences, we integrate theories of reasoning and decision-making with cognitive theories of religiosity and the formation of belief and unbelief. We then test the hypothesis that individual differences in religiosity can be predicted by individual differences in the propensity and ability to question intuitions while solving reasoning problems.

1.2. Cognitive styles and religiosity

The relation between analytic rationality and the rejection of religious beliefs has, of course, not gone unnoticed. Atheists have generally been found to be, both stereotypically and empirically; intellectual, rational, and sceptical (Beit-Hallahmi, 2006; Caldwell-Harris, Wilson, LoTempio, & Beit-Hallahmi, 2010; Hunsberger & Brown, 2001). Intellectualism has been found to be an important predictor of

religious apostasy among college students (Caplovitz & Sherrow, 1977). Consistent with these attributes, atheists most frequently give intellectual, rational, and scientific reasons for their rejection of religious beliefs (Hunsberger & Altemeyer, 2006). It is therefore hypothesized that when intuitions conflict with reasoning, less religious people will display a more analytic cognitive style than more religious people. Moreover, in light of findings that skill in logical inference is an important component of intelligence testing (Stanovich & West, 2008), and the numerous studies reporting a negative correlation between intelligence and religiosity (e.g., Bertsch & Pesta, 2009; Larson & Witham, 1998; Lewis, Ritchie, & Bates, 2011; Lynn, Harvey, & Nyborg, 2009; Reeve, 2009), it appears that highly religious people may also be less skilled at basic logical inference than less religious people. Therefore, based on the forgoing evidence and reasoning, we hypothesize that more religious people, compared to less religious people, may be both less skilled at logical inference (cognitive ability) as well as more prone to be misled by immediate intuitions (cognitive style) that essentially foreclose on the logical processes that might draw inferences that would weaken them.

Shenhav, Rand, and Greene (2011), working from a dual-process framework, recently reported evidence consistent with this hypothesis. In a series of studies run independently of the current work, Shenhav and colleagues demonstrated that performance on a reasoning task associated with analytic processing (i.e., the cognitive reflection test or CRT; Frederick, 2005) was negatively correlated with belief in God. CRT problems are structured to suggest obvious but misleading answers to otherwise elementary arithmetic questions and hence require further processing to reject the incorrect answer that comes immediately to mind. Shenhav and colleagues report that subjects failing to reject the incorrect answer were more likely to believe in God. Crucially, the correlation remained significant even when cognitive ability (as measured by the Shipley Vocabulary Test and the Wechsler Adult Intelligence Scale Matrix Reasoning test) was controlled. Shenhav and colleagues theorized that belief in God is predicted by reasoning style because it is a particularly fundamental intuitive belief (Atran, 2002; Barrett, 2004; Boyer, 1994; Guthrie, 1993) and therefore hard to override via analytic processing. There are, however, problems with this argument. First, the authors cited by Shenhav and colleagues also frequently describe religious beliefs as attractive and memorable because they are “minimally” counterintuitive (Barrett, 2000; Boyer, 2001; Norenzayan, Atran, Faulkner, & Schaller, 2006; Pyysiäinen & Anttonen, 2002). Moreover, as noted above, research on nonbelievers reveals that increasing numbers of people find many if not all religious concepts strongly counterintuitive (Hunsberger & Altemeyer, 2006). Finally, the interfering intuitions of the cognitive tasks employed in dual process research, including the CRT task used by Shenhav and colleagues, are not fundamental intuitions but merely plausible solutions to specific problems. Thus, while religious intuitions may or may not be unique, we suggest a possibly more fundamental basis for a negative association of analytic cognitive style and religious beliefs: the asymmetry of belief and unbelief.

1.3. The asymmetry of belief and unbelief

The asymmetric model of belief and unbelief posits that comprehension automatically implies belief (Bain, 1859; Gadamer, 1960; Spinoza, selected letters (S. Feldman Ed.; S. Shirley, & IN: Hackett (Originally published in, 1677; Gilbert, 1991; Gilbert, 1993)). On this view, to understand something is to implicitly accept it, at least briefly, as a prerequisite to understanding. It then requires a second move to critically evaluate and certify or, alternatively, to “unbelieve” it. Belief is therefore rapid, automatic, and effortless, whereas the act of unbelief is slow, deliberate, and effortful. Consistent with this, experimental manipulations involving brief interruption of the opportunity to evaluate the truth and falsity of beliefs leads consistently to a positive belief bias (Gilbert, Krull, & Mallone, 1990; Gilbert, Tafarodi, & Malone, 1993). An asymmetry of belief and unbelief hypothesis is clearly compatible with dual process theories of problem solving and decision making. That is, when a candidate answer to a problem spontaneously occurs, the default, according to belief–unbelief asymmetry, is initially to accept that answer as correct. It requires further processing to cast doubt on the initial answer. Further analysis is effortful, however, and must proceed in the face of what seems, at least superficially, an already available answer.

1.4. The present argument and hypotheses

A dual-process belief–unbelief asymmetry argument relating analytic cognitive style to religious beliefs need not require that religious beliefs are uniquely intuitive. Rather, the proposal is that an analytic style of thinking examines truth claims critically, though necessarily after overcoming initial acceptance. All ideas are ultimately open to question and analysis. Given belief–unbelief asymmetry, however, unexamined ideas – or lightly examined ideas – are unlikely to be doubted or rejected. Further analysis does, however, open the possibility of unbelieving, modifying, or, of course, continued or even deeper acceptance of those ideas. Individuals with an analytic cognitive style should therefore be more likely to overcome the acceptance bias and reject or modify what they deem to be unwarranted ideas, whether encountered in the course of problem-solving, examining options in decision making, or considering the truth-value of ideas more generally. That religious beliefs are likely to be especially vulnerable in a modernist context in which rationality and empiricism provide the basis for truth claims is generally accepted by both theists and atheists.¹ Thus, we suggest that individuals with an analytic cognitive style are more likely to reject religious beliefs simply because such beliefs are vulnerable to analytic evaluation.

The present argument applies not only to the basic belief in God but also to any religious belief, such as a belief in miracles or an afterlife. Moreover, an analytic stance, as

noted, need not lead to outright rejection but also to doubt or to the modification of ideas. An analytic stance should also lead to less conventional God beliefs (in Western society), which might be thought of as ranging from orthodox beliefs in a personal God, to notions of an abstract spirit or force of nature, through doubt in God, and finally to outright rejection.

