



# The Wonderlic Personnel Test and elementary cognitive tasks as predictors of religious sectarianism, scriptural acceptance and religious questioning<sup>☆</sup>

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## ABSTRACT

Lynn, Harvey and Nyborg [Lynn, R., Harvey, J., & Nyborg, H. (in press). Average intelligence predicts atheism rates across 137 nations. *Doi:10.1016/j.intell.2008.03.004*.] discovered that average intelligence (IQ) co-varies with national atheism rates. Extending this work, we investigated relationships among individual IQ scores, elementary cognitive task (ECT) performance, and three types of religious beliefs. Sectarianism (believing one's religion is the only path to God) correlated negatively with IQ and ECT. Considerable mean differences also existed on this factor between the highest and lowest IQ ( $d = .69$ ) and ECT ( $d = .73$ ) quartiles. Scriptural acceptance (believing one's scripture is literally true), however, correlated only nominally with IQ and ECT. Religious questioning (one's willingness to question religious convictions) correlated positively with ECT, and consistent differences existed on this factor between the highest and lowest scoring IQ ( $d = .38$ ) and ECT ( $d = .55$ ) quartiles. Only ECT explained unique variance in religious beliefs, as controlling for it attenuated the effects of IQ. Possible theoretical explanations for these effects are discussed.

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## 1. Introduction

In 1928, Howells and Sinclair independently published findings showing a negative relationship between measures of religiosity and intelligence (IQ) test scores. Since then, others have replicated these results with a variety of measures (see Francis, 1998; Lynn, Harvey, & Nyborg, in press, for reviews). As markers of religiosity, researchers have used (among other things): preference for conservative Christian beliefs (Symington, 1935), attitudes toward organized religion (Young, Dustin, & Holtzman, 1966), church attendance (Bender, 1968), and national atheism rates (Lynn et al., in press). Measures of intellectual ability have included: the Primary Mental Abilities test (Turner, 1980),

grade point average (Young et al., 1966), membership in Mensa (Southern & Plant, 1968), the Peabody Picture Vocabulary Test (Kanazawa, in press, as cited in Lynn et al., in press), and the Armed Services Vocational Aptitude Battery (Lynn et al., in press).

Despite differences in measures used, research in this area generally paints a consistent picture. On average, people who rate themselves as “not religious at all” have higher IQs than those who hold stronger religious beliefs (Kanazawa, in press). Those with more traditional religious beliefs score lower on IQ tests than do those with less strict beliefs (Franzblau, 1934; Verhage, 1964). Similarly, positive attitudes toward organized religion have been associated with lower grade point averages (Young et al., 1966), while those who disbelieve in a God tend to have higher IQs (Lynn et al., in press).

Explanations for why IQ scores predict religious belief often focus on the perceived incompatibility of the unquestioning acceptance of divine influence central to most religions, and the desire for naturalistic explanations which epitomize scientific and skeptical thinking (see, e.g., Dawkins,

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2006). Further, the ability to think skeptically and critically presumably overlaps with whatever IQ tests measure (Lynn et al., *in press*). Several studies find that fewer members of scientific societies believe in the existence of a God compared with the general population. Larsen and Witham (1998), for example, report that belief in a God is vastly under-represented among members of the American National Academy of Science (only 7% report theistic beliefs). Similarly, developmental studies show a decrease in religious commitment as children mature and their abstract reasoning skills improve (see, e.g., Turner, 1980). This decrease is seen particularly during adolescence, as students are exposed to more intensive, science-based curricula.

The size of the relationship between IQ scores and religious beliefs is relatively small (correlations range in the mid .20s to mid .30s, depending on the measures used), and the direction of causality is unknown. Possibly, increased exposure to skeptical thinking and the method of scientific discovery reduces the strength with which irreconcilable religious beliefs can be maintained, resulting in somewhat better performance on IQ tests. Alternatively, people who are less able to acquire the capacity for critical thought may rely more heavily on comfortable belief systems that provide uncontested (and uncontested) answers.

