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# The Relation Between Intelligence and Religiosity: A Meta-Analysis and Some Proposed Explanations

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**Abstract**

A meta-analysis of 63 studies showed a significant negative association between intelligence and religiosity. The association was stronger for college students and the general population than for participants younger than college age; it was also stronger for religious beliefs than religious behavior. For college students and the general population, means of weighted and unweighted correlations between intelligence and the strength of religious beliefs ranged from −.20 to −.25 (mean $r$ = −.24). Three possible interpretations were discussed. First, intelligent people are less likely to conform and, thus, are more likely to resist religious dogma. Second, intelligent people tend to adopt an analytic (as opposed to intuitive) thinking style, which has been shown to undermine religious beliefs. Third, several functions of religiosity, including compensatory control, self-regulation, self-enhancement, and secure attachment, are also conferred by intelligence. Intelligent people may therefore have less need for religious beliefs and practices.

**Keywords**

intelligence, religiosity, meta-analysis

For more than eight decades, researchers have been investigating the association between intelligence levels and measures of religious faith. This association has been studied among individuals of all ages, using a variety of measures. Although a substantial body of research has developed, this literature has not been systematically meta-analyzed. Furthermore, proposed explanations for the intelligence–religiosity association have not been systematically reviewed. In the present work, our goal was to meta-analyze studies on the relation between intelligence and religiosity and present possible explanations for this relation.

Following Gottfredson (1997), we define intelligence as the "ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience" (p. 13). This definition of intelligence is often referred to as analytic intelligence or the *g* factor—the first factor that emerges in factor analyses of IQ subtests (e.g., Carroll, 1993; Spearman, 1904). Other newly identified types of intelligence, such as creative intelligence (Sternberg, 1999, 2006) or emotional intelligence (Mayer, Caruso, & Salovey, 1999), are out of the scope of the present work because the available studies on the relation between intelligence and religiosity examined only analytic intelligence. In addition, there are still disputes about the nature of nonanalytic intelligence (see recent exchange between Mayer, Caruso, Panter, & Salovey, 2012, and Nisbett et al., 2012a).

Religiosity can be defined as the degree of involvement in some or all facets of religion. According to Atran and Norenzayan (2004), such facets include beliefs in supernatural agents, costly commitment to these agents (e.g., offering of property), using beliefs in those agents to lower existential anxieties such as anxiety over death, and communal rituals that validate and affirm religious beliefs. Of course, some individuals may express commitment or participate in communal rituals for reasons other than religious beliefs. This issue was put into sharp relief by Allport and Ross (1967), who drew a distinction between intrinsic and extrinsic religious orientations. Intrinsic orientation is the practice of religion for its own sake; extrinsic religion is the use of religion as a means to secular ends. This distinction will be referred to in later sections.

Since the inception of IQ tests early in the 20th century, intelligence has continuously occupied a central position in psychological research (for a summary of the field, see

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Nisbett et al., 2012b). Religion, on the other hand, has a more intermittent history. Gorsuch (1988) noted that interest in the psychology of religion was strong before 1930, almost extinct between 1930 and 1960, and on the rise after 1960. This latter trend has accelerated in recent years. Indeed, it is safe to say that the bulk of the present content of psychology of religion has been constructed over the last 20 years (see, for example, Atran & Norenzayan, 2004, or the special religiosity issues of *Personality and Social Psychology Review*, February 2010, and of the *Journal of Social Issues*, December 2005).

Given the importance of both intelligence and religious beliefs in psychological research, the relation between them constitutes an intriguing question. Indeed, as shown below, this question attracted attention very early in the history of psychological research, and it continues to foster debate today. The nature of the relation between intelligence and religiosity can advance our knowledge about both constructs: We might learn who holds religious beliefs and why; we might also learn how and why intelligent people do (or do not) develop a particular belief system.

## The Relation Between Intelligence and Religiosity: A Brief History

To our knowledge, the first studies on intelligence and religiosity appeared in 1928, in the *University of Iowa Studies series, Studies in Character* (Howells, 1928; Sinclair, 1928). These studies examined sensory, motor, and cognitive correlates of religiosity. Intelligence tests were included in the battery of administered tasks. Both Howells (1928) and Sinclair (1928) found that higher levels of intelligence were related to lower levels of religiosity.

Accumulation of additional research during the subsequent three decades prompted Argyle (1958) to review the available evidence. He concluded that "intelligent students are much less likely to accept orthodox beliefs, and rather less likely to have pro-religious attitudes" (p. 96). Argyle also noted that, as of 1958, all available evidence was based on children or college student samples. He speculated, however, that the same results might be observed for adults of post-college age.

In the subsequent decade, the pendulum swung in the opposite direction. Kosa and Schommer (1961) and Hoge (1969) drew conclusions from their data that were inconsistent with those of Argyle (1958). According to Kosa and Schommer, "social environment regulates the relationship of mental abilities and religious attitudes by channeling the intelligence into certain approved directions: a secular-oriented environment may direct it toward skepticism, a church-oriented environment may direct it toward increased religious interest" (p. 90). They found that in a Catholic college, more intelligent students knew more about religious doctrine and participated more in strictly religious organizations. To the extent that such participation is an indicator of religiosity, these results supported the Kosa and Schommer prediction. Unfortunately, measures of religious beliefs were not used.

Hoge (1969, 1974) tracked changes in religious attitudes on 13 American campuses. He compared survey data, most of which were collected between 1930 and 1948, with data that he collected himself in 1967 and 1968. On four campuses, Hoge also examined the relation between SAT scores and religious attitudes. Correlations were small and mostly negative. Hoge (1969) concluded that "no organic or psychic relationship exists between intelligence and religious attitudes and . . . the relationships found by researchers are either due to educational influences or biases in the intelligence tests" (p. 215). Hoge acknowledged that range restrictions of college students' intelligence scores may decrease correlations between intelligence and other variables. Nevertheless, he concluded that the low negative-intelligence-religiosity correlations implied that there is no relation between intelligence and religiosity.

Seventeen years later, in a revision of Argyle's 1958 book, Argyle and Beit-Hallahmi (1975) again reviewed the literature on the relation between intelligence and religiosity. Unlike the first edition, the revised monograph did not offer a conclusion regarding the magnitude or direction of this relation. This waning conviction continued during the remainder of the century. For example, Beit-Hallahmi and Argyle (1997) suggested that "there are no great differences in intelligence between the religious and non-religious, though fundamentalists score a little lower" (p. 183). They also noted the lack of large-scale studies that controlled for demographic variables, "or any studies which make clear what the direction of causation is, if there is any effect at all" (p. 177). In an introduction to his own study, Francis (1998) reviewed the published evidence and stated that the number of studies reporting a negative relation exceeded the number reporting a positive relation or no relation. However, his own findings from that study as well as others (e.g., Francis, 1979) showed no relation, posing a clear challenge to "the research consensus formulated in the late 1950s by Argyle (1958)" (Francis, 1998, p. 192). Ironically, Francis worked exclusively with children and adolescents—precisely the population that, according to Argyle (1958), does show a negative relation between intelligence and religiosity.

As if in response to Beit-Hallahmi and Argyle's (1997) call, the last decade has seen a number of large-scale studies that examined the relation between intelligence and religiosity (Kanazawa, 2010a; Lewis, Ritchie, & Bates, 2011; Nyborg, 2009; Sherkat, 2010). Kanazawa (2010a), Sherkat (2010), and Lewis et al. (2011) all found negative relations between intelligence and religiosity in post-college adults. Nyborg (2009) found that young atheists (age 12 to 17) scored significantly higher on an intelligence test than religious youth.

The last decade also saw studies on the relation between intelligence and religiosity at the group level. Using data from 137 nations, Lynn, Harvey, and Nyborg (2009) found

a negative relation between mean intelligence scores (computed for each nation) and mean religiosity scores. However, IQ scores from undeveloped and/or non-Westernized countries might have limited validity because most tests were developed for Western cultures. Low levels of literacy and problems in obtaining representative samples in some countries may also undermine the validity of these findings (Hunt, 2011; Richards, 2002; Volken, 2003). In response to these critiques, Reeve (2009) repeated the analysis but set all national IQ scores lower than 90 to 90. The resulting IQ-religiosity correlation was not lower than what had been reported in prior studies (see Reeve, 2009, for a discussion of his truncating procedure). In the same vein, Pesta, McDaniel, and Bertsch (2010) found a negative relation between intelligence and religiosity scores that were computed for all 50 states in the United States. These results are less susceptible to the problems (e.g., cultural differences) that plagued studies at the country level. Thus, the current literature suggests that aggregates may also exhibit a negative relation between intelligence and religiosity. However, the reasons for relations at the group level may be quite different from reasons for the same relations at the individual level.

Finally, parallel to studies on intelligence and religiosity, psychologists have also examined a related issue—the prevalence of religiosity among scientists. This line of research also started early (Leuba, 1916) and the topic continued to attract attention in more recent years (e.g., Larson & Witham, 1998). Studies in this area have found that, relative to the general public, scientists are less likely to believe in God. For example, Leuba (1916) reported that 58% of randomly selected scientists in the United States expressed disbelief in, or doubt regarding the existence of God; this proportion rose to nearly 70% for the most eminent scientists. Larson and Witham (1998) reported similar results, as evidenced by the title of their article—"Leading scientists still reject God." Of course, higher intelligence is only one of a number of factors that can account for these results.