In the studies reported below we assess cognitive style (analytic versus intuitive) using two reasoning tasks that engender intuitive, but erroneous, responses. We assess cognitive ability using a verbal intelligence measure as well as a parallel reasoning task that does not imply a conflicting intuitive response. We also assess religious engagement (R_e) along with specific conventional religious beliefs (R_b) under the assumption that people who are engaged – that is, they go to church, pray, and report that religion is important in their everyday lives – are likely to do so, in part, because of their religious beliefs. We postulate that analytic reasoning acts directly on specific religious beliefs, and that weakening of religious beliefs should then lead to reduced religious engagement, including participation in religious activities and rituals; that is, an *analytic cognitive style* → *diminished religious belief* → *reduced religious participation* relation. We therefore test a mediation hypothesis in which an analytic thinking style directly predicts reduced religious belief, which then predicts reduced religious engagement fully explaining the expected bivariate correlation between analytic cognitive style and religious engagement. We also examine separately the association of an analytic cognitive style with the nature of God beliefs.

In Study 2, we also assess paranormal forms of supernatural belief. To the extent that paranormal beliefs are, like religious beliefs, vulnerable to rational and empirical disconfirmation, their rejection should be related to a more analytic cognitive style. Preliminary evidence for this claim comes from self-report data (Aarnio & Lindeman, 2005; Aarnio & Lindeman, 2007; Lindeman & Aarnio, 2006; Lindeman & Aarnio, 2007) using the Rational–Experiential Inventory (Pacini & Epstein, 1999). This research indicates that paranormal believers report having more intuitive and less analytic personality types (although without controlling for cognitive ability). Paranormal beliefs are less prevalent than religious beliefs and likely much less generally intuitively appealing than religious beliefs (Rice, 2003). If the intuitiveness of religious belief is the crucial factor that determines the relation between reasoning style and religious belief, as suggested by Shenhav et al. (2011), one would expect a weaker correlation between reasoning style and paranormal belief. We therefore assess both paranormal and religious belief and their relations to performance measures of analytic reasoning while controlling for cognitive ability.

2. Study 1: religious belief

2.1. Method

2.1.1. Participants

Two hundred thirty-seven participants were recruited through *Mechanical Turk*TM. Two participants were ex-

¹ Indeed, sophisticated theological arguments seldom attempt to defend religious beliefs within an enlightenment scientific naturalism, but rather prefer to critique the perceived narrowness of truth-tests via rationality, efficient causation, and empiricism (e.g., Chapp, 2011; Gadamer, 1960).

cluded because they failed an attention check question presented half way through the procedure. For this, participants were shown a list of activities and asked to write “I read the instructions” in the “other” box if they were, in fact, reading the instructions. Twelve more were dropped from the sample because of missing information leaving 223 with complete data (131 females; average age = 34.65, SD = 12.55), except for education which was assessed for only 181 participants.² Participation was voluntary and participants received remuneration. All participants indicated that they lived in the United States. Sessions lasted approximately 15 min.

2.1.2. Procedure

Participants first provided demographic information (sex, age, education, and location). Cognitive variables were assessed before asking questions concerning religious belief to ensure that cognitive measures were not influenced by participants’ hypotheses concerning the relation between religion and decision making.

2.1.3. Cognitive measures of analytic cognitive style and cognitive ability

Two different measures of analytic cognitive style (ACS) were employed to provide some generality to our conclusions. We, like [Shenhav et al. \(2011\)](#), used the cognitive reflection test (CRT; [Frederick, 2005](#)); a widely used measure of cognitive ability and cognitive style (e.g., [Toplak, West, & Stanovich, 2011](#)). The CRT consists of three quasi-mathematical problems that generate implicit misleading intuitions, for example:

A bat and a ball cost \$1.10 in total. The bat costs \$1.00 more than the ball. How much does the ball cost?

We also used three Base-Rate Conflict (BRC) problems that contain a conflict between a salient stereotype and more analytical probabilistic information. Consider the following BRC problem (taken from [De Neys & Glumicic, 2008](#)):

In a study 1000 people were tested. Among the participants there were 995 nurses and 5 doctors. Jake is a randomly chosen participant of this study.

Jake is 34 years old. He lives in a beautiful home in a posh suburb. He is well spoken and very interested in politics. He invests a lot of time in his career. What is most likely?

- (a) Jake is a nurse.
- (b) Jake is a doctor.

Here there are two conflicting pieces of information: the base-rate probability of group membership (i.e., 99.5% chance that Jake is a nurse) and diagnostic information that cues an intuitive response based on stereotypical beliefs about doctors and nurses (i.e., that Jake is a doctor). Many people select the intuitive response and neglect or underweight the base-rate information ([De Neys &](#)

[Glumicic, 2008](#); for a review, see [Barbey & Sloman, 2007](#)). Those who are more willing (cognitive style) and better able to (cognitive ability) engage in analytic processing are less likely to select the intuitive response ([Stanovich, 2009](#); [Stanovich & West, 2000](#)). Note that, unlike the CRT, there is no objectively correct response for these base-rate problems. Performance refers to the proportion of non-intuitive (base-rate-consistent) responses selected.

As the ACS measures reflect both cognitive ability and cognitive style, two measures were used to control for cognitive ability (CA) independent of interfering intuitions. WordSum is a brief vocabulary test that correlates well with full scale measures of intelligence ([Huang & Hauser, 1998](#)). For this, participants were presented a list of 10 target words in capital letters and asked to choose the option that most closely matches the meaning of the target word. The second CA measure consisted of three Base-Rate Neutral (BRN) problems that were structurally identical to the BRC problems except that the personality descriptions were not stereotypically associated with either response alternative. Thus, BRN problems assess the basic cognitive ability required to use the base-rate information to solve the problem without the interfering intuitive response. BRC problems, on the other hand, were intended to assess the ability to override a conflicting and, in the context of the problem, misleading, intuitive response. Thus, performance on BRC problems while controlling for BRN performance provides a measure of preference for probability information over the stereotype independent of the ability to use probability information, and is therefore reflective of an analytic cognitive style. All cognitive variables were converted to POMP scores ([Cohen, Cohen, Aiken, & West, 1999](#)) and unweighted means of the ACS and CA variables were computed separately.

2.1.4. Measures of religiosity: religious engagement, religious belief, and theistic belief

The religious engagement (R_e) scale is intended to index religious engagement or level of participation and consists of three questions: importance of religion, church attendance, and prayer frequency. The Religious Belief (R_b) scale assessed six conventional religious beliefs widely held by religious people ([International Social Survey Program \(ISSP\), 1991, 1993](#)). These are beliefs in heaven, hell, miracles, afterlife, angels and demons, and an immaterial soul. Each of the religiosity items was converted to a POMP score, and a mean was then calculated across items from each scale. Higher scores reflect higher R_e and R_b . A confirmatory factor analysis supported separate R_e and R_b factors (see [Figs. S1 and S2 in the Supplementary materials](#)). Both scales had good internal consistency: Cronbach’s $\alpha = 0.87$ for R_e , $\alpha = 0.93$ for R_b . All items are listed in the [Supplementary materials \(Religiosity Inventory\)](#).