We posit here that differences in intelligence should co-vary with the degree of fundamentalism people express about their religious beliefs. Specifically, we suspect that people with more dogmatic, literal beliefs about the truth of their religion will average lower IQ scores than those with more open and non-literal beliefs. We do not expect large differences, but finding that IQ explains some of the variance in how literally people view their religion would be notable, and consistent with recent research in this area (e.g., Lynn et al., *in press*). Moreover, we do not expect the relationship to be linear across the range of IQ. Although clearer differences should exist between those in the lowest and highest scoring IQ groups, the link between religious beliefs and intelligence is likely not strong enough to be additive across all ranges of IQ. This hypothesis was tested by grouping students into quartiles based on their level of general mental ability. We predicted reliable differences in religious beliefs at the lower and higher ends of general mental ability, with weak to no differences in between.

A second goal of our study was to explore whether measures of basic information processing ability (e.g., reaction time) co-vary with religious beliefs. Information processing ability may be key to the development of other forms of intelligence, like crystallized knowledge, or the capacity for abstract reasoning and critical thinking (see Jensen, 2006, p. 176). For example, Kranzler and Jensen (1989; see also Vernon, 1989) reported significant correlations between information processing ability and scores on the Raven's Progressive Matrices. Verguts, De Boeck, and Maris (2000) later replicated this result, and showed that faster participants were able to generate and test more solution rules on a problem by problem basis, which then led to higher overall matrices scores. Similarly, Arend et al. (2002) found that measures of information processing ability accurately predicted subject performance on a deductive reasoning task. Hence, we were interested in whether information processing ability—in addition to global IQ scores—would predict aspects of religious belief like fundamentalism.

We measured information processing ability via subject performance on Elementary Cognitive Tasks (ECTs). ECTs represent a range of tasks where subjects perform trivially easy cognitive acts (like judging line lengths, or selecting letters). In general, ECTs require people to evaluate and react to simple visual stimuli, but presumably they index the speed and efficiency with which the nervous system processes information (Jensen, 1998, 2006). A large literature shows that ECT performance correlates about .50 with scores on standardized IQ tests (see Jensen, 1998; 2006; Sheppard & Vernon, 2008, for reviews).

We used three ECTs in the present study: inspection time (IT), reaction time (RT) and over-claiming (OC). In the IT task, participants see two rapidly-presented (vertical) lines presented on a computer screen. One line, selected randomly, appears longer than the other. The task is simply to pick the longer line on every trial. Responses are not timed; instead, accuracy is tracked as a function of the display duration for the lines. Lower IT scores indicate better performance (i.e., the person still maintains high levels of accuracy, even when the two lines appear very briefly). Nonetheless, scores on the IT task correlate around .50 with standardized IQ tests, once corrected for attenuation (for meta-analytic reviews, see Grudnik & Kranzler, 2001; Kranzler & Jensen, 1989).

RT-based elementary cognitive tasks come in many varieties (see, e.g., Jensen, 2006; Sheppard & Vernon, 2008). Here, we used a choice-RT task where on every trial subjects rapidly selected the position of a target letter (i.e., the letter "A") in a display containing both the target and distractor letters (i.e., the letter "S"). This RT task contributes two measures to analysis: the average (median) time it takes the participant to respond over all trials, and the average variability (standard deviation) in response speed across trials. As with IT, scores on RT tasks correlate moderately well with IQ (Jensen, 2006). Reaction time, however, is a complex construct, and different measures of RT correlate more or less with intelligence (see Sheppard & Vernon, 2008, for a review).

The third ECT employed here is the over-claiming task (Paulhus & Harms, 2004). This task measures corrected familiarity with general world knowledge items. Participants see the name of a famous person, scientific term, or other concept, and then merely rate how familiar they are with the concept using a Likert scale. On some trials, the presented concept is fictitious. Signal detection analysis is then used to separate the person's true familiarity from his/her tendency to over-claim (i.e., to claim familiarity with concepts that do not exist). Corrected familiarity in the over-claiming task also correlates moderately well with scores on standardized IQ tests (Paulhus & Harms, 2004; see Williams, Paulhus, & Nathanson, 2002, for evidence that familiarity in the over-claiming task is an automatic process).