Despite the recent uptick of research on the intelligence–religiosity connection, we are not aware of any recent scholarly reviews besides those listed hereinbefore. Outside of academic journals, however, there have been at least two reviews (Beckwith, 1986; Bell, 2002). Beckwith (1986) concluded that 39 of the 43 studies that he summarized supported a negative relation between intelligence and religiosity, and Bell (2002) simply repeated this tally. However, some of the studies reviewed by Beckwith were only indirectly relevant (e.g., comparisons between more and less prestigious universities), and some relevant studies were excluded.

In summary, the relation between intelligence and religiosity has been examined repeatedly, but so far there is no clear consensus on the direction and/or the magnitude of this association. There is a hint that age might moderate the relationship, but this issue has not been put to test. Finally, there is also no consensus on what might explain this relation.

## The Present Investigation

The purpose of the present investigation was twofold. First, we aimed to conduct a quantitative assessment of the nature and magnitude of the relation between intelligence and religiosity. Embedded in this purpose was also the intent to examine a tripartite division of research participants—precollege, college, and non-college (non-college refers to individuals of college age or older who are not in college)—as a moderator of this association. Francis's studies (e.g., Francis, 1998) suggest that in the precollege population, intelligence is only weakly related to religiosity. Because the college experience has many unique characteristics (e.g., first time away from home, exposure to new ideas, higher levels of freedom and independence), and because the range of intelligence is restricted in the college population, this demographic group was considered separately. This left the non-college population as the third category to be examined.

The second purpose of the investigation was to examine explanations for any observed associations between intelligence and religiosity. Most extant explanations (of a negative relation) share one central theme—the premise that religious beliefs are irrational, not anchored in science, not testable and, therefore, unappealing to intelligent people who "know better." As Bertsch and Pesta (2009) put it, "people who are less able to acquire the capacity for critical thought may rely more heavily on comfortable belief systems that provide uncontested (and uncontestable) answers" (p. 232). Nyborg (2009) offered a similar view: "High IQ-people are able to curb magical, supernatural thinking and tend to deal with the uncertainties of life on a rational-critical-empirical basis" (p. 91). Some investigators adopted this approach but, as Hoge (1969) had done earlier, added education as a possible mediating variable. Reeve and Basalik (2011), for example, suggested that "populations with higher average IQ are likely to gravitate away from religious social conventions and towards more rational . . . systems conferred by the higher (average) educational achievement of that population" (p. 65).

We identified three other explanations of the negative intelligence–religiosity association, offered by Argyle (1958), Kanazawa (2010a, 2010b), and Sherkat (2010). Argyle (1958) suggested briefly and without elaboration that more intelligent people tend to rebel against conventions, including orthodox religious beliefs. Kanazawa (2010a, 2010b) posited that religious beliefs developed early in our ancestral environment because they were evolutionarily adaptive; atheism, in contrast, is evolutionarily novel. He also proposed that intelligence developed as a capacity to cope more effectively with evolutionarily novel problems. Given that atheism is evolutionarily novel, it is more likely to be adopted by more intelligent people. Sherkat (2010), focusing on Christian fundamentalism (as opposed to general religiosity) and verbal ability (as opposed to general intelligence), proposed that fundamentalism has a negative effect on verbal

ability. The reason is that very conservative Christians scorn secular education, the search for knowledge, information from the media, and anything emanating from the scientific method. Furthermore, conservative Christians maintain homogeneous social networks, shun nonadherents, and avoid information from external sources. The overall effect is that fundamentalist Christian beliefs as well as ties to sectarian denominations have a negative effect on verbal ability.

Religion may indeed be a set of beliefs in the supernatural (e.g., Nyborg, 2009) that was adaptive in an ancestral environment (Kanazawa, 2010a). However, we believe that religion is much more than that and, as such, the interpretations of its inverse relation with intelligence are more complicated than those offered so far. Specifically, recent theoretical and empirical work on the role and functions of religion in human life (e.g., Sedikides, 2010) allow a new look at the relation between intelligence and religiosity. However, we will take that look only after we establish the nature of this relation.

## Method

### Selection of Studies

We searched for relevant articles in *PsycINFO*, using the following intelligence-related search terms: i*ntelligence quotient, IQ, intelligence*, and *cognitive ability*. Search terms relating to religiosity were also entered, including *religion, spirituality, religiosity*, and *religious beliefs.* A Google Scholar search was conducted for articles that contained the word *religion* and either *IQ* or *intelligence*. In addition, articles from the *Journal for the Scientific Study of Religion* and *Review of Religious Research* in years not indexed by *PsycINFO* were inspected one-by-one. The *Archive for the Psychology of Religion*, which is not covered by *PsycINFO*, was also reviewed. Finally, reference lists of studies that were identified by any of the aforementioned methods were searched for additional relevant studies.

Studies were included in the meta-analysis if they examined the relation between intelligence and religiosity at the individual level, and if the effect size (Pearson *r*) of that relation was provided directly or could be computed from other statistics. For several studies, intelligence and religiosity were measured, but the authors did not report the relation between these two variables. Authors of such studies were contacted to obtain the relevant information. If authors did not respond to our first request, two more reminders were sent. When necessary, second and/or third coauthors were also contacted. Studies that examined the relation between intelligence and religiosity indirectly (e.g., comparisons at group levels, comparisons between scientists and the general population) were excluded.

Studies included in the present meta-analysis used a variety of intelligence and religiosity measures. Most of the intelligence tests are widely used (e.g., Wechsler tests, Peabody Picture Vocabulary Test, etc.). A subgroup of studies used university entrance exams (UEEs; e.g., SAT, GRE), which are highly correlated with standard IQ measures (correlations in the .60-.80 range are typical for college students). Indeed, these tests are often viewed as measures of general intelligence (Frey & Detterman, 2004; Koenig, Frey, & Detterman, 2008). We also included studies that administered tests of cognitive abilities (e.g., synonym tests, working memory tests) that could reasonably serve as proxies for IQ measures.

We also examined the relations between school performance (grade point average, GPA) and religiosity. Intelligence and GPA correlate only moderately (the .25-.40 range is typical for college students; e.g., Feingold, 1983; Pesta & Poznanski, 2008; Ridgell & Lounsbury, 2004). Indeed, Coyle and Pillow (2008; Study 1) reported that correlations between intelligence and SAT/ACT scores were substantially higher than those between intelligence and GPA. However, while GPA is probably a poor indicator of intelligence, it can also be seen as a measure of educational achievement. As noted hereinbefore, some investigators saw education as the mediator of the relation between intelligence and religion, a view that will get some support if GPA (viewed as a measure of educational performance) is negatively related to religiosity. Accordingly, we planned to examine the relation between GPA and religiosity separately.

The religiosity measures included belief scales that assessed various themes related to religiosity (e.g., belief in God and/or the importance of church). In addition, we included studies that measured frequency of religious behaviors (e.g., church attendance, prayer), participation in religious organizations, and membership in denominations.

Table 1 presents the studies that were analyzed. If results for more than one independent sample of participants were reported in a single article, they were considered as separate studies in the analysis. Altogether there were 63 studies from 52 sources. Articles from which data were extracted are marked by an asterisk in the Reference section. Table 1 presents a number of characteristics for each study; these will be explained in greater detail in the following section. Finally, Table 1 presents an effect size for each study—the zero-order correlation between intelligence and religiosity.

### Data Extraction and Coding

The first author extracted an effect size *r* for each study; a negative correlation indicated that higher intelligence was associated with lower religiosity. When several correlations were available due to the use of multiple religiosity and/or intelligence measures, the average correlation was computed. However, the separate correlations were retained for moderation analyses if each correlation corresponded to a different level of a moderator (see the following for details). The first author also coded all of study attributes that are described in the following. The third author recomputed all effect sizes and recoded all study attributes. Only one coding