A third variable, a qualitative theistic belief measure was based on the answer to the question: “What sort of God, if any, do you believe in?” for which six options were provided (proportion selected for each in brackets): (1) Personal God (40.5%), (2) God as an impersonal force (8.4%), (3) a God who created everything, but does not intervene in human affairs (16.5%), (4) do not know whether or not any of these Gods exist (12.7%), (5) do

² OLS regression analyses reported in [Tables 2, 4 and 5](#) were conducted using list-wise deletion. The final models in these tables were also assessed using imputation of missing data with full information maximum likelihood structural equation modelling with effectively identical results (see [Fig. S3 in the Supplementary materials](#)).

Table 2

Hierarchical multiple regression analyses predicting religious beliefs (R_b) with analytic cognitive style (ACS) controlling for sex, age, conservatism, education, religious engagement (R_e) and cognitive ability (CA).

	B	$S.E.$	β	t	p	R^2_{Δ}	p_{Δ}
Intercept	33.42	8.98		3.72	0.000		
Sex	12.15	3.00	0.28	4.05	0.000		
Age	-0.08	0.12	-0.05	-0.67	0.501		
Conservatism	7.22	1.27	0.39	5.67	0.000		
Education	-0.36	1.25	-0.02	-0.29	0.774	0.26	0.001
Intercept	36.74	6.35		5.79	0.000		
Sex	7.42	2.15	0.17	3.45	0.001		
Age	0.02	0.09	0.01	0.26	0.796		
Conservatism	2.87	0.96	0.15	2.99	0.003		
Education	-1.65	0.89	-0.09	-1.86	0.065		
R_e	0.46	0.04	0.67	12.91	0.000	0.38	0.001
Intercept	40.02	6.99		5.73	0.000		
Sex	6.49	2.20	0.15	2.95	0.004		
Age	0.06	0.09	0.03	0.66	0.511		
Conservatism	2.77	0.94	0.15	2.95	0.004		
Education	-0.77	0.93	-0.04	-0.83	0.407		
R_e	0.44	0.04	0.64	12.35	0.000		
CA	-0.04	0.07	-0.03	-0.52	0.602		
ACS	-0.11	0.04	-0.14	-2.52	0.013	0.02	0.013

3. Study 2: religious and paranormal beliefs

3.1. Method

3.1.1. Participants

Two hundred and eighty-seven participants were recruited through email and completed the study online. Twenty participants were excluded because they submitted incomplete data or failed an attention check question that occurred half way through the procedure. The participants (208 females; average age = 35.04, $SD = 12.77$) had left their email address after completing a survey as part of an ongoing project concerning sleep paralysis (Cheyne, 2010). This sample, in contrast to the US sample in Study 1, was broadly international, including participants from USA (38.7%), Canada (24.7%), United Kingdom (24%), Oceania, (9.3%), Europe, (2.7%) and various other regions (0.7%). All participants indicated that their primary language was English. Sessions lasted approximately 40 min and participation was voluntary.

3.1.2. Procedure and materials

Religious and cognitive variables were identical to Study 1. As in Study 1, participants completed the cognitive measures before being asked about their religious beliefs. Participants were also given a slightly revised version of the Paranormal Belief Scale (Tobacyk, 1988; original scale: Tobacyk & Milford, 1983), in that we excluded the redundant religious items from the religious belief subscale of the Paranormal Belief Scale. We used the remaining six subscales (example items in parentheses): Psi (“Mind reading is possible”), Witchcraft (“Witches do exist”), Omens of luck (“Black cats can bring bad luck”), Spiritualism (“It is possible to communicate with the dead”), Extraordinary life forms (“The Loch Ness monster of Scotland exists”) and Precognition (“Astrology is a way to accurately predict

the future”). Scores on the subscales were summed to create an overall paranormal belief (P_b) score. All three scales had acceptable internal consistency, Cronbach's $\alpha = 0.84$, 0.89, and 0.96, for R_e , R_b , and P_b , respectively.

Demographic variables were assessed and coded as in Study 1. The age range was from 16 to 69. Conservative political ideology scores again indicated a relatively liberal sample overall: strongly liberal (28.7%), liberal (36.2%), moderates (21.3%), conservative (9.9%), strongly conservative (3.9%). The sample was also, again, relatively highly educated. Most of the sample indicated having a Bachelor's degree (30%), a Master's degree (11.3%), a Doctoral degree (2%), or some college experience but no degree (30%). The remainder had vocational training (10.7%), high school (8%), or some high school or less (4.1%).

3.2. Results and discussion

Correlations among the major variables are presented in Table 3. R_e , R_b , and P_b were significantly positively correlated. All cognitive variables were significantly correlated with P_b and all cognitive variables except WS were significantly correlated with R_e and P_b . Sex was again correlated with both religious and cognitive variables though somewhat less consistently so than in Study 1. Conservative political ideology was again consistently significantly correlated with religious variables and also with P_b , and consistently but weakly and generally non-significantly with cognitive variables. Education was significantly negatively correlated with P_b and conservative political ideology and positively with cognitive variables.

Overall, the results for R_b and P_b were, as expected, highly similar. We note that, although P_b and R_b were significantly correlated, only 14.7% of the sample could be considered consistent believers in the supernatural (i.e., in the top 3rd on both P_b and R_b scales). Indeed, P_b and

Table 3

Pearson product-moment correlations among major variables in Study 2. R_e – religious engagement, R_b – religious beliefs, P_b – paranormal beliefs, WS – WordSum, BRN – base-rate neutral, CRT – cognitive reflection test, BRC – base-rate conflict, sex, age, conservatism, education. $N = 267$. Coefficients in bold are significant, $p < .05$.

	R_b	P_b	CA		ACS		Demographic variables			
			WS	BRN	CRT	BRC	Sex	Age	CPI	ED
R_e	0.74	0.32	–0.05	–0.27	–0.23	–0.20	0.17	0.10	0.29	0.00
R_b		0.55	–0.13	–0.22	–0.29	–0.31	0.25	0.04	0.28	–0.09
P_b			–0.06	–0.13	–0.31	–0.23	0.22	0.05	0.02	–0.10
WS				0.11	0.24	0.20	–0.05	0.24	–0.10	0.25
BRN					0.17	0.43	–0.09	–0.12	–0.10	0.28
CRT						0.19	–0.23	–0.02	–0.06	0.18
BRC							–0.04	–0.10	–0.15	0.25
Sex								–0.12	0.00	–0.04
Age									0.13	0.00
CPI										–0.19

R_b were correlated only for the participants in the lowest 3rd on the P_b ($r = .564$, $p < .001$) and R_b ($r = .500$, $p < .001$) scales (all other p 's $> .162$). Indeed, the P_b and R_b correlation was linear only over the first two-thirds of the R_b scale (see Fig. S3, Supplementary materials). Thus, consistent with previous research (Aarnio & Lindeman, 2007), the large majority of believers tend to be of the paranormal or religious type, but not both. The relatively weak correlation between cognitive ability and P_b is consistent with previous research indicating only a tenuous correlation between intelligence and paranormal belief (Smith, Foster, & Stovin, 1998).