In sum, we had college students complete the Wonderlic Personnel Test (WPT), and three elementary cognitive tasks. Participants then responded to various surveys—pre-existing in the literature—measuring several aspects of religious belief. Specifically, we measured the degree to which people (1) believe their particular religion is the one favored by God (sectarianism), (2) accept their religion's

scripture as the true word of God (scriptural acceptance), and (3) question their own religious convictions (religious questioning). We predict:

**Hypothesis 1.** Scores on the WPT will correlate inversely with the degree to which participants endorse sectarianism and scriptural acceptance beliefs, and directly with the degree to which they endorse religious questioning.

**Hypothesis 2.** Scores on the ECTs will correlate inversely with measures of sectarianism and scriptural acceptance and directly with measures of religious questioning.

**Hypothesis 3.** Differences in religious beliefs will be most pronounced at the extreme ends of the IQ and ECT distributions sampled here.

Finally, we tested the incremental validity of WPT, controlling for ECT, and then ECT, controlling for IQ. We were interested in whether global (i.e., IQ) or basic (i.e., ECTs) measures of intelligence would best predict religious attitudes.

## 2. Method

### 2.1. Participants and materials

The participants were 278 undergraduates, completing the project for extra course credit. These included 116 (42%) males and 162 females (58%) with a mean age of 22.4 (SD = 6.12) years. By race, the sample comprised 226 (81%) White students; 24 (9%) Black students; 13 (5%) Asian students; 6 (2%) Hispanic students, and 9 (3%) who reported their race as “other”. In the sample, 83% identified themselves as belonging to a Christian religion. Finally, the verified mean grade point average (GPA) for our participants was 2.91 (SD = 0.72).

We used the Wonderlic Personnel Test (WPT; Form IV, [Wonderlic & Associates, 2002](#)) as a standardized measure of intelligence. The WPT is a 12-minute, paper-and-pencil exam with a population mean of 22 and a population standard deviation of 7. Test–retest reliabilities for the WPT range from .82 to .94 ([Geisinger, 2001](#)). [Dodrill and Warner \(1988\)](#) report a .91 correlation between the WPT and scores on the Wechsler Adult Intelligence Scale Revised. Students completed the ECTs on standard desktop computers using Cathode Ray Tube monitors, with display resolutions of 800 × 680 pixels, and refresh rates of 75 hertz.

Religious belief surveys were selected from among those existing in the literature. Factor analysis produced three independent factors accounting for 44% of the variance: Sectarianism (i.e., how strongly people believe theirs is the “true” religion favored by God; items were a subset of [Altemeyer & Hunsberger's, 1992](#), religious fundamentalism scale), Scriptural Acceptance (i.e., how likely people are to believe their religions' scriptural teachings are true; items were a sub-set of [Hogge and Friedman's, 1967](#), Scriptural Literalism Scale), and Religious Questioning (i.e., how rigid people's belief systems are; items were a sub-set of [Darley & Batson's, 1973](#), Quest concept created by [McFarland in 1989](#)). The Appendix presents the items, loadings and the scale reliabilities resulting from the factor analysis. We used regression to create scores on the three factors for each participant.

### 2.2. Procedure

We ran participants in small groups by first administering the 12-minute version of the WPT. Thereafter, participants completed the ECTs and then the religious surveys on desktop computers. The IT task stimulus timing and display features were those used by [Luciano, Leisser, Wright, & Martin \(2004\)](#). Briefly, a fixation cross appeared centered on the computer monitor, followed by the line stimulus, and then a lightning bolt mask. The duration of the line stimulus varied from trial to trial based on the subject's accuracy (see, e.g., [Luciano et al., 2004](#)). We operationalized IT as the mean line duration for each subject across 95 trials (with all subjects first performing three practice trials). Subjects were told to take as much time as they needed for the IT task, and to focus only on responding correctly.

For the RT task, subjects first saw a fixation cross (for 1 s) followed by a display containing three letters (always two “Ss” and one “A”) centered on the screen. The display remained on the screen until response. Subjects had to rapidly and accurately indicate the position in which the target letter (“A”) appeared using the number pad on the computer keyboard. Unlike the IT task, here participants were told that speed of response was important, and that they should respond as fast as possible while also maintaining high accuracy. Subjects completed 6 practice trials followed by 60 experimental trials. We calculated both median RTs and the standard deviation of RT (within persons, across trials) for each participant after first excluding any error trials.