**Table 1.** Overview of Studies Included in the Meta-Analysis.

| Study | Total *n* | Proportion of males | Intelligence measure | Religiosity measure | Number of items in religiosity measure | Sample | Bias | Effect size (*r*) |
|---|---|---|---|---|---|---|---|---|
| Bender (1968) | 96 | 1.0 | UEE and GPA | Attendance | 1 | Non-college | Time gap | −.10[a] |
| Bertsch and Pesta (2009) | 278 | 0.42 | Wonderlic Personnel Test | Beliefs | >2 | College | n/a | −.15 |
| Blanchard-Fields, Hertzog, Stein, and Pak (2001); C. Hertzog, personal communications, October 2011: | | | | | | | | |
| Study 1 | 96 | 0.60 | Shipley Vocabulary Test | Mixed | >2 | College | n/a | .00[b] |
| Study 2 | 219 | 0.42 | Shipley Vocabulary Test | Mixed | >2 | Non-college | n/a | −.32[c] |
| Bloodgood, Turnley, and Mudrack (2008) | 230 | 0.63 | UEE | Attendance | 1 | College | n/a | −.15 |
| D. G. Brown and Lowe (1951) | 108 | n/a | UEE | Beliefs | >2 | College | Extreme groups | −.43 |
| Carlson (1934) | 100 | n/a | UEE | Beliefs | >2 | College | Time gap | −.19 |
| Carothers, Borkowski, Burke Lefever, and Whitman (2005); S. S. Carothers, personal communication, September 2011 | 101 | 0 | WAIS-R Vocabulary and Block design | Attendance | >2 | Non-college | n/a[d] | −.25 |
| Ciesielski-Kaiser (2005) | 216 | 0.36 | Shipley Institute for Living Scale | Beliefs | >2 | College | n/a | −.14 |
| Corey (1940) | 234 | n/a | UEE | Beliefs | >2 | College | n/a | −.03 |
| Cottone, Drucker, and Javier (2007) | 123 | 0.35 | WAIS III comprehension and similarities and GPA | Beliefs | >2 | College | n/a | −.14[e] |
| Crossman (2001) | 75 | 0 | Immediate free recall[f] | Beliefs | >2 | Non-college | n/a | −.36 |
| Deptula, Henry, Shoeny, and Slavick (2006) | 11,963 | n/a | Modified Peabody Picture Vocabulary Test | Beliefs | 1 | Precollege | n/a | −.10 |
| Dodrill (1976) | 44 | 0.54 | WAIS | Beliefs | >2 | Non-college | Extreme groups | .05 |
| Dreger (1952) | 60 | 0.50 | Wonderlic Personnel Test | Beliefs | >2 | Non-college | n/a[g] | −.13 |
| Feather (1964) | 165 | 1.0 | Syllogisms | Beliefs | >2 | College | n/a | −.16 |
| Feather (1967) | 40 | 0.50 | Syllogisms | Membership | 1 | College | n/a | −.09 |
| Foy (1975) | 36 | 0.50 | WAIS | Beliefs | >2 | Non-college | n/a | −.50 |
| Francis (1979) | 2,272 | n/a | IQ from school records | Mixed | >2 | Precollege | n/a | .04[h] |
| Francis (1998); Francis (1997) | 711 | 0.40 | Raven Progressive Matrices | Mixed | Both 1 and >2 | Precollege | n/a | −.04[i] |
| Francis, Pearson, and Stubbs (1985) | 290 | 0.72 | IQ (not specified) | Beliefs | >2 | Precollege | n/a | −.13 |
| Franzblau (1934) | 354 | 0.44 | Terman Test of Mental Abilities | Beliefs | >2 | Precollege | n/a | −.15 |
| Gilliland (1940) | 326 | n/a | Not specified | Beliefs | >2 | College | n/a | .00 |
| Gragg (1942) | 100 | 0.50 | UEE | Beliefs | >2 | College | n/a | −.02 |
| Hadden (1963) | 261 | n/a | GPA | Mixed | >2 | College | n/a | −.06 |
| Hoge (1969) | | | | | | | | |
| Study 1 | 179 | n/a | UEE | Mixed | >2 | College | n/a | −.12[j] |
| Study 2 | 135 | n/a | UEE | Mixed | >2 | College | n/a | −.08[j] |
| Study 3 | 327 | n/a | UEE | Mixed | >2 | College | n/a | −.07[j] |
| Horowitz and Garber (2003) | 172 | 0.46 | WISC Vocabulary and Block design | Mixed | 1 | Precollege | Time gap | .05[k] |

*(continued)*

**Table 1. (continued)**

| Study | Total *n* | Proportion of males | Intelligence measure | Religiosity measure | Number of items in religiosity measure | Sample | Bias | Effect size (*r*) |
|---|---|---|---|---|---|---|---|---|
| Howells (1928) | | | | | | | | |
| Study 1 | 461 | 0.43 | Thorndike Intelligence Test, Iowa Comprehension Test, and GPA | Beliefs | >2 | College | n/a | −.25[l] |
| Study 2 | n/a | n/a | Not specified | Beliefs | >2 | College | n/a | −.29 |
| Inzlicht, McGregor, Hirsh, and Nash (2009; Study 2) | 22 | 0.41 | Wonderlic Personnel Test | Beliefs | 1 | College | n/a | −.13 |
| V. Jones (1938) | 268 | n/a | UEE | Beliefs | >2 | College | n/a | −.24 |
| Kanazawa (2010a); S. Kanazawa, personal communications, 2011: | | | | | | | | |
| Study 1 | 14,277 | 0.47 | Peabody Picture Vocabulary Test | Beliefs | 1 | Non-college | Time gap | −.12 |
| Study 2 | 7,160 | 0.44 | Verbal synonyms | Beliefs | 1 | Non-college | n/a | −.14 |
| Kosa and Schommer (1961) | 361 | 1.0 | Assorted tests and GPA | Membership | >2 | College | n/a | .09[m] |
| Lewis, Ritchie, and Bates (2011) | 2,155 | n/a | Assorted tests | Mixed | >2 | Non-college | n/a | −.16[n] |
| McCullough, Enders, Brion, and Jain (2005) | 951° | n/a | Stanford–Binet | Beliefs | >2 | Non-college | Extreme groups | −.45 |
| Nokelainen and Tirri (2010); P. Nokelainen, personal communication, December 2011 | 20 | 0.45 | WAIS III | Beliefs | >2 | Precollege | Attenuated range | −.20 |
| Nyborg (2009) | 3,742 | n/a | Assorted tests | Membership | 1 | Precollege | n/a | −.05 |
| Pennycook, Cheyne, Seli, Koehler, and Fugelsang (2012) | | | | | | | | |
| Study 1 | 223 | .41 | Assorted tests | Mixed | >2 | Non-college | n/a | −.19[p] |
| Study 2 | 267 | .22 | Assorted tests | Mixed | >2 | Non-college | n/a | −.17[q] |
| Poythress (1975) | 195 | n/a | UEE | Beliefs | >2 | College | n/a | −.19 |
| Räsänen, Tirri, and Nokelainen (2006) | 142 | n/a | Assorted tests | Beliefs | >2 | precollege | n/a | −.17 |
| Salter and Routledge (1974) | | | | | | | | |
| Study 1 | 339 | n/a | UEE | Beliefs | 1 | College | n/a | −.15 |
| Study 2 | 241 | n/a | UEE | Beliefs | 1 | College | n/a | −.18 |
| Saroglou and Fiasse (2003) | 120 | 0.56 | GPA | Beliefs | 1 | College | n/a | .07 |
| Saroglou and Scariot (2002; Study 2); V. Saroglou, personal communications, March 2012 | 94 | 0.41 | GPA | Mixed | >2 | Precollege | n/a | .13 |
| Shenhav, Rand, and Greene (2011; Study 2) | 306 | 0.35 | Shipley Vocabulary Test, and WAIS III Matrix Reasoning Test | Beliefs | >2 | College | n/a | −.06 |
| Sherkat (2010); D. E. Sherkat, personal communications, October 2011 | 12,994 | 0.43 | Vocabulary Test | Mixed | 1 | Non-college | n/a | −.15[r] |
| Sherkat (2011) | 1,780 | n/a | Scientific Literacy Scale from General Social Survey | Beliefs | 1 | Non-college | n/a | −.34 |

*(continued)*

**Table 1. (continued)**

| Study | Total *n* | Proportion of males | Intelligence measure | Religiosity measure | Number of items in religiosity measure | Sample | Bias | Effect size (*r*) |
|---|---|---|---|---|---|---|---|---|
| Sinclair (1928) | 67 | 0.48 | UEE | Beliefs | >2 | College | Extreme groups | − .44 |
| Southern and Plant (1968) | 72 | .58 | Mensa membership | Beliefs | >2 | Non-college | Extreme groups | −.75 |
| Stanovich and West (2007); R. F. West, personal communication, October 2011: | | | | | | | | |
| Study 1 | 439 | 0.24 | UEE | Beliefs | 1 | College | n/a | −.24 |
| Study 2 | 1,045 | 0.31 | UEE | Beliefs | 1 | College | n/a | −.18 |
| Symington (1935) | | | | | | | | |
| Study 1 | 200 | n/a | Otis Test of Mental Ability | Beliefs | >2 | College | Attenuated range | −.24 |
| Study 2 | 160 | n/a | Otis Test of Mental Ability | Beliefs | >2 | College | Attenuated range | −.47 |
| Szobot et al. (2007); C. M. Szobot, personal communication, December 2011 | 236 | 1.0 | WAIS III block design and Vocabulary | Attendance | 1 | Precollege | n/a | .15 |
| Turner (1980) | | | | | | | | |
| Study 1 | 200 | 1.0 | Thurstone Primary Mental Abilities Scale | Beliefs | >2 | Precollege | n/a | −.04 |
| Study 2 | 200 | 1.0 | Thurstone Primary Mental Abilities Scale | Beliefs | >2 | Precollege | n/a | −.02 |
| Verhage (1964) | 1,538 | n/a | Groninger Intelligence Test | Membership | 1 | Non-college | n/a | −.12 |
| Young, Dustin, and Holtzman (1966) | | | | | | | | |
| Study 1 | 481 | 0.69 | GPA | Beliefs | >2 | College | n/a | .03 |
| Study 2 | 574 | 0.57 | GPA | Beliefs | >2 | College | n/a | −.11 |

*Note.* UEE = University Entrance Exams; GPA = grade point average; n/a = not applicable; WAIS = Wechsler Adult Intelligence Scale; WISC = Wechsler Intelligence Scale for Children.
[a]Average of .00 correlation with GPA and −.20 correlation with the intelligence measure.
[b]Average of .04 correlation with religious beliefs and −.03 correlation with religious behavior.
[c]Average of −.33 correlation with religious beliefs and −.30 correlation with religious behavior.
[d]The procedure of the study included "time gap" and "extreme groups" (for further explanation, see bias section under Data Extraction and Coding below); these features were expected to decrease and increase, respectively, the effect size, resulting in zero net bias.
[e]Average of −.15 correlation with GPA and −.14 with the intelligence measure.
[f]The Immediate Free Recall, a component of Gudjonnson's (1987) suggestibility scale, correlated .69 with the WAIS-R (Gudjonsson & Clare, 1995).
[g]Using extreme groups in religiosity but eliminating participants with low intelligent scores or inconsistent responses to the religiosity scales were assumed to cancel one another.
[h]Average of .03 correlation with religious belief and .05 correlation with religious behavior.
[i]The −.04 effect size is the average of −.02 correlation with a religious beliefs scale and −.02 and −.08 correlations with two one-item religious behavior questions.
[j]The three effect sizes in Hoge's (1969) studies are each an average of a correlation with religious beliefs and a correlation with religious behavior: −.08 and −.17, −.13 and –.04, and −.08 and −.06, respectively.
[k]Average of −.05 correlation with religious beliefs and .15 correlation with religious behavior.
[l]Average of −.15 correlation with GPA and −.36 with the intelligence measure.
[m]Average of .00 correlation with GPA and .18 correlation with the intelligence measure.
[n]Average of −.10 and −.25 correlations with two religious beliefs measures and −.14 and −.15 correlations with two religious behavior measures.
[o]Average of Ns of several comparisons between Terman's sample and the general population (see Table 9).
[p]Average of −.20 correlation with religious beliefs and −.18 correlation with a mixed measure of religious belief and behavior.
[q]Average of −.18 correlation with religious beliefs and −.16 correlation with a mixed measure of religious belief and behavior.
[r]Average of −.29 correlation with religious beliefs and −.01 correlation with religious behavior.

variable (goal of study) involved a subjective judgment, and the two discrepancies for this variable were resolved by discussion. Discrepancies in either the computation of effect sizes or the coding of study attributes indicated mistakes and were corrected.