We again examined the association between cognitive performance and theistic beliefs. The coefficients for CRT and BRC are highly similar to those in Study 1, $\gamma = -.06$, $-.22$, $-.26$, and $-.18$, for WS, BRN, CRT, and BRC, respectively (significant correlations in bold, $p < .05$). To examine the association of the qualitative differences among theistic beliefs and analytic cognitive style we combined the data from Studies 1 and 2 and cross-tabulated the six different theistic beliefs with CRT performance (i.e., whether a participant answered 0, 1, 2, or 3 CRT questions correctly). This created a 4×6 table with cell frequencies ranging from 7 to 96 with only two cells with less than 10 observations. Analysis of this table yielded a significant likelihood-ratio $\chi^2(15) = 42.71$, $p < .001$, and a gamma coefficient comparable to those computed for the two studies separately, $\gamma = .26$, $p < .001$. Fig. 1 illustrates the negative association between theistic beliefs and CRT performance. Examination of the adjusted standardized residuals indicated that those expressing belief in a personal God were significantly overrepresented, and atheists significantly underrepresented among participants answering none of the CRT questions correctly, whereas the pattern was reversed among those answering two or three questions correctly. Over half of those reporting the most conventional God belief (a personal God) scored 0 out of 3 on the CRT, whereas over 60% of atheists answered at least 2 of 3 questions correctly. The residual differences indicated that significantly more believers in a personal God and fewer atheists answered zero questions than participants in all other categories (all p 's $< .001$). Also, significantly fewer universal agnostics obtained zero scores than Deists (all p 's $< .01$). At the other end of the CRT scale,

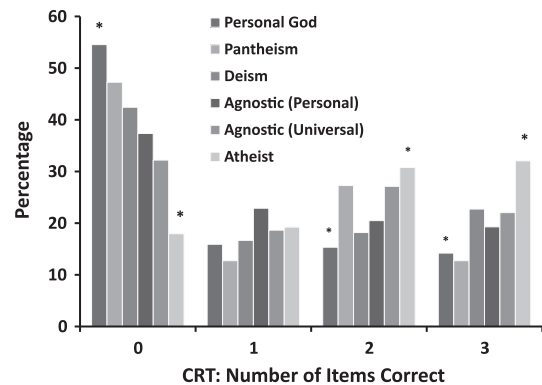


Fig. 1. The number of correct responses on the three item cognitive reflection test as a function of type of theistic belief. Asterisks indicate cells with significant adjusted residuals, $p < .02$.

atheists were significantly more likely to be among those answering all three questions correctly than participants from all other categories (all p 's $< .005$), and believers in a personal God and Pantheists were less likely to do so (all p 's $< .05$). Moreover, the rather orderly pattern of scores suggests that these categories might represent a scale of conventionality/unconventionality of belief from: (1) a culturally conventional personal God, though (2) a Spinozist Pantheism, (3) Deism, (4) personal and (5) universal agnosticism, to (6) atheism. These results also suggest that an analytic stance is associated with more than simple acceptance or rejection of belief in God.

Hierarchical regression analyses predicting R_b with analytic cognitive style (ACS) controlling for sex, education, P_b and cognitive ability (CA) replicated the main findings of Study 1 (Table 4). Sex and conservatism significantly independently predicted R_b in step 1. R_e was highly significant and sex remained so at step 2. At step 3, ACS, but not CA, made a significant contribution to the prediction of R_b along with sex and R_e . R^2_{change} was highly significant at each step. As in the previous regression analysis, we entered CA separately from ACS and the beta for CA was non-significant.

A regression analysis predicting paranormal beliefs parallel to that for R_b (Table 5) was carried out next. At the

Table 4

Multiple regression analyses predicting religious beliefs (R_b) with analytic cognitive style (ACS) controlling for sex, age, conservatism, education, religious engagement (R_e), paranormal beliefs (P_b), and cognitive ability (CA).

	B	$S.E.$	β	t	p	R^2_{Δ}	p_{Δ}
Intercept	6.55	10.53		0.62	0.535		
Sex	15.42	3.50	0.25	4.40	0.000		
Age	0.08	0.11	0.04	0.71	0.476		
Conservatism	6.20	1.36	0.27	4.57	0.000		
Education	-0.47	1.08	-0.03	-0.43	0.665		
						0.14	0.001
Intercept	20.51	7.45		2.75	0.006		
Sex	7.47	2.51	0.12	2.98	0.003		
Age	-0.04	0.08	-0.02	-0.52	0.606		
Conservatism	1.47	1.00	0.06	1.48	0.140		
Education	-1.34	0.76	-0.07	-1.76	0.080		
R_e	0.66	0.04	0.71	16.42	0.000		
						0.44	0.001
Intercept	23.31	8.46		2.76	0.006		
Sex	6.08	2.47	0.10	2.46	0.014		
Age	-0.07	0.08	-0.03	-0.85	0.397		
Conservatism	1.46	0.97	0.06	1.50	0.134		
Education	-0.61	0.81	-0.03	-0.76	0.447		
R_e	0.62	0.04	0.67	15.22	0.000		
CA	0.05	0.08	0.03	0.60	0.550		
ACS	-0.16	0.04	-0.18	-3.91	0.000		
						0.02	0.001

Table 5

Multiple regression analyses predicting paranormal beliefs (P_b) with analytic cognitive style (ACS) controlling for sex, age, conservatism, education, religious engagement (R_e), and specific religious beliefs (R_b), and cognitive ability (CA).