A trial in the over-claiming task started by displaying a concept (e.g., “The Waste Land”), followed by a Likert scale. Students used the number pad to rate how familiar they were with the concept on a 1 (“I've never heard of it”) to 5 (“I am very familiar with it”) scale. Some of the concepts presented to students were fictitious (e.g., “Biosexual”). Having students rate both real and fictitious items allowed us to calculate corrected familiarity scores for each participant. Specifically, we measured (1) mean confidence ratings for real and not-real items. (2) The proportion of real items (out of 60) the subject claimed to be familiar with (indicated by ratings > 1.0 for each concept). This value is the *hit* rate. (3) The proportion of not-real items (out of 30) the subject incorrectly claimed were familiar. This value is the *false alarm* rate.

Using hit and false alarm rates, we next calculated *sensitivity* (represented by the symbol  $d'$ ), which is equal to the hit rate minus the false alarm rate for each subject. Sensitivity offers a measure of familiarity corrected for any tendency to over-claim. Research on the over-claiming task shows that sensitivity correlates about .50 with paper and pencil IQ tests ([Paulhus & Harms, 2004](#)). Next, we calculated a *criterion* measure (represented by the Greek letter  $\beta$ ), which is equal to the hit rate plus the false alarm rate for each subject. Criterion measures capture individual differences in how willing people are to claim they know a concept, when familiarity with that concept is not strong. For example, some may require only weak familiarity with a concept before claiming they know it (i.e., a liberal criterion,  $\beta > 1.0$ ); whereas, others may require very strong familiarity before making the same claim (i.e., a conservative criterion,  $\beta < 1.0$ ). Typically,  $\beta$  is only weakly correlated with IQ (see, e.g.,

Paulhus & Harms, 2004), perhaps because it reflects personality factors more than cognitive ability. Finally we calculated an *adjusted confidence* level by subtracting the confidence ratings for the not-real items from the ratings to real items.

In order to summarize the variance captured the three ECTs, hierarchical principal axis factor analysis was used to create a single factor score based on these measures (Jensen, 1998). The initial analysis using an oblique rotation indicated two correlated factors were present. These accounted for 63% of the total variance in the ECT variables. The first factor was comprised of the OC sensitivity and adjusted confidence scores, and the second factor represented the speeded measures of median RT, the average variation in RT, and the average IT scores. Regression-based factor scores were created for each factor, which were then submitted to a second analysis. This produced a single factor (ECT), representing the shared variance among all ECT variables, such that higher scores represented faster RTs, shorter display times needed for accurate IT performance, more accurate discrimination of real OC items from not-real ones, and higher confidence levels.

Participants then completed the religious surveys. Each item appeared centered on the computer screen, and subjects indicated the degree to which they agreed with the item, using a six-point Likert scale from 1 (strongly disagree) to 6 (strongly agree). The Likert scale also appeared on screen for every item.

### 3. Results

We used an alpha level of .05 to evaluate the results of all significance tests. Table 1 shows descriptive statistics and zero-order correlations for the variables of interest. The WPT correlated significantly with sectarianism ( $r = -.24$ ), but not with scriptural acceptance ( $r = -.10$ ) nor religious questioning ( $r = .10$ ). Additionally, the ECT factor scores correlated significantly with sectarianism ( $r = -.31$ ) and religious questioning ( $r = .20$ ), but not with scriptural acceptance ( $r = -.06$ ). The simple correlations offer only moderate support for Hypotheses 1 and 2. While in the predicted direction, only half the correlations emerged as significant. Namely, higher IQ and ECT performance were associated with less belief in the sole truth of one's religion. Higher ECT

performers were also more likely to question their religious beliefs.

Our use of a college-student sample, however, resulted in a somewhat restricted range of scores on the WPT. The population standard deviation for this test is 7.0; whereas, we observed a sample standard deviation of 5.0 (see Table 1). We thus corrected the correlations between the WPT and the religion factor scores for range restriction. The resulting WPT correlations were  $-.33$ ,  $-.14$ , and  $.14$ , for sectarianism, scriptural acceptance, and religious questioning, respectively. Even after correction, the correlations offer only partial support for Hypotheses 1 and 2.