*Gender.* We coded the percentage of study participants who were males, for studies that provided the gender distribution.

*Intelligence measures.* For each study, we coded which intelligence test was used; a separate coding category was included for GPA. However, with the exception of GPA and UEE, the number of studies associated with a single intelligence measure was too small (ranging from one to four, see Table 1) to allow a meaningful analysis of this variable.

*Religiosity measures.* We coded whether the religiosity measure involved beliefs, frequency of church attendance and/or prayer, or participation/membership in religious organizations. A "mixed" category included studies that reported correlations for more than one type of religiosity measure. Although measures of beliefs were heterogeneous with respect to the focus of the belief (e.g., belief in God, belief in scriptures, beliefs in spirits), there were not enough studies to allow a more detailed classification. We also coded the number of items in the religiosity measures, expecting measures with more items to be more reliable. However, this variable did not produce any results of interest.

*Goal of study.* We coded whether assessing the relation between intelligence and religiosity was the main goal of the study, one of several goals, or not a goal at all.

*Sample type.* Studies were classified as investigating precollege, college, or non-college samples, as defined hereinbefore. Note that this variable is related to age and education. The precollege participants were almost exclusively between 12 and 18 years of age. Only one study in this category (Francis, 1979) included participants younger than 12. College participants were undergraduates and, very infrequently, a mixture of undergraduates and graduate students. We assumed that intelligence scores of college participants were restricted in range relative to those of the general population. Non-college participants were recruited outside of academic contexts and tended to be older than participants in the college group.

*Religion and race.* Participants' religions were coded as Protestant, Catholic, "Christian" (a term that often went undifferentiated in the studies), Jewish, or unspecified. For each religion, a study was coded as "all" (90% or more) or "mostly" (more than 50%). There were no studies in the "mostly Jewish" category. We coded race according to four categories: Mostly Caucasians, all Caucasians, African Americans, and mixed or not available. However, for religion and race, the resulting distributions were too skewed to allow meaningful analysis.

*Bias.* We coded studies as biased if their methodology could artificially attenuate or inflate the intelligence–religiosity correlation. There were two potential causes of bias that could attenuate correlations: restriction of range and time gap between measurements. Restricted range studies examined samples that were limited in their range of either religiosity (e.g., because only very religious participants were included) or intelligence (e.g., because only highly intelligent participants were included). Note that we used this coding in addition to the aforementioned college category in which all studies were assumed to be restricted in their range of intelligence scores. In time gap studies, researchers administered the intelligence measure some time (usually a number of years) before the religiosity measure. There were no time gap studies in which religiosity was measured before intelligence.

A third bias category—extreme groups—was comprised of studies in which investigators compared participants very high in intelligence (or religiosity) with participants very low in intelligence (or religiosity). This design was expected to inflate intelligence−religiosity correlations. The fourth category included all remaining studies.

*Published or unpublished.* We coded whether or not the study was published. However, this variable did not influence the results.

## Analysis

Random-effects and fixed-effects analyses were performed. Random-effects models produce results that can be generalized to future studies not having designs that are identical to those of studies included in the meta-analysis; fixed-effects models limit generalization to new participants in the meta-analyzed study designs (Hedges & Vevea, 1998; Rosenthal, 1995; Schmidt, Oh, & Hayes, 2009). Fixed-effects models give weight to studies proportional to their sample sizes; these models can therefore be misleading when methodological features of larger studies differ from those of smaller ones. On the other hand, random-effects models can be lacking in statistical power.

In the present meta-analysis, there was a sufficient number of studies to permit meaningful random-effects analyses of central tendency and moderators, using the PASW 18 statistical package (e.g., correlation, analysis of variance). All random-effects analyses used unweighted effect sizes as dependent variables and studies as the units of analysis. Fixed-effects analyses of central tendency, homogeneity, publication bias, and moderators were performed using the Comprehensive Meta-Analysis software package (Borenstein, Hedges, Higgins, & Rothstein, 2005).

**Table 2.** Correlations Between Religiosity and Intelligence.

| Studies | Random-effects results: Unweighted *M r* (*SD*) | Median | *t* test against 0 | Fixed-effects results: Weighted *M r* | 95% CI | Combined *Z* | Heterogeneity chi-square | File drawer *k*[a] |
|---|---|---|---|---|---|---|---|---|
| All (*k* = 63) | −.16 (.18) | −.14 | −6.83*** | −.13[b] | [−.14, −.12] | −34.36*** | 554.00*** | 10,129 |
| No GPA (k = 58) | −.18 (.19) | −.15 | −7.16*** | −.13[c] | [−.14, −.12] | −34.70*** | 566.99*** | 10,240 |
| No GPA and no extreme groups (k = 53) | −.15 (.14) | −.15 | −7.77*** | −.12[d] | [−.13, −.12] | −32.70*** | 378.98*** | 7,250 |

*Note.* GPA = grade point average; CI = confidence interval.
[a]Two-tail test.
[b]*k* = 62 because sample size was missing for one study. The effect size for that study was −.29.
[c]*k* = 57 (see Footnote a).
[d]*k* = 52 (see Footnote a).
***$p < .001$.

## Results

### Overall Relation of Intelligence to Religiosity

The first row of Table 2 presents basic statistics describing the relation between intelligence and religiosity for all 63 studies. Results are presented for random-effects analyses (unweighted mean correlations) and fixed-effects analyses (weighted mean correlations). Fifty-three studies showed negative correlations while 10 studies showed positive correlations. Thirty-seven studies showed significant correlations; of these, 35 were negative and 2 were positive. The unweighted mean correlation (*r*) between intelligence and religiosity was −.16, the median *r* was −.14, and the weighted mean *r* was −.13. The similarity of these three indicators of central tendency indicates that the distribution was approximately symmetrical and was not skewed by several very large studies that were in the database. Random- and fixed-effects models yielded significant evidence that the higher a person's intelligence, the lower the person scored on the religiosity measures.

The distribution of intelligence–religiosity correlations was highly heterogeneous as indicated by the significant chi-square statistic (Table 2). The file drawer calculation indicated that 10,129 studies with average effects of $r = 0$ would have to be added to nullify the two-tailed test of the combined probability. Application of a fixed-effects trim and fill procedure (Duval & Tweedie, 2000) for detecting gaps in the distribution of effect sizes suggested that two positive effects would have to be added to make the distribution symmetrical; even with these imputed studies added, however, the overall estimated effect size did not change.

### Biases in the Intelligence–Religiosity Relation

*GPA.* As stated hereinbefore, GPA is a poorer measure of intelligence than are standardized cognitive tests. To examine whether GPA had a weaker correlation with religiosity than did other measures of intelligence, studies using GPA ($k = 5$) were compared with studies using other tests ($k = 54$), omitting four studies that used both kinds of measures. A random-effects (unweighted effect sizes) ANOVA showed a significant difference, $F(1, 57) = 5.22$, $p < .05$ ($M_{GPA} = .01$, $M_{other\ tests} = -.18$). A fixed-effects (weighted effect sizes) comparison was also significant, $p < .001$ ($M_{GPA} = -.03$, $M_{other\ tests} = -.13$). When GPA–religiosity correlations from the five studies using only GPA are combined with GPA–religiosity correlations from the four studies using GPA as well as other intelligence measures, the mean GPA–religiosity correlation was not significantly different from zero, $M_{GPA} = -.027$, $p = .33$. It was concluded that GPA had no meaningful relation to religiosity and, accordingly, all subsequent analyses omitted the five studies that used only GPA. For the four studies that used GPA and other intelligence tests, we used only their non-GPA results in subsequent analyses.

After excluding all findings for GPA, 58 studies remained for analysis. The effect size for these non-GPA studies (shown in the second row of Table 2) was more negative than that of the full data set in the random-effects analysis but did not change in the fixed-effects analysis.

*Statistical artifacts.* As noted hereinbefore, two methodological features were considered likely to attenuate the intelligence–religiosity relation—restriction of range and the presence of a time gap between measurements. A third methodological feature—extreme groups—was expected to inflate the intelligence–religiosity relation. Any effects that distorted the "true" intelligence–religiosity relation should be removed.

In an ANOVA of the unweighted effect sizes (random-effects model), the following groups of studies were compared: restricted range studies ($M = -.31$, $k = 3$), time gap studies ($M = -.12$, $k = 4$), extreme groups studies ($M = -.43$, $k = 5$), and the remaining studies ($M = -.14$, $k = 46$). The omnibus *F* was significant, $F(3, 54) = 7.06$, $p < .001$.