	B	$S.E.$	β	t	p	R^2_{Δ}	p_{Δ}
Intercept	12.79	8.66		1.48	0.141		
Sex	10.91	2.88	0.23	3.79	0.000		
Age	0.13	0.09	0.08	1.33	0.186		
Conservatism	-0.23	1.12	-0.01	-0.20	0.840		
Education	-1.33	0.89	-0.09	-1.50	0.136		
						0.06	0.002
Intercept	17.65	8.33		2.12	0.035		
Sex	8.15	2.81	0.17	2.90	0.004		
Age	0.08	0.09	0.05	0.91	0.365		
Conservatism	-1.87	1.12	-0.10	-1.68	0.095		
Education	-1.64	0.85	-0.11	-1.92	0.056		
R_e	0.23	0.04	0.31	5.11	0.000		
						0.09	0.001
Intercept	18.55	9.40		1.97	0.050		
Sex	6.48	2.75	0.14	2.36	0.019		
Age	0.05	0.09	0.03	0.54	0.587		
Conservatism	-1.89	1.08	-0.10	-1.75	0.081		
Education	-0.90	0.90	-0.06	-1.01	0.315		
R_e	0.19	0.05	0.26	4.18	0.000		
CA	0.10	0.08	0.08	1.17	0.243		
ACS	-0.19	0.04	-0.28	-4.38	0.000		
						0.06	0.001

first step, only sex made a significant independent contribution to P_b . At step 2, R_e made a significant independent contribution to the prediction of P_b . Sex remained significant and education became marginally significant step 2. At step 3, ACS, but not CA, made a significant independent contribution to the prediction of P_b along with sex and R_e . R^2_{change} was significant at each step. Again, we entered CA separately from ACS and the beta for CA was non-significant. Not surprisingly, the association between ACS and P_b , was less attenuated by R_e (Table 4) than was the association between ACS and R_b (Table 5).

In summary, the regression analyses presented in Tables 3–5 indicated that analytic cognitive style made consistently significant contributions to both religious and paranormal beliefs over and above cognitive ability and the included demographic variables. However, given the significant positive correlation between the two types of supernatural belief, it is possible that the analyses for R_b and P_b are simply redundant analyses. To assess the independence of the relation between ACS and each of the supernatural belief variables (R_b and P_b) a separate regression analysis was conducted entering both belief variables

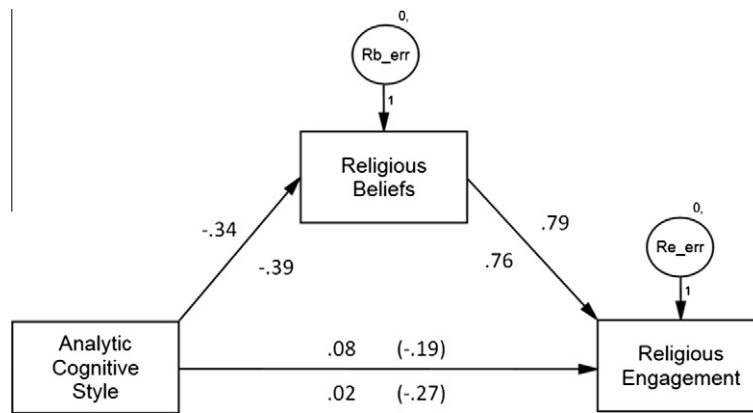


Fig. 2. Mediation of the analytic cognitive style – religious engagement relation by religious beliefs. Standardized path coefficients for Study 1 above lines and for Study 2 below lines. Values in parentheses indicate bivariate regression coefficients for each study.

simultaneously as predictors of ACS. Betas for both belief variables were significant, $\beta(R_b) = -0.27$, $p < .001$, $\beta(P_b) = -0.20$, $p < .002$, $R^2 = .17$, $F(2,279) = 29.05$, $p < .001$. Thus, the results for each type of supernatural belief are independent tests of the analytic cognitive style \leftrightarrow supernatural beliefs relation.

3.3. Testing the ACS \rightarrow R_b \rightarrow R_e mediation hypothesis (Studies 1 and 2)

Structural equation modeling of combined data from both studies was used to test the hypothesis that the association between analytic cognitive style and religious engagement is mediated by conventional religious beliefs. Study 1 and Study 2 data were entered as groups in a structural equation modeling analysis in which ACS predicted R_b and R_e and R_b predicted R_e. To assess the replication of mediation across both studies, the unstandardized coefficient for the path from ACS to R_e was set to zero for both groups. This constrained model was well-fitting by several goodness-of-fit indices, including a non-significant chi-square, $\chi^2(2) = 3.31$, $p = .191$; small root mean square error, RMSEA = .035; and robust Bentler–Bonnett normed fit, NFI = .994 and comparative fit-indices, CFI = .997. Separate mediation analysis of the data from each study yielded highly similar standardized path coefficients (see Fig. 2). There were also robust indirect effects for ACS on R_e, for both samples, -0.29 and -0.28 , p 's $< .001$ for study 1 and study 2 respectively. In both samples the mediation effect was also significant by Sobel tests, $z = 5.30$ and 6.54 , respectively, p 's $< .001$.

4. General discussion

The present research provides evidence that an analytic cognitive style, defined as a propensity to engage in effortful reasoning, is associated with a tendency to subscribe to both religious and paranormal forms of supernatural belief. Participants likely to reject an intuitive response for two types of reasoning problems were more likely to reject supernatural beliefs, even when cognitive ability, as well

as sex, age, political ideology, education and religious engagement were controlled.

The present studies, completed independently from those reported in Shenhav et al. (2011), replicate and extend their reported relation between reasoning style and theistic belief. Shenhav and colleagues based their predictions on the assumption that religious beliefs are uniquely intuitive and scored the CRT in terms of “intuitive” responses, which are highly, though not perfectly, correlated with correct responses based on analytic reasoning; so highly ($r = -0.90$ in each of our two studies) as to be indistinguishable in terms of predictive power. Our argument and approach is, however, somewhat different. Even if it is indeed the case that some individuals reason about supernatural beliefs more analytically than others, why does increased analytic processing so systematically decrease the likelihood of supernatural belief? In our view, beliefs in things such as angels, demons, black magic, or mind reading are unlikely to be reinforced by analytic thought, not because they are especially intuitive, but because they are *counterintuitive*; that is, violations of a naturalistic worldview (Atran & Norenzayan, 2004). We suggest therefore that analytic individuals have decreased levels of supernatural belief because they are more likely to scrutinize ideas, detect such violations, and unbelieve them.

The present results regarding theistic beliefs, though broadly in agreement with those of Shenhav and colleagues, are also somewhat more detailed with regard to God belief and unbelief. What is perhaps the most striking finding of the present study goes beyond a demonstration of a negative relation between an analytic cognitive style and degree of belief in God. This is the finding, illustrated in Fig. 1, that increasing performance on the CRT was associated with a systematically changing conception of God. It was not simply the case that more analytic individuals were more likely to reject all forms of God belief, though many were, but that they may also sometimes adopt less conventional and more abstract God beliefs. God as an abstract force or a non-intervening creator is sufficiently unconventional to require at least some analytic reflection upon the nature of God. They also represent positions that

arguably resolve contradictions between theism and a naturalistic worldview.