Also of note in Table 1 is that (1) the correlation between the WPT and ECT factor scores was moderately high ( $r = .58$ ), (2) among the religious belief factors, only sectarianism and scriptural acceptance were significantly correlated ( $r = .12$ ), (3) aggregating ECT scores produced better validity than that for any single ECT measure (see, e.g., Jensen, 2006), and (4) the over-claiming task criterion measure predicted scriptural acceptance ( $r = -.19$ ), such that people with liberal response biases scored lower on the scale (i.e., were less likely to believe that scripture represented God's will). This latter result was unexpected.

To test Hypotheses 3, we split WPT scores into quartiles of approximately equal  $n$ -sizes. Table 2 displays descriptive statistics for the religious belief factors as a function of IQ and ECT quartile. A multivariate ANOVA on IQ revealed significant differences among the sectarianism ( $F(3, 274) = 6.22$ ,  $p < .001$ ) and religious questioning ( $F(3, 274) = 4.12$ ,  $p < .01$ ) factors (scriptural acceptance was marginal at  $p = .08$ ). For sectarianism, post hoc tests (Tukey's Least Significant Difference, LSD) indicated that the lowest IQ quartile had the highest sectarianism scores (all  $ps < .01$ ). In fact, this group was the only to average positive scores on the sectarianism factor; all other groups showed negative factor-score means. The lowest IQ quartile, therefore, differed considerably from the rest of the sample, and were most likely to believe in the favored status of their own religion. The effect size (Cohen's  $d$ ) for the extreme group comparison (i.e., first and fourth IQ quartiles) on sectarianism was  $d = .69$ .

Post hoc tests for religious questioning showed that the highest IQ quartile was more likely to question their religious

**Table 1**  
Descriptive statistics and simple correlations for the study variables.

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Wonderlic IQ	23.34	5.00	–														
2 Sectarianism	0.00	0.89	-.24	–													
3 Scriptural acceptance	0.00	0.88	-.10	.12	–												
4 Religious questioning	0.00	0.90	.10	-.06	-.02	–											
5 RT median	455.71	55.62	-.20	.14	.02	-.10	–										
6 RT standard deviation	72.23	19.27	-.22	.17	.07	-.06	.34	–									
7 Inspection time	112.63	76.60	-.23	.07	.05	-.04	.16	.16	–								
8 Mean real	2.93	0.60	.43	-.10	-.21	.13	-.08	-.13	-.16	–							
9 Mean not-real	1.67	0.54	-.16	.20	-.19	-.07	.06	.06	.06	.45	–						
10 Real/not difference	1.26	0.60	.58	-.28	-.04	.19	-.13	-.18	-.21	.60	-.47	–					
11 Proportion of hits	0.63	0.18	.28	.00	-.19	.07	-.10	-.11	-.11	.83	.59	.30	–				
12 Proportion of false alarms	0.35	0.26	-.10	.17	-.17	-.09	-.05	-.04	.01	.41	.88	-.38	.70	–			
13 Sensitivity ( $d'$ )	0.28	0.19	.40	-.24	.05	.20	-.02	-.05	-.12	.21	-.67	.81	-.03	-.74	–		
14 Criterion ( $\beta$ )	0.98	0.41	.06	.11	-.19	-.03	-.08	-.07	-.04	.62	.83	-.12	.89	.95	-.49	–	
15 ECT factor score	0.00	0.73	.58	-.31	-.06	.20	-.51	-.54	-.34	.53	-.38	.87	.29	-.27	.66	-.05	–

Notes:  $N = 278$ . Correlations of .12 or greater are significant ( $p < .05$ ).

beliefs compared with the first and second (but not third) IQ quartile groups. Hence, those with the highest 25% of IQ scores were more likely to anticipate questioning their religious beliefs relative to the bottom 50% of IQ scores in our sample. Cohen's *d* for the lowest and highest IQ quartiles was .38 on religious questioning.