Surprisingly, studies with restriction of range yielded an effect size ($M = -.31$) that was more negative than that of the 46 studies with no evident source of bias ($M = -.14$). Therefore, range-restricted studies were retained. Because

**Table 3.** Sample Type as a Moderator of the Religiosity–Intelligence Relation ($k = 53$).

| | Random-effects results | | | Fixed-effects results | | | | |
|---|---|---|---|---|---|---|---|---|
| Sample type | Unweighted *M r* (*SD*) | Median | *t* test against 0 | Weighted *M r* | 95% CI | Combined *Z* | Heterogeneity chi-square | File drawer *k* |
| Precollege ($k = 12$) | −.06 (.10) | −.05 | −1.86† | −.07 | [−.08, −.06] | −9.97*** | 60.54*** | 123 |
| College ($k = 27$) | −.14 (.13) | −.15 | −5.59*** | −.15[a] | [−.17, −.12] | −12.00*** | 118.72*** | 775 |
| Non-college ($k = 14$) | −.23 (.13) | −.18 | −6.92*** | −.15 | [−.16, −.14] | −30.25*** | 110.10*** | 2,245 |

*Note.* CI = confidence interval.
[a]k = 26 (see Note a, Table 2).
†p < .10. ***p < .001.

time gap studies yielded an effect size ($M = -.12$) close in magnitude to the no-bias studies, they also were left in. As expected, the extreme groups effect size ($M = -.43$) that was significantly more negative than that of the unbiased studies ($p < .001$ by post hoc least significant difference [LSD] test). The five studies with extreme groups were therefore excluded, leaving 53 studies for further analysis. The overall results for these 53 studies are shown in the third row of Table 2; the effect size changed very little from the corresponding effect size for all 63 studies.

## Moderators of the Intelligence–Religiosity Relation

*Sample type.* We expected that the relation between intelligence and religiosity would differ by sample type (precollege, college, and non-college). As shown in Table 3, the unweighted and the weighted effect sizes were highest at the non-college level, intermediate at the college level, and lowest at the precollege level. An ANOVA on the unweighted effect sizes (random-effects approach) was significant, $F(2, 50) = 6.41$, $p < .01$; post hoc LSD tests showed that all pairwise comparisons among these means were significant at $p \leq .05$. The fixed-effects analysis also showed a highly significant overall between-groups effect, $p < .001$. However, when weighted by sample size, the non-college group no longer showed the most negative correlation. Table 3 also shows that the effects were significantly below zero and were heterogeneous for all three sample types.

The fixed-effects trim and fill method for detecting possible publication bias yielded negligible impact for the precollege and non-college groups. For the college group, however, there was evidence of publication bias, such that nine negative effect sizes would need to be added to yield a symmetrical distribution. The imputation of these effects resulted in an adjusted mean effect of −.21, noticeably quite different from the observed weighted mean effect of −.15. Because the adjusted effect size is hypothetical, it will not be incorporated into subsequent analyses. However, this result and the range restriction in intelligence scores in this group suggest that the true intelligence–religiosity relation in the college population may be more negative than the literature indicates. We return to this issue below.

*Type of religiosity measure.* Type of religiosity measure (behavior, beliefs, group membership, or a combination of measure types) had a marginally significant effect in the unweighted (random-effects) analysis, $F(3, 49) = 2.31$, $p < .09$ ($M_{\text{behavior}} = -.06$, $k = 5$; $M_{\text{beliefs}} = -.18$, $k = 33$; $M_{\text{group membership}} = -.09$, $k = 3$; and $M_{\text{combination of measures}} = -.10$, $k = 12$). Religious behavior and membership in religious organizations are conceptually similar in that both can be motivated by either religious beliefs or by extrinsic reasons. It is not surprising, then, that the difference in mean effect size between these two groups was not significant, $t = .26$. On the other hand, the comparison of these two groups of studies with the studies measuring beliefs was significant, $t(39) = 2.15$, $p < .05$.

Omitting studies that used combination of measures, a fixed-effects analysis also showed that the effect for belief measures was stronger than the effect for behavior or group membership measures, $p < .001$ ($M_{\text{beliefs}} = -.14$, $M_{\text{behavior}} = .02$, $M_{\text{group membership}} = -.07$). Given these results, studies measuring behavior and studies measuring membership were combined into one enlarged behavior category.

For the 10 studies using a combination of measures for which separate belief and behavior effect sizes could be calculated, a random-effects analysis was conducted that compared measure type within studies. The difference between beliefs and behavior was in the same direction as the difference found in the between-studies analysis, though due to the small number of studies it was not significant, matched $t(9) = 1.32$, $p = .22$ ($M_{\text{beliefs}} = -.11$, $M_{\text{behavior}} = -.06$).

Given that the intelligence–religiosity relation differed by sample type and the beliefs/behavior distinction, it was of interest to examine their combined effects. Excluding the 10 studies that used a combination of beliefs/behavior measures, the remaining 43 studies were examined in a 2 (beliefs/behavior) × 3 (sample type) ANOVA. The results showed significant effects for the beliefs/behavior factor, $F(1, 37) = 6.44$, $p < .02$, and sample type, $F(2, 37) = 4.56$, $p < .02$. Importantly, the interaction was not significant, $F = .42$.

To get as accurate picture as possible of the results, rather than presenting means only for the 43 studies that measured either beliefs or behaviors, we looked at all available data. Accordingly, we added the 10 studies that provided effect

**Table 4.** The Intelligence–Religiosity Relation by Sample Type and the Belief/Behavior Distinction ($k = 63$).

| | Unweighted mean correlations | | Weighted mean correlations | |
|---|---|---|---|---|
| Sample | Behavior | Beliefs | Behavior | Beliefs |
| Precollege | .05 (5) | −.08 (10) | −.01 | −.08 |
| College | −.05 (7) | −.16 (24) | −.02 | −.17[a] |
| Non-college | −.18 (6) | −.25 (11) | −.04 | −.20 |

[a]$k = 23$ (see Note a, Table 2).

sizes for beliefs and behaviors, displaying each study twice (once in the beliefs column and once in the behavior column). Table 4 presents unweighted and weighted mean correlations for the 63 data entries. These mean correlations were extremely similar to the corresponding mean correlations observed for only the 43 data entries.

Note that data entries in the Behavior column in Table 4 ($k = 18$) represent independent studies as do data entries in the Beliefs column ($k = 45$). The nonindependence involves the fact that 10 studies appear in both columns because they had behavior and belief effects. The differences among the three sample groups within each column were significant in random- and fixed-effects analyses ($p < .05$). In absolute terms, the mean correlations in the Behavior columns were weak, particularly when means were unweighted. Because of nonindependence, this enlarged data set of $k = 63$ results was not used in any subsequent analysis (unless otherwise noted).

*Percentage of male participants.* As an exploratory analysis, we examined the relation between percentage of males in each study and effect size of the intelligence–religiosity relation. In the 34 studies in which it could be determined, percentage of males was positively correlated with unweighted effect sizes, $r(32) = .50$, $p < .01$. This correlation indicates that the negative intelligence–religiosity relation was less negative in studies with more males. This relation held in terms of magnitude for the precollege and college groups, $r(6) = .48$, *ns*, and $r(12) = .51$, $p = .06$, but was weaker at the non-college level, $r(10) = .19$, *ns*. When analyzed as a fixed-effects regression, the relation between percentage of males and effect size was also markedly positive, $p < .001$.

A more direct test of the possibility that the intelligence–religiosity relation is less negative for males is a within-study comparison between males and females. Kanazawa[1] conducted this test for two studies (Kanazawa, 2010a; combined $N = 21{,}437$). If anything, the results pointed in the opposite direction. The intelligence–religiosity correlations for females and males, respectively, were −.11 and −.12 in Study 1, and −.14 and −.16 in Study 2. Although the difference between females and males was not significant, even when combined meta-analytically across studies ($Z = 1.39$, $p = .16$), the direction of this difference is inconsistent with the between-studies finding of the meta-analysis. Thus, the issue of gender as a moderator of the intelligence–religiosity relation remains a topic for future research.

*Goal of the study.* Study goal (i.e., whether investigating the intelligence–religiosity relation was the main goal of the study, one of several goals, or not a goal) was not related to effect sizes in a random-effects ANOVA ($p < .34$). In a fixed-effects analysis, the between-groups effect was significant, $p < .001$ ($M_{\text{main goal}} = -.09$, $M_{\text{one of several goals}} = -.17$, $M_{\text{not a goal}} = -.14$). Thus, the negative relation between intelligence and religiosity was more negative for studies in which this relation was not the main question of interest.

Having estimated the overall intelligence–religiosity relation, and having tested a number of moderators of this relation, we now proceed to ancillary analyses. We begin by correcting *r* values for range restriction, converting *r* values to Cohen's *d* scores, and using these *d* scores to estimate IQ differences between believers and nonbelievers. We then examine whether the observed relation between intelligence and religiosity might be accounted for by a number of "third variables." Finally, we examine evidence that might shed light on the causal direction of the intelligence–religiosity relation.

## *Effect Size of the Intelligence–Religiosity Relation: r, Corrected r, Cohen's d, and IQ Points*

Clearly, the size of the intelligence–religiosity relation depends on sample group and type of religiosity measure. In the precollege group, the best estimate of the size of this relation is $r = -.08$; this effect size was obtained in random- and fixed-effects analyses of studies with religiosity measures that assessed religious beliefs (see Table 4).