None of the foregoing conclusions were qualified by the demographic variables included in the present study. Ancillary findings involving the demographic variables were generally in agreement with previous research. Consistent with previous research, women obtained higher scores on all measures of religiosity (Argyle & Beit-Hallahmi, 1975; Batson, Schoenrade, & Ventis, 1993; Benson, Donahue, & Erickson, 1989) and paranormal beliefs (Stark & Bainbridge, 1985). Consistent with Frederick (2005), women also obtained lower scores on the CRT in both studies. Frederick also presented evidence that the CRT sex difference is independent of math ability and that women gave more intuitive responses relative to men when looking entirely at incorrect responses. More specifically, there are two ways to be wrong on the CRT: (1) by giving the incorrect intuitive response and (2) by giving an incorrect non-intuitive response, and a larger proportion of the males' incorrect responses were of the second type. The present results thus open the possibility that part of the sex difference in religiosity might be explained by sex differences in analytic cognitive style (see also Aarnio & Lindeman, 2005).

Also consistent with previous research (Bouchard, 2009; Grupp & Newman, 1973; Keysar, 2007; Kosmin, 2008; Zelan, 1968) more conservative participants were significantly more religious. Conservative participants were also somewhat less analytic, though the effects were generally non-significant. The effects for education were also consistent with previous research, in that the association with religion and conservative political ideology was marginally negative (Albrecht & Heaton, 1984; Argyle & Beit-Hallahmi, 1975; McFarland, Wright, & Weakliem, 2011; Petersen, 1994). The correlation between education and our cognitive variables was much stronger, however, as more highly educated individuals consistently scored higher on measures of cognitive ability and analytic thinking style.

The present research findings agree with those of research reporting a correlation between paranormal beliefs and self-reported measures of intuitive versus analytic thinking style (Aarnio & Lindeman, 2005; Aarnio & Lindeman, 2007; Lindeman & Aarnio, 2006; Lindeman & Aarnio, 2007). Also consistent with research on intelligence (Bertsch & Pesta, 2009; Lynn et al., 2009; Reeve, 2009), we found several significant negative correlations between cognitive measures thought to be generally reflective of cognitive ability – as assessed by neutral base-rate problems and WordSum – and religiosity (both engagement and beliefs) as well as paranormal beliefs. Measures of cognitive ability, however, produced weaker and less consistent correlations with religiosity and paranormal beliefs than did the analytic cognitive style measures.

Consistent with the mediation hypothesis (i.e., that cognitive style differences predict religious behavior indirectly via belief differences), not only did analytic cognitive style predict religious and paranormal beliefs independently of demographic variables, it did so independently of religious engagement and, moreover, the effects on religious beliefs completely explained the negative association between analytic cognitive style and religious engagement. This is

critical for a theory of cognitive influences on religiosity; namely that analytic cognitive style negatively affects religiosity and does so via lower acceptance of conventional religious beliefs. This is consistent with the Shenhav et al. (2011) finding that CRT performance predicted self-reported change in religious beliefs. Neither finding clearly establishes causal direction, of course. Indeed, an intriguing speculative alternative explanation is that examining one's beliefs and finding them wanting is a motivator of analytic thinking. It is worth noting, however, that Shenhav and colleagues also reported experimental evidence for a short-term causal link between cognitive style and belief in God by demonstrating diminished God belief for participants who were primed to think analytically (and vice versa for those who were primed to think intuitively). Finding a short-term situational effect is intriguing in that it suggests that religious beliefs are, to some extent at least, reevaluated each time they are considered; a process consistent with an asymmetrical belief–unbelief hypothesis.

The application of the belief–unbelief asymmetry model to religious and paranormal beliefs extends previous work that focused on narratives about mundane facts and secular events (Gilbert et al., 1990; Gilbert et al., 1993) to religious and paranormal beliefs. The results are consistent with (though not direct evidence for) the hypothesis that supernatural belief is a default state and that a consequence of analytic reasoning styles is to undermine default beliefs. Thus, on this view, people are biased to believe in God, heaven, hell, angels, demons, souls, and other supernatural beliefs embedded in the culture when they first learn about those concepts but those disposed to analyze such concepts will be more likely to change their mind. Of course, further research is required to integrate supernatural belief with the belief–unbelief asymmetry model under an experimental design.

Given the hypothesis that supernatural belief is a default state that requires some level of analytic processing to override and given the generally accepted proposition that analytic reasoning is, on the whole, underutilized (Evans, 2008; Kahneman, 2003; Stanovich, 2009), the high levels of supernatural belief worldwide are unsurprising. Perhaps what, on this view, needs explaining is decreasing religiosity in many secular Western societies (e.g., Crockett & Voas, 2006; Kosmin & Keysar, 2009; Zuckerman, 2008). It is important to acknowledge that numerous social and cultural factors will condition the vulnerability of supernatural claims to analytic reasoning, including institutional and formal integration of specific supernatural beliefs into coherent master narratives accepted by the larger culture. Of course, the extent to which secularism and religious pluralism continue to increase and cause traditional religious master narratives to lose their hegemony, the integrative power and authority of such narratives will decrease, causing them to become more vulnerable to unbelief. We speculate, therefore, that the vulnerability of beliefs to being unbelieved via analytic processing will depend upon both the availability of contradictory beliefs and the integration of such contradictory beliefs into an authoritative formal system.

Future studies might therefore consider the different degrees of acceptance of alternative cultural master narra-

tives (religious versus secular-scientific) by individuals differing in analytic cognitive style. There are two interesting possibilities. More highly analytic individuals may simply be more sceptical of all epistemic claims independently of worldview. Alternatively, more highly analytic individuals may not only reject religious perspectives but may also be more attracted to a secular scientific worldview, given that such a worldview claims to invite critical analysis as an integral part of its “self-correcting” nature. In addition, future studies might also investigate the role of scientific beliefs themselves, which, *ex hypothesi*, would initially be believed for the same (rapid, automatic, and effortless processing) reasons as supernatural beliefs. The present model makes no predictions, for example, about whether highly analytic individuals will be more or less likely to initially believe new scientific factual claims, but predicts that an analytic thinking style should render individuals more likely to abandon disconfirmed scientific beliefs or new scientific facts at odds with prior facts and theory depending upon their prior probabilities.

Considered in light of research suggesting an important role for analytic thinking styles, the asymmetric belief-unbelief hypothesis may be quite general. If beliefs must first be accepted in order to be understood, as the available data suggests (Gilbert, 1991, 1993), the propensity to hold any set of empirically or logically vulnerable beliefs might potentially be predicted by the ability and willingness to think analytically. The present results clearly supported the hypothesis that individual differences in analytic cognitive style are useful for understanding selected cognitive aspects of supernatural belief in particular. Our data are consistent with the simple but, in our opinion, profound idea that two people who share the same cognitive ability, education, political ideology, sex, age and level of religious engagement may acquire very different sets of beliefs about the world if they differ in their propensity to think analytically.