As a further test of Hypothesis 3, we used sectarianism to predict classification of the sample into the four IQ quartiles via logistic regression. This analysis resulted in a significant amount of (pseudo) variance accounted for (19%;  $\chi^2(4, N=278) = 20.45, p < .001$ ). The use of sectarianism scores successfully classified 65% of the cases in each of the two lowest IQ groups, 43% in the third IQ quartile, and 75% in the highest IQ group. The model could not be improved by the addition of any other variables. The same analysis using religious questioning was only marginally significant ( $p = .06$ ), and correctly categorized 52% of the lowest IQ quartile scores, 64% of the second, 47% of the third and 65% of the fourth.

Table 2 also presents mean religious factor scores by ECT quartiles (higher ECT scores indicate better performance). A multivariate ANOVA revealed significant differences on all factors: sectarianism ( $F(3, 274) = 7.91, p < .001$ ), scriptural acceptance ( $F(3, 274) = 3.06, p = .03$ ), and religious questioning ( $F(3, 274) = 9.03, p > .001$ ). For sectarianism, the mean factor scores decreased monotonically from the lowest to the highest scoring ECT quartiles. Post hoc tests showed significant differences for all comparisons, except that Q3 ( $M = -.17$ ) differed from neither Q2 ( $M = .03$ ) nor Q4 ( $M = -.30$ ). Hence, people who did better on the ECT tasks were generally less likely to profess the special nature of their religion. Cohen's *d* for the extreme group comparison was .73.

For scriptural acceptance, the mean differences were not monotonic across ECT quartiles, as the second ECT quartile scored highest on this factor. Nonetheless, only the best-performing ECT quartile produced negative acceptance scores, and this group differed significantly from the second and third (but not first) ECT quartiles. The highest scoring ECT group, therefore, scored lower on scriptural acceptance than did most (but not all) of the remaining ECT groups. Turning to religious questioning, only the best-performing ECT group

**Table 2**

Mean and standard deviation sectarianism, scriptural acceptance and religious questioning factor scores by IQ and ECT quartiles

	IQ quartile			
	First	Second	Third	Fourth
IQ range	≤ 19	20–23	24–26	> 26
Sample size	63	74	73	78
Sectarianism	.42 <sup>a</sup> (.93)	-.10 <sup>b</sup> (.85)	-.12 <sup>b</sup> (.83)	-.20 <sup>b</sup> (.87)
Scriptural acceptance	.08 <sup>ab</sup> (.76)	.03 <sup>ab</sup> (.85)	.13 <sup>a</sup> (.91)	-.22 <sup>b</sup> (.97)
Religious questioning	-.09 <sup>a</sup> (.93)	-.22 <sup>a</sup> (.82)	.04 <sup>ab</sup> (.84)	.27 <sup>b</sup> (.96)
	ECT quartile			
ECT range	≤ -.42	-.43–.08	.08–.46	> .46
Sample size	70	68	70	70
Sectarianism	.40 <sup>a</sup> (1.1)	.03 <sup>b</sup> (.67)	-.17 <sup>bc</sup> (.85)	-.30 <sup>c</sup> (.82)
Scriptural acceptance	.02 <sup>ab</sup> (.86)	.18 <sup>b</sup> (.78)	.07 <sup>b</sup> (.94)	-.24 <sup>ac</sup> (.91)
Religious questioning	-.08 <sup>a</sup> (.97)	-.21 <sup>a</sup> (.87)	-.15 <sup>a</sup> (.79)	.42 <sup>b</sup> (.84)

Notes. Standard deviations are in parentheses. For the factor scores, means not sharing superscripts are significant via Tukey's least significant differences.

**Table 3**

Incremental validity of IQ and ECT as predictors of sectarianism and religious questioning

	Sectarianism			Religious questioning		
	$\beta$	<i>t</i> -value	<i>r</i> <sup>2</sup>	$\beta$	<i>t</i> -value	<i>r</i> <sup>2</sup>
IQ alone	-.238	-4.07*	.06	.104	1.74	.01
ECT alone	-.311	-5.43*	.10	.198	3.35*	.04
IQ and ECT Combined			.10			.04
IQ	-.087	-1.24	-	-.016	-0.23	-
ECT	-.260	-3.71*	-	.207	2.85*	-

\*  $p < .05$ .

produced positive mean scores—all other quartiles produced negative factor score values, indicating they were less likely to question their religious beliefs. The effect size for Q1 versus Q4 on religious questioning was .55.