For the college group, the effect sizes presented so far were not corrected for range restriction of intelligence scores. Below, we present the uncorrected and the corrected *r*s for this group. Computation of the corrected *r*s was based on Thorndike's (1949) Case 2 formula, which requires use of the ratio between the unrestricted and restricted *SD*s of intelligence scores.[2] Sackett, Kuncel, Arneson, Cooper, and Waters (2009; P. R. Sackett, personal communication, May 2012) calculated a 1/.67 ratio between *SD*s of SAT scores for students who applied to but did not attend college, and students who applied to and attended college. These estimates

**Table 5.** Effect Size of the Relation Between Intelligence and Religiosity for Selected Groups.

| | College uncorrected | | College corrected | | Non-college | |
|---|---|---|---|---|---|---|
| Effect size | Unweighted | Weighted | Unweighted | Weighted | Unweighted | Weighted |
| All studies | | | | | | |
| *r* | −.14 | −.15 | −.21 | −.22 | −.23 | −.15 |
| *d* | −.28 | −.30 | −.43 | −.45 | −.47 | −.30 |
| IQ points | 4.2 | 4.5 | 6.4 | 6.8 | 7.1 | 4.5 |
| Studies with religiosity measure assessing religious beliefs | | | | | | |
| *r* | −.16 | −.17 | −.24 | −.25 | −.25 | −.20 |
| *d* | −.32 | −.34 | −.49 | −.52 | −.52 | −.41 |
| IQ points | 4.8 | 5.1 | 7.4 | 7.8 | 7.8 | 6.2 |

pertain to three cohorts (1995-1997) of students who applied to 41 colleges and universities in the United States. The schools were diverse in location and size, and included private and public institutions. This ratio is conservative in that it is based on the population of SAT test takers rather than the entire population.

One of the studies included in the present meta-analysis (Bertsch & Pesta, 2009) used the ratio of 1/.71 to correct a correlation between college students' scores on the Wonderlic Personnel Test and religiosity.[3] We chose to use only the ratio computed by Sackett et al. (2009), because it was based on a far larger sample; still, the similarity between the two ratios was reassuring.

In addition to correcting the correlations at the college level, we also examined (at college and non-college levels), the Cohen's *d* equivalents of the observed *r*s.[4] Conversion from *r* to *d* is informative when one of the two correlated variables can be dichotomized meaningfully. In the present analysis, religiosity dichotomizes conceptually to believers and nonbelievers. Because the correlations used in the meta-analysis were based on the entire population (studies of extreme groups were excluded), conceptualizing the equivalent *d*s as the difference between believers and nonbelievers is extremely conservative. Still, the *d* of the difference in intelligence scores between these two groups is highly informative; multiplying *d* by 15—the standard deviation of the most widely used intelligence tests such as the Wechsler Adult Intelligence Scale–Third Edition [WAIS–III]—provides an estimate of the number of IQ points separating believers from nonbelievers.

Table 5 presents the results for all studies at the college and non-college levels (top panel) and for studies utilizing religiosity measures that targeted religious beliefs. (In Table 5, we used all the studies from the college and non-college groups from the enlarged data set presented in Table 4; $k = 63$.) Not surprisingly, the corrected effect sizes at the college level (middle part of the table) are more negative than the uncorrected effect sizes (left side of the table). In addition, the corrected effect sizes at the college level appear comparable with those at the non-college level. Relative to the non-college level, the corrected college effect sizes are similar in the random-effects analysis and somewhat larger in the fixed-effects analysis. A cautious conclusion is that the two populations do not differ in the degree to which intelligence and religiosity are negatively related.[5]

Random- and fixed-effects analyses produced more negative effect sizes when religiosity measures assessed religious beliefs. Effect sizes (*r*s) for the college (corrected) and non-college groups ranged from −.20 to −.25 (mean $r = -.24$); in IQ points, the effect sizes ranged from 6.2 to 7.8 ($M = 7.3$).

## *Testing Third Variable Effects: Gender, Age, and Education*

A correlation between intelligence and religiosity may be due to a third variable such as gender, age, or education. Gender may act as a third variable because of its relation to religiosity—women tend to be more religious than men (McCullough, Enders, Brion, & Jain, 2005; Sherkat & Wilson, 1995; Stark, 2002). Age is also related to religiosity, although this relation is not consistent across the life span or across cultures (Argue, Johnson, & White, 1999; Sherkat, 1998). Education, as noted earlier, is related to intelligence and religiosity. Accordingly, we identified studies that provided the relevant information (usually a correlation matrix of all variables) that allowed us to compute partial correlations between intelligence and religiosity, controlling for each of the hypothesized third variables.

Table 6 presents zero-order and partial correlations controlling for gender for 13 studies. The absolute differences between the zero-order and partial correlations ranged from .00 to .03, with a median difference of .01. Thus, controlling for gender neither augmented nor reduced correlations between intelligence and religiosity.

Table 7 presents zero-order and partial correlations controlling for age for 10 studies. Excluding Franzblau (1934), absolute differences between the two types of correlations ranged from .00 to .02, with a median of .00. Franzblau's data yielded zero-order and partial correlations of −.15 and −.21, respectively. On balance, it seems that controlling for

**Table 6.** Zero-Order and Partial (Controlling for Gender) Correlations Between Intelligence and Religiosity.

| Study | Zero-order correlations | Partial correlations |
|---|---|---|
| Blanchard-Fields, Hertzog, Stein, and Pak (2001) | | |
| Study 1: Student sample | .00 | .01 |
| Study 2: Adult sample | −.32 | −.30 |
| Bloodgood, Turnley, and Mudrack (2008) | −.15 | −.16 |
| Cottone, Drucker, and Javier (2007) | −.14 | −.14 |
| Deptula, Henry, Shoeny, and Slavick (2006) | −.10 | −.10 |
| Foy (1975) | −.50 | −.52[a] |
| Francis (1979) | .04 | .04 |
| Francis (1997, 1998) | −.04 | −.04 |
| Francis, Pearson, and Stubbs (1985) | −.13 | −.11 |
| Hadden (1963) | −.06 | −.05 |
| Kanazawa (2010a; personal communication, January 2012) | | |
| Study 1 | −.12 | −.11 |
| Study 2 | −.14 | −.15 |
| Lewis, Ritchie, and Bates (2011) | −.16 | −.16 |
| Pennycook, Cheyne, Seli, Koehler, and Fugelsang (2012) | | |
| Study 1 | −.19 | −.22 |
| Study 2 | −.17 | −.16 |

[a]Average of zero-order correlations that were computed separately for men and women.

**Table 7.** Zero-Order and Partial (Controlling for Age) Correlations Between Intelligence and Religiosity.

| Study | Zero-order correlations | Partial correlations |
|---|---|---|
| Blanchard-Fields, Hertzog, Stein, and Pak (2001) | | |
| Study 1: Student sample | .00 | .00 |
| Study 2: Adult sample | −.32 | −.30 |
| Ciesielski-Kaiser (2005) | −.14 | −.14 |
| Cottone, Drucker, and Javier (2007) | −.14 | −.14 |
| Deptula, Henry, Shoeny, and Slavick (2006) | −.10 | −.10 |
| Francis, Pearson, and Stubbs (1985) | −.13 | −.14 |
| Franzblau (1934) | −.15 | −.21 |
| Hadden (1963) | −.06 | −.06 |
| Kanazawa (2010a; personal communication, January 2012) | | |
| Study 1 | −.12 | −.12 |
| Study 2 | −.14 | −.15 |
| Lewis, Ritchie, and Bates (2011) | −.16 | −.14 |
| Pennycook, Cheyne, Seli, Koehler, and Fugelsang (2012) | | |
| Study 1 | −.19 | −.19 |
| Study 2 | −.17 | −.18 |

age has little effect on correlations between intelligence and religiosity.

As previously noted, some investigators suggested that education mediates the relation between intelligence and religiosity (Hoge, 1974; Reeve & Basalik, 2011). Interestingly, Kanazawa (S. Kanazawa, personal communication, January 2012) espouses an opposing view, namely that intelligence accounts for any negative relation between education and religiosity. Table 8 presents results that address the two competing hypotheses. The analyses are based on seven studies from three sources. Results from the student sample studied by Blanchard-Fields, Hertzog, Stein, and Pak (2001; first row in Table 8) can be excluded because of range restriction for intelligence and education (indeed, all correlations for that study were weak). The results of the remaining six studies indicate that education does not mediate the intelligence–religiosity relation.

To begin with, intelligence was more negatively related to religiosity than was education (unweighted mean correlations were −.18 and −.06, respectively). We tested the significance of this difference separately for each study, using a procedure for comparing nonindependent correlations

**Table 8.** Zero-order and Partial Correlations Among Intelligence, Religiosity and Education.

| | Intelligence and religiosity | | Intelligence and education | Education and religiosity | |
|---|---|---|---|---|---|
| Study | Zero-order correlations | Partial correlations[a] | Zero-order correlations | Zero-order correlations | Partial correlations[b] |
| Blanchard-Fields, Hertzog, Stein, and Pak (2001) | | | | | |
| Study 1: Student sample[c] | .00 | .02 | .21* | −.06 | −.06 |
| Study 2: Adult sample[d] | −.32*** | −.31*** | .30*** | −.08 | .03 |
| Kanazawa (2010a; personal communication, 2012) | | | | | |
| Study 1[e] | −.12*** | −.14*** | .32*** | .05*** | .10*** |
| Study 2[f] | −.14*** | −.08*** | .50*** | −.17*** | −.09*** |
| Lewis, Ritchie, and Bates (2011)[g] | −.16*** | −.12*** | .41*** | −.14*** | −.08** |
| Pennycook, Cheyne, Seli, Koehler, and Fugelsang (2012) | | | | | |
| Study 1 | −.19** | −.20** | .22*** | .01 | .06 |
| Study 2 | −.17** | −.16** | .27*** | −.05 | .00 |

[a]Controlling for education.
[b]Controlling for intelligence.
[c]$N = 96$.
[d]$N = 219$.
[e]$N$ ranges from 14,265 to 14,987.
[f]$N$ ranges from 6,030 to 10,971 except for the correlation between intelligence and education ($N = 23,026$).
[g]$N$ ranges from 1851 to 2307.
*$p < .05$. **$p < .01$. ***$p < .001$.