Acknowledgement

Funding for this study was provided by the Natural Sciences and Engineering Research Council of Canada.

Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.cognition.2012.03.003>.

References

- Aarnio, K., & Lindeman, M. (2005). Paranormal beliefs, education, and thinking styles. *Personality and Individual Differences*, 39, 1227–1236.
- Aarnio, K., & Lindeman, M. (2007). Religious people and paranormal believers: Alike or Different. *Journal of Individual Differences*, 28, 1–9.
- Albrecht, S. L., & Heaton, T. B. (1984). Secularization, higher education, and religiosity. *Review of Religious Research*, 26, 43–58.
- Argyle, M., & Beit-Hallahmi, B. (1975). *The social psychology of religion*. London, UK: Routledge and Kegan Paul.
- Atran, S. (2002). *In gods we trust: The evolutionary landscape of religion*. Oxford: Oxford University press.
- Atran, S., & Norenzayan, A. (2004). Religion's evolutionary landscape: Counterintuition, commitment, compassion, communion. *Behavioural and Brain Sciences*, 27, 713–770.
- Bain, A. (1859). *The emotions and the will*. London: Longmans, Green.
- Barbey, A. K., & Sloman, S. A. (2007). Base-rate respect: From ecological rationality to dual processes. *Behavioural and Brain Sciences*, 30, 241–256.
- Barrett, J. L. (2000). Exploring the natural foundations of religion. *Trends in Cognitive Science*, 4, 29–34.
- Barrett, J. L. (2004). *Why would anyone believe in God?* Lanham, MD: Altamira.
- Batson, C. D., Schoenrade, P., & Ventis, W. L. (1993). *Religion and the individual: A social-psychological perspective*. New York, NY, US: Oxford University Press.
- Beit-Hallahmi, B. (2006). Atheists: A psychological profile. In M. Martin (Ed.), *The Cambridge companion to atheism*. New York: Cambridge University Press.
- Benson, P. L., Donahue, M. J., & Erickson, J. A. (1989). Adolescence and religion: A review of the literature from 1970–1986. *Research in the Social Scientific Study of Religion*, 1, 153–181.
- Bertsch, S., & Pesta, B. J. (2009). The Wonderlic Personnel Test and elementary cognitive tasks as predictors of religious sectarianism, scriptural acceptance, and religious questioning. *Intelligence*, 37, 231–237.
- Bouchard, T. J. Jr., (2009). Authoritarianism, religiousness, and conservatism: I “obedience to authority” the explanation for their clustering, universality and evolution? In E. Voland & W. Schiefelhöven (Eds.), *The biological evolution of religious mind and behaviour* (pp. 165–180). New York, NY: Springer.
- Boyer, P. (1994). *The naturalness of religious ideas: A cognitive theory of religion*. Berkeley, CA: University of California Press.
- Boyer, P. (2001). *Religion explained: The evolutionary origins of religious thought*. New York, NY: Basic Books.
- Caldwell-Harris, C. L., Wilson, A. L., LoTempio, E., & Beit-Hallahmi, B. (2010). Exploring the atheist personality: Well-being, awe, and magical thinking in atheists, Buddhists, and Christians. *Mental Health, Religion & Culture*, 7, 659–672.
- Caplovitz, D., & Sherrow, F. (1977). *The religious drop-outs: Apostasy among college students*. Beverly Hills, CA: Sage Press.
- Chapp, L. S. (2011). *The God of covenant and creation: Scientific naturalism and its challenge to the Christian faith*. London, UK: T&T Clark International.
- Cheyne, J. A. (2010). Recurrent isolated sleep paralysis. In M. Thorpy & G. Plazzi (Eds.), *Parasomnias and other movement-related sleep disorders*. Amsterdam: Elsevier.
- Cohen, P., Cohen, J., Aiken, L. S., & West, S. G. (1999). The problem of units and the circumstance for POMP. *Multivariate Behavioral Research*, 34, 315–346.
- Crockett, A., & Voas, D. (2006). Generations of decline: Religious change in 20th Century Britain. *Journal for the Scientific Study of Religion*, 45, 567–584.
- De Neys, W. (2006). Dual processing in reasoning – Two systems but one reasoner. *Psychological Science*, 17, 428–433.
- De Neys, W., & Glumicic, T. (2008). Conflict monitoring in dual process theories of thinking. *Cognition*, 106, 1284–1299.
- Epstein, S. (1994). Integration of the cognitive and psychodynamic unconscious. *American Psychologist*, 49, 709–724.
- Evans, J. B. T. (2008). Dual-processing accounts of reasoning, judgment, and social, cognition. *Annual Review of Psychology*, 59, 255–278.
- Frederick, S. (2005). Cognitive reflection and decision making. *The Journal of Economic Perspectives*, 19, 25–42.
- Frey, U. (2009). Cognitive Foundations of Religiosity. In: E., Voland & W. Schiefelhöven (Eds.), *The biological evolution of religious mind and behavior* (pp. 229–241). Heidelberg, DE: Springer.
- Gadamer, G. (1960). *Truth and method* (second, revised edition). (J. Weinsheimer & D. G. Marshall Trans.), New York, NY: Crossroad.
- Gallup (2011). US Political ideology stable with conservatives leading. August 1, <<http://www.gallup.com/poll/148745/political-ideology-stable-conservatives-leading.aspx>>.
- Gilbert, D. T. (1991). *How mental systems believe*. *American Psychologist*, 46, 107–119.
- Gilbert, D. T., Krull, D. S., & Mallone, P. S. (1990). Believing the unbelievable: Some problems in the rejection of false information. *Journal of Personality and Social Psychology*, 59, 601–613.
- Gilbert, D. T., Tafarodi, R. W., & Malone, P. S. (1993). You can't not believe everything you read. *Journal of Personality and Social Psychology*, 65, 221–233.
- Gilbert, D. T. (1993). The assent of man: The mental representation and control of belief. In D. M. Wegner & J. W. Pennebaker (Eds.), *Handbook of mental control* (pp. 57–87). Englewood Cliffs, NJ: Prentice Hall.