Using logistic regression to predict ECT quartile membership from sectarianism scores resulted in a significant amount of (pseudo) variance accounted for (14%;  $\chi^2(4, N=278) = 15.43, p < .001$ ). Classification of scores into ECT quartiles was accurate for 74% of the cases in the lowest quartile, 64% in the second lowest, 59% in the third and 60% of cases in the highest ECT group. Using religious questioning scores also resulted in a significant amount of (pseudo) variance accounted for (11%;  $\chi^2(4, N=278) = 11.44, p = .001$ ). Classification accuracy was 64% in the lowest quartile, 23% in the second, 70% in the third and 63% in the highest quartile.

Summarizing the Table 2 data, two of three religious factors (sectarianism and religious questioning) showed clear differences at the extreme ends of both IQ and ECT. The Highest IQ and ECT performers were less confident that their religion was the one true path to God, and were more likely to question their religious beliefs, compared with the sample's lowest IQ and ECT performers. Results for scriptural acceptance were less clear, as differences were not monotonic across the IQ and ECT quartile groups.

In a final set of analyses, we used linear regression to test the incremental validity of the WPT in predicting sectarianism and religious questioning scores over measures of information processing ability (and vice versa; see Table 3). The variance shared by WPT scores and sectarianism was 5.8%, while the overlap between ECT and sectarianism scores was 9.6%. However, when entered simultaneously into a regression equation, WPT predicted no significant unique variance in sectarianism scores beyond that predicted by ECT. The same pattern was seen for religious questioning, with more variance shared with ECT (4%) than with WPT (1%). The latter again contributed no unique variance to predicting religious questioning differences over ECT, whereas ECT remained significant even when controlling for WPT. Thus, the covariance between IQ and religious beliefs (at least for sectarianism and religious questioning) was statistically explained by individual differences on the ECTs.

#### 4. Discussion

We examined the relationship between religious beliefs and cognitive ability. Specifically, we identified three aspects of religious belief via factor analysis. These included the degree to which people (1) believe their particular religion is

the one favored by God (sectarianism), (2) accept their religion's scripture as the true word of God (scriptural acceptance), and (3) question their own religious convictions (religious questioning). Cognitive ability was measured both with a conventional IQ test, and with student performance on ECTs. We found weak but reliable correlations between IQ/ECT scores and two of the three religious factors (i.e., sectarianism and religious questioning). Further, as predicted, the differences were most pronounced at the extreme ends of the IQ and ECT distributions, with effect sizes ranging from .38 to .73. Finally, we discovered that ECT performance explained unique variance in religious beliefs, and completely attenuated the predictive validity of the WPT for both sectarianism and religious questioning.

Tying results in with prior research, our measure of sectarianism was most similar to other measures of religiosity used in the literature (as reviewed by Beckwith, 1986). The test of our first hypothesis replicated prior research, showing a small, negative correlation between sectarianism and IQ. In general, participants with lower IQ more strongly endorsed the idea that their religion was the one favored by God, and therefore, the only way to live a meaningful life. This was especially true when comparing the lowest IQ quartile here to the top IQ quartile.

Our second hypothesis examined more specifically how one component of IQ (information processing ability) relates to the type and/or strength of religious belief. Using ECTs to measure information processing ability, we found a stronger pattern of results with religious belief relative to using IQ as the predictor. Participants with slower response/inspection times, and those who were less able to discriminate real from not real facts, endorsed stronger sectarian beliefs. These participants were also less likely to consider any changes occurring in their religious convictions over time. Thus, significant relationships exist between two of our religiosity measures and individual differences in information processing ability.