(Meng, Rosenthal, & Rubin, 1992); the combined difference across the six studies was highly significant, $Z = 9.32$, $p < .001$. Furthermore, controlling for education did not have much of an effect on the intelligence–religiosity relation—unweighted means of the six zero-order and partial correlations were −.18 and −.17, respectively.

In contrast, controlling for intelligence led to a somewhat greater change in the education–religiosity relation; the unweighted means for the six zero-order and partial correlations were −.06 and .00, respectively. This finding is consistent with S. Kanazawa's (personal communication, January 2010) view that intelligence accounts for the education–religiosity relation. However, given that the analysis is based on only six studies, our conclusions are tentative.

Perhaps it is not how long people have been in school but rather how much they learnt that mediates the relation between intelligence and religiosity. GPA can be viewed as an indicator of how much knowledge one acquired in school. If amount of knowledge mediates the relationship between intelligence and religiosity, intelligence and religiosity should be correlated with GPA. While GPA is indeed correlated with intelligence, it was shown earlier that GPA is not related to religiosity. We again conclude that there is no evidence to support the notion that education mediates the intelligence–religiosity relation.

## Does Intelligence Drive Religiosity?

The present findings are correlational and cannot support any causal relation. However, two sets of results are consistent with the hypothesis that intelligence influences (or at least is an antecedent of) religiosity. The first set concerns the aforementioned time gap studies; the second is based on studies of gifted children, primarily Terman's (1925-1959) study and, indirectly, the Hunter study (Subotnik, Karp, & Morgan, 1989).

*Time gap studies.* In four studies, intelligence was measured long before religiosity, with time gaps ranging from 3 to 25 years (Bender, 1968; Carlson, 1934; Horowitz & Garber, 2003; Kanazawa, 2010a, Study 1). If intelligence measured on one occasion influences religiosity that is measured a number of years later, then a significant correlation between these two variables is consistent with a model in which intelligence drives religiosity. A fifth time gap study by Carothers, Borkowski, Burke Lefever, and Whitman (2005) was not included in this analysis. These investigators studied only participants who were very high or very low on religiosity. This "extreme groups" design could have inflated the effect size ($r = −.25$, see Table 1) despite the time gap procedure.

The four time gap studies yielded a mean effect size of $r = −.12$ for unweighted and weighted analyses. This value was marginally significant in the random-effects analysis, $t(3) = 1.99$, $p = .07$, one-tailed, and highly significant ($p < .001$) in the fixed-effects analysis. The results are actually more impressive than they first appear. First, the Horowitz and Garber (2003) study used behavior- and belief-based measures of religiosity. If we consider only the belief-based measure, the unweighted average $r$ of the four studies becomes −.14, $t(3) = 3.98$, $p < .05$. In addition, Bender (1968) and Carlson (1934) studied college students and, if corrected

**Table 9.** Comparing Religiosity in Terman's Sample with Religiosity in USA General Public.

| Terman's sample | | | | | General public | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Year of data collection | Age | *n* | *M* | *SD* | Year of data collection | Age | *n* | *M* | *SD* | *t* test | *r* |
| 1960 | 44-60 | 894 | 1.79 | 1.46 | 1965 | 45-64 | 927 | 3.42 | 1.11 | 26.84*** | .53 |
| 1977 | 61-77 | 650 | 1.75 | 1.51 | 1978 | 65+ | 117 | 3.45 | 1.16 | 11.57*** | .39 |
| 1986 | 70-86 | 606 | 1.48 | 1.47 | 1986 | 65+ | 135 | 3.13 | 1.42 | 11.87*** | .40 |
| 1991 | 75-91 | 399 | 1.45 | 1.48 | 1991 | 65+ | 76 | 3.50 | 1.04 | 11.54*** | .47 |

*Note.* The Terman's sample data were available from McCullough, Enders, Brion, and Jain (2005). The general public data were available from the following surveys: Gallup Organization (1965), Yankelovich, Skelly, and White, Inc (1978), Gallup Organization (1986), and Yankelovich Clancy Shulman, Inc. (1991).
***$p < .001$.

for range restriction, their effect sizes (−.20 and −.19, respectively) become −.29 and −.26, respectively.

On the other hand, two limitations of these studies should be noted. In all four studies, religiosity was predicted from an earlier measure of intelligence without controlling for an earlier measure of religiosity. In addition, intelligence was not predicted from an earlier measure of religiosity. Still, it is remarkable that intelligence can predict religiosity scores that are obtained years later.

*The Terman study.* The Terman (1925-1959) longitudinal study of bright children initially included 1,528 participants who were identified at approximately 10 years of age as having IQs that in general exceeded 135. Religiosity was assessed among "Termites" in several subsequent waves of data collection. Holahan and Sears (1995) and McCullough et al. (2005) have noted that Termites grew up to be less religious than the general public. Until recently, however, it was difficult to conduct a systematic comparison among Termites' religiosity scores at each wave of data collection, and between Termites' religiosity and that of the general public. This is because religiosity measures administered to the Termites varied across data collection points, and were not always comparable with measures administered to the general public.

This problem was addressed by McCullough et al.'s (2005) study of religious development among the Termites. These investigators rescored Termites' religiosity data from six time points on a uniform 0-to-4 scale (0 = *no importance or being actively antireligious*, 4 = *high importance, high interest, and high satisfaction gained from religion*). Because public surveys (e.g., Gallup Organization, 1965) also measure the importance of religion, we were able to compare religiosity levels scores from Terman's sample at four time points (as presented in McCullough et al., 2005, article) to religiosity scores obtained at approximately the same years for age-matched individuals from the general public. To accomplish this comparison, we reverse scored the three-point religiosity measure (1 = *very important*, 3 = *not important*) used in four public surveys (Gallup Organization, 1965, 1986; Yankelovich, Skelly, & White, Inc, 1978; Yankelovich Clancy Shulman, Inc., 1991), and then rescaled the reversed scores to the 0-to-4 scale that was used by McCullough et al. (2005).[6]

Table 9 presents the findings. In all four comparisons, Terman's sample scored significantly lower on religiosity than the general public (the average of these effects was used in the meta-analysis as one of the extreme groups' studies). Admittedly, the years of data collection and ages of the two groups do not match perfectly. However, the results are so strong that it is difficult to imagine that more exact matching would make a difference.

These results are even more striking if the Termites' religious upbringing is considered. Terman and Oden (1959) reported that close to 60% of Termites reported that they received "very strict" or "considerable" religious training; approximately 33% reported receiving little training, and about 6% reported no religious training. This suggests that the Termites underwent changes in their religiosity after their childhood.

*The Hunter study.* Subotnik et al. (1989) compared findings from Terman's studies with findings from another group of gifted children. The latter sample consisted of graduates of Hunter College Elementary School who were 38 to 50 years old at the time of the comparison. The Hunter participants were tested approximately at the age of nine with the 1937 edition of the Stanford–Binet. Termites' intelligence was assessed with the 1916 edition of the Stanford–Binet. Because IQ scores based on the 1937 version are comparable with somewhat lower IQ scores based on the 1916 version, Subotnik et al. limited the Hunter group to individuals scoring 140 or greater (range: 140-196, $M = 159$); Termites' IQs ranged from 120 to 180, $M = 148$.

For the Hunter group, researchers administered a number of questions that were used earlier in the Terman study (Terman & Oden, 1959). Although these questions were not comparable with measures used in surveys of the U.S. public (R. F. Subotnik, personal communication, January 2012), the Hunter–Terman comparison is still informative. Because the religiosity measures did not show any gender differences, we present results only for the combined groups.

The Hunter and the Terman samples were asked to choose any number of possible sources of personal satisfaction from

a list that included religion. In Terman's sample ($N = 428$), 13.1% chose religion; 15.6% chose religion in the Hunter sample ($N = 147$), $Z$ of the difference < 1. Both samples were also asked to identify any number of variables related to success from a list that included religious/spiritual values. In Terman's sample ($N = 410$), 1.2% checked the religious option, compared with .4% in the Hunter group ($N = 139$), $Z < 1$. These results suggest that on an absolute level, religion was relatively unimportant to middle-aged adults who were identified as gifted in childhood in both samples. In addition, we speculate that if the Hunter sample is similar to the Terman sample with respect to religiosity, it too may be less religious than the general population.

In the Terman and the Hunter samples, a high intelligence level at an early age preceded lower religiosity many years later. However, our analyses of these results neither controlled for possible relevant factors at an early age (e.g., socioeconomic status) nor examined possible mediators (e.g., occupation) of this relation.

## Discussion

Results of the present meta-analysis demonstrated a reliable negative relation between intelligence and religiosity. The size of the relation varied according to sample type and the nature of the religiosity measure. The relation was weakest at the precollege level, although even in that group it was significantly different from zero. After correlations observed in college populations were corrected for range restriction of intelligence scores, the magnitude of the intelligence–religiosity relation at the college level was comparable with that at the non-college level.

The relation was also more negative when religiosity measures assessed religious beliefs rather than religious behavior. This difference brings to mind the distinction between intrinsic religious orientation (religion practiced for its own sake) and extrinsic religious orientation (using religion as a means to secular ends; Allport & Ross, 1967). Because religious behavior (e.g., attending church) can be enacted for reasons extrinsic to faith, they are more aligned with the concept of extrinsic religious orientation. Religious beliefs, which are held privately, appear more aligned with the concept of intrinsic religious orientation. In Allport and Ross's (1967) view, intrinsic religious orientation represents more normative or "truer" religiosity (for a review of this issue, see Cohen, Hall, Koenig, & Meador, 2005). Accordingly, the finding that intelligence is more negatively related to religious beliefs than to religious behavior supports the conclusion of a negative relation between the constructs of intelligence and religiosity. However, some limitations on this conclusion are noted below.

With one exception (Sherkat, 2010), the interpretations that follow focus on the assumption that intelligence affects religiosity rather than the reverse. To be sure, this assumption is not derived from our correlational data. Rather, it is derived from data indicating that intelligence develops earlier than does religiosity. Intelligence can be *reliably* measured at a very early age while religiosity cannot (e.g., Jensen, 1998; Larsen, Hartmann, & Nyborg, 2008). In their classic study, for example, H. E. Jones and Bayley (1941) showed that the mean of intelligence scores assessed at ages 17 and 18 (a) correlated .86 with the mean scores assessed at ages 5, 6, and 7; and (b) correlated .96 with the mean of intelligence scores assessed at ages 11, 12, and 13. Because intelligence can be measured at an early age, it can be used to predict outcomes observed years later. For example, Deary, Strand, Smith, and Fernandes (2007) reported a .69 correlation between intelligence measured at age 11 and educational achievement at age 16.

Unlike intelligence, religiosity assessed at an early age is a weak predictor of religiosity assessed years later. For example, Willits and Crider (1989) found only small to moderate correlations between religiosity at age 16 and that at 27 (.28 for church attendance and .36 for beliefs). O'Connor, Hoge, and Alexander (2002) found no relationship between measures of church involvement at ages 16 and 38.

The assumption that intelligence affects religiosity is also consistent with two of our findings: (a) In time gap studies, intelligence measured on one occasion predicted religiosity that was measured years later; and (b) Terman's study participants, who were selected at an early age on the basis of high intelligence scores, reported years later lower religiosity than the general public (participants in the Hunter study also showed this trend but the evidence in this case is indirect).

Below, we discuss three proposed reasons for the inverse relation between intelligence and religiosity. The first two—"atheism as nonconformity" and "cognitive style"—repeat (with some elaboration) explanations that were previously proposed in the literature. The third reason—"functional equivalence"—is (to the best of our knowledge) new.

### *Atheism as Nonconformity*

As noted hereinbefore, Argyle (1958) implied that more intelligent people are less likely to conform to religious orthodoxy. This notion incorporates two implicit assumptions. The first is that atheism can be characterized as nonconformity in the midst of religious majority. The second is that more intelligent people are less likely to conform. There is qualified empirical support for the first assumption and strong support for the second.

First, although the prevalence of religiosity varies widely among countries and cultures, more than 50% of the world population consider themselves religious. Using survey data collected by P. Zuckerman (2007) from 137 countries, Lynn et al. (2009) and Reeve (2009) observed a prevalence of 89.9% believers in the world and 89.5% believers in the United States. However, a recent Win-Gallup International (2012) poll of 59,927 persons in 57 countries found that only 59% of the respondents (60% in the United States) consider

themselves religious, a decline of 9% (13% in the United States) from a similar 2005 poll. Atheism might be considered a case of nonconformity in societies where the majority is religious. This is not so, however, if one grows up in largely atheist societies, such as those that exist in Scandinavia (P. Zuckerman, 2008).

People who do grow up in a religious environment are likely to believe and practice what is supported and espoused in their social environment (Gervais & Henrich, 2010; Gervais, Willard, Norenzayan, & Henrich, 2011). Still, what makes an atheist in a religious society a nonconformist is not only that most people are religious, but also that religion is more than a privately held belief. According to Graham and Haidt (2010), religious practices can serve to strengthen social bonds and ensure a group's continued existence. Ysseldyk, Matheson, and Anisman (2010) suggested that religion provides social identity and an "eternal" group membership. There is also empirical evidence suggesting that religiosity may be an in-group phenomenon, reinforcing prosocial tendencies within the group (see a review by Norenzayan & Gervais, 2012), but also predisposing believers to reject out-groups members (see meta-analysis by D. L. Hall, Matz, & Wood, 2010). To become an atheist, therefore, it may be necessary to resist the in-group dogma of religious beliefs. Not surprisingly, there is evidence of anti-atheist distrust and prejudice (Gervais, Shariff, & Norenzayan, 2011; Gervais & Norenzayan, 2012b; for a review, see Norenzayan & Gervais, 2012).

Intelligent people may be more likely to become atheists in religious societies, because intelligent people tend to be nonconformists. In a meta-analysis of seven studies, Rhodes and Wood (1992) found that more intelligent people are more resistant to persuasion and less likely to conform. In addition to the studies reviewed by Rhodes and Wood, three other investigations reported a significant negative relation between intelligence and conformity (Long, 1972; Smith, Murphy, & Wheeler, 1964; Osborn, 2005). Rhodes and Wood (1992) proposed that the greater knowledge that intelligent people possess allows them to be more critical and less yielding when presented with arguments or claims (cf. W. Wood, 1982; W. Wood, Kallgren, & Preisler, 1985). Recently, Millet and Dewitte (2007) reported a positive relation between intelligence and self-perceived uniqueness; this led them to propose that more intelligent people conform less because of their ability to be self-sufficient and to secure resources in isolation.

If more intelligent people are less likely to conform, they also may be less likely to accept a prevailing religious dogma.

## *Atheism and Cognitive Style*

As noted hereinbefore, the most common explanation for the inverse relation between intelligence and religiosity is that the intelligent person "knows better" than to accept beliefs that are not subject to empirical tests or logical reasoning (e.g., Nyborg, 2009). But why would intelligent people know better? It does not take a great deal of cognitive ability to understand that religion does not arise from scientific discourse. One does not generally hear from believers that their faith is based on fact or logic, but they continue to believe anyhow. What is it exactly about intelligent people that makes them more resistant to religion?

The answer to this question may be related to cognitive style. Dual processing models of cognition (e.g., Epstein, 1994; Kahneman, 2003; Stanovich & West, 2000) distinguish between analytic and intuitive styles (this distinction has also been called "system 2" vs. "system 1," "think" vs. "blink," etc.). Analytic thinking is controlled, systematic, rule-based, and relatively slow; intuitive thinking, in contrast, is reflexive, heuristic-based, spontaneous, mostly nonconscious, and relatively fast. We propose that more intelligent people tend to think analytically and that analytic thinking leads to lower religiosity. There is empirical support for both these hypotheses.

A common test of the tendency to use analytic thinking is Frederick's Cognitive Reflection Test (CRT; Frederick, 2005). This instrument assesses the ability to choose correct but intuitively unattractive answers, which is thought to reflect reliance on analytic thinking. CRT scores are positively associated with better performance on a number of heuristic problems (i.e., lesser susceptibility to misleading intuitions; Cokely & Kelley, 2009; Frederick, 2005; Toplak, West, & Stanovich, 2011; but see Campitelli & Labollita, 2010).

CRT scores are also positively related to intelligence, with correlations in the .40-.45 range (Frederick, 2005; Obrecht, Chapman, & Gelman, 2009; Toplak et al., 2011). There is also evidence linking higher intelligence to better performance on a variety of other heuristics and biases tasks (there are exceptions, however; see Stanovich & West, 2008). Importantly, Stanovich and West (2008) proposed that intelligent people are more able to override cognitive biases, not so much because they realize that the appealing intuition might be wrong or because they have the ability to find the more time-consuming logical solution. Instead, more intelligent people may be more capable of sustaining the cognitive effort needed for good performance on heuristics tasks.

There is strong evidence that analytic style, as measured by performance on heuristic tasks (e.g., CRT) or induced by priming is related to lower religiosity (Gervais & Norenzayan, 2012a; Pennycook, Cheyne, Seli, Koehler, & Fugelsang, 2012; Shenhav, Rand, & Greene, 2011). Interestingly, both Shenhav et al. (2011) and Gervais and Norenzayan (2012a) argued that religious beliefs are a matter of intuitive processes that can be overridden through analytic approach. In contrast, Pennycook et al. (2012) proposed that religious beliefs are actually counterintuitive (unwarranted on either logical or empirical grounds), and thus require more analytic scrutiny if they are to be rejected. Independent of the exact

mediating mechanism, we propose that intelligent people are less religious because they are more likely to use analytic processes.

There is some empirical support for our proposition. Both Shenhav et al. (2011) and Pennycook et al. (2012) administered intelligence measures in addition to measures of religiosity and cognitive style. Using a college sample, Shenhav et al. (2011) found a negative but not significant relation between intelligence and religiosity (mean $r = -.06$; see table 1). Using non-college samples in two studies, Pennycook et al. (2012) found significant correlations between two measures of intelligence and a measure of religious beliefs. Controlling for two measures of analytic style, these correlations were reduced from −.24 and −.15, *ps* < .05, to −.13, $p < .05$, and −.04, *ns*, respectively, in Study 1, and from −.13, and −.22, *ps* < .05, to −.02 and −.08, *ps* > .28, respectively, in Study 2.

In contrast, correlations between measures of analytic style and religiosity were lower but mostly remained significant when controlling for two measures of intelligence. In study 1, these correlations were reduced from −.33 and −.19, *ps* < .05, to −.26, $p < .05$, and −.11, $p < .10