- Grupp, F. W., Jr., & Newman, W. M. (1973). Political ideology and religious preference: The John Birch Society and Americans for democratic action. *Journal for the Scientific Study of Religion*, 12, 401–413.
- Guthrie, S. E. (1993). *Faces in the clouds: A new theory of religion*. Oxford: Oxford University Press.
- Huang, M. H., & Hauser, R. M. (1998). Trends in Black–White test score differentials: II the WORDSUM vocabulary test. In U. Neisser (Ed.), *The rising curve: Long-term gains in IQ and related measures* (pp. 303–332). Washington, DC: American Psychological Association.
- Hunsberger, B. E., & Altemeyer, B. (2006). *Atheists: A groundbreaking study of America's nonbelievers*. Amherst, NY: Prometheus Books.
- Hunsberger, B. E., & Brown, L. B. (2001). Religious socialization, apostasy and the impact of family background. *Journal for the Scientific Study of Religion*, 23, 239–251.
- International Social Survey Program (ISSP), 1991, 1993, <<http://www.Chass.utoronto.ca/datalib/major/issp.htm>>.
- Kahneman, D. (2003). A perspective on judgment and choice: Mapping bounded rationality. *American Psychologist*, 58, 697–720.
- Keysar, A. (2007). Who are America's atheists and agnostics? In B. Kosmin & A. Keysar (Eds.), *Secularism and secularity: Contemporary international perspectives* (pp. 33–39). Hartford, CT: Institute for the Study of Secularism in Society and Culture.
- Kosmin, B. (2008). A religious, irreligious and anti-religious Americans: The no religion population of the US – Nones. <<http://www.trincoll.edu/secularisminstitute/>> (23.06.09).
- Kosmin, B. A. & Keysar, A. (2009). ARIS 2008. American religious identification survey. Summary report, March. <<http://commons.trincoll.edu/aris/publications/aris-2008-summary-report/>>.
- Larson, E. J., & Witham, L. (1998). Leading scientists still reject god. *Nature*, 394, 313.
- Lawson, E. T. (2000). Towards a cognitive science of religion. *Numen*, 47, 338–349.
- Lewis, G. J., Ritchie, S. J., & Bates, T. C. (2011). The relationship between intelligence and multiple domains of religious belief: Evidence from a large adult US sample. *Intelligence*, 39, 468–472.
- Lindeman, M., & Aarnio, K. (2006). Paranormal beliefs: Their dimensionality and correlates. *European Journal of Personality*, 20, 585–602.
- Lindeman, M., & Aarnio, K. (2007). Superstitious, magical, and paranormal beliefs: An integrative model. *Journal of Research in Personality*, 41, 731–744.
- Lynn, R., Harvey, J., & Nyborg, H. (2009). Average intelligence predicts religiosity across 137 countries. *Intelligence*, 37, 11–15.
- McFarland, M. J., Wright, B. R. E., & Weakliem, D. L. (2011). Educational attainment and religiosity: Exploring variation by religious tradition. *Sociology of Religion*, 72, 166–188.
- Morewedge, C. K., & Kahneman, D. (2010). Associative processes in intuitive judgment. *Trends in Cognitive Sciences*, 14, 435–440.
- National Science Foundation (2002). Science and engineering: Indicators 2002. Science and technology: Public attitudes and public understanding. Science fiction and pseudoscience. <<http://www.nsf.gov/sbe/srs/seind02/c7/c7s5.htm>>.
- Norenzayan, A., Atran, S., Faulkner, J., & Schaller, M. (2006). Memory and mystery: The cultural selection of minimally counterintuitive narratives. *Cognitive Science*, 30, 531–553.
- Pacini, R., & Epstein, S. (1999). The relation of rational and experiential information processing styles to personality, basic beliefs, and the ratio-bias phenomenon. *Journal of Personality and Social Psychology*, 76, 972–987.
- Petersen, L. R. (1994). Education, homogeneity, and religious commitment. *Journal for the Scientific Study of Religion*, 33, 122–134.
- Pyysiäinen, I. (2001). *How religion works*. Boston, MA: Brill.
- Pyysiäinen, I., & Anttonen, V. (Eds.). (2002). *Current approaches in the cognitive science of religion*. London, UK: Continuum.
- Reeve, C. L. (2009). Expanding the g-nexus: further evidence regarding the relations among national IQ, religiosity, and national health outcomes. *Intelligence*, 37, 495–505.
- Rice, Tom. (2003). Believe it or not: Religious and other paranormal beliefs in the United States. *Journal for the Scientific Study of Religion*, 42, 95–106.
- Shenhav, A., Rand, D. G., & Greene, J. D. (2011). Divine intuition: Cognitive style influences belief in god. *Journal of Experimental Psychology: General*. doi: 10.1037/a0025391.
- Slooman, S. A. (1996). The empirical case for two systems of reasoning. *Psychological Bulletin*, 119, 3–22.
- Smith, M. D., Foster, C. L., & Stovinn, G. (1998). Intelligence and paranormal belief: Examining the role of context. *Journal of Parapsychology*, 62, 65–77.
- Spinoza, B. (1982). The ethics and selected letters (S. Feldman Ed.; S. Shirley, Trans.) Indianapolis, IN: Hackett (Originally published in 1677).
- Stanovich, K. E. (2004). *The Robot's rebellion: Finding meaning in the age of Darwin*. Chicago: The University of Chicago Press.
- Stanovich, K. E. (2009). Is it time for a tri-process theory? Distinguishing the reflective and algorithmic mind. In J. St. B. T. Evans & K. Frankish (Eds.), *In two minds: Dual processes and beyond* (pp. 55–88). Oxford, UK: Oxford University Press.
- Stanovich, K. E., & West, R. F. (2000). Individual differences in reasoning: Implications for the rationality debate. *Behavioral and Brain Sciences*, 23, 645–726.
- 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.
- Stark, S., & Bainbridge, W. S. (1985). *The future of religions: Secularization, revival, and cult formation*. Berkeley and Los Angeles, CA: University of California Press.
- Thompson, V. A., Prowse Turner, J., & Pennycook, G. (2011). Intuition, reason and metacognition. *Cognitive Psychology*, 63, 107–140.
- Tobacyk, J. J. (1988). A revised paranormal belief scale. Unpublished manuscript, Louisiana Tech University.
- Tobacyk, J. J., & Milford, G. (1983). Belief in paranormal phenomena: Assessment instrument development and implications for personality functioning. *Journal of Personality and Social Psychology*, 44, 1029–1037.
- Toplak, M. V., West, R. F., & Stanovich, K. E. (2011). The Cognitive Reflection Test as a predictor of performance on heuristics-and-biases tasks. *Memory & Cognition*, 39, 1275–1289.
- Zelan, J. (1968). Religious apostasy, higher education, and occupational choice. *Sociology of Education*, 41, 370–379.
- Zuckerman, P. (2008). *Society without god: What the least religious nations can tell us about contentment*. New York: New York University Press.
- Zuckerman, P. (2007). Atheism: contemporary numbers and patterns. In M. Martin (Ed.), *The Cambridge companion to atheism*. Cambridge: Cambridge University Press.