Theoretically, information processing ability may reflect the efficiency of neural processing, and therefore may be a building block for the development of more complex cognition and rational thought (see, e.g., Jensen, 2006). This hypothesis would account for the reliable relationships found here between ECT performance and the religion factors. Also in line with this conclusion is the finding that only ECT explained unique variance in religious beliefs. Controlling for ECT attenuated the relationship between IQ and both sectarianism and religious questioning. Differences in religious beliefs may therefore be more related to differences in basic information processing ability than to differences in global IQ scores. Further, while sectarianism and religious questioning do not share large amounts of variance with ECT (i.e., only about 10%), the discovery that judging line lengths, rapidly selecting target letters, and rating familiarity with general world knowledge concepts predicts religious belief is theoretically interesting. Future research might test whether ECTs can attenuate the relationship between global IQ and other measures of religious belief (e.g., atheism rates).

Our third hypothesis was that differences in religious beliefs would be strongest at the extreme ends of the intelligence and information processing spectrums. We found a consistent pattern of results across both measures

of cognitive ability. The lowest performing IQ and ECT groups scored significantly higher in sectarianism, but significantly lower in religious questioning, relative to the highest performing groups. Differences for the middle two quartiles were weaker and less reliable than those found at the extremes. The same pattern held in the logistic regression, where classifying participants using sectarianism scores was most successful for the lowest (65%) and highest (75%) IQ quartiles.

Limitations to the present study include the use of a predominantly Christian sample. We did not have enough non-Christian participants to see whether IQ and ECT performance predicts which religion one belongs to. Also, our sample of college students produced a restricted range on the WPT. The correlations in Table 1 therefore are likely underestimates of true values. Finally, the RT and IT task, separately, produced very weak correlations with our criteria in most cases. This is perhaps a reliability issue. Future research in this area should follow Jensen's (2006) recommendations of using a large battery of ECTs, each containing a sufficient number of trials, to maximize reliability. Even still, the predictive validity of ECTs will likely stem from their aggregation, as any single ECT possesses too much specificity to correlate very strongly with a criterion (see, e.g., Jensen, 2006).

At a practical level, important social issues are often decided as much by religious beliefs as by reason. Examples include whether to ban gay marriage and stem cell research, or whether creationism should be taught alongside evolution by natural selection in science classes. Discovering a negative relationship between measures of general mental ability and literalist religious beliefs could partially influence the amount of weight given to arguments generated by faith- versus reason-based criteria.

## Appendix A

Religious survey scale items, factor loadings, and reliabilities.

Item	Factor loading		
	1	2	3
1. To lead the best, most meaningful life, you must belong to the one true religion.	.63		
2. Of all the people on earth, one group has a special relationship with God because it believes the most in his revealed truths and tries the hardest to follow his laws.	.61		
3. There is a religion on this earth that teaches, without error, God's truth.	.60		
4. There are only two types of people in the world: the Righteous, who will be rewarded by God; and the rest, who will not.	.58		
5. The long-established traditions in religion show the best way to honor and serve God, and should never be compromised.	.54		
6. No one religion is especially close to God, nor does God favor any particular group of believers.*	.54		
7. God will punish most severely those who abandon his true religion.	.51		
8. The Scriptures are a collection of myths.*		.69	
9. The miracles reported in the scriptures actually occurred.		.61	
10. The Scriptures contain God's rules for living.		.61	

## Appendix A (continued)

Item	Factor loading		
	1	2	3
11. The Scriptures should be regarded more as beautiful writing than as religious truths.*		.60	
12. Life originated differently than suggested by scripture.*		.58	
13. Satan is just a name people give to their own bad impulses. There is really no such thing as a diabolical Prince of Darkness who tempts us.*		.57	
14. There are more accurate accounts of history than the scriptures.*		.56	
15. The scriptures should be taken as divinely-inspired writings.		.55	
16. I am constantly questioning my religious beliefs.	.69		
17. As I grow and change, I expect my religion to also grow and change.	.65		
18. I expect my religious convictions to change in the next few years.	.63		
19. There are many religious issues on which my views are still changing.	.62		
20. My life experiences have led me to rethink my religious convictions.	.55		
21. For me, doubting is an important part of what it means to be religious.	.41		

Notes. Cronbach's alpha for Factor 1 items (secularism) = .81, Factor 2 items (scriptural acceptance) = .84, Factor 3 items (religious questioning) = .84. \*Indicates a reverse scored item.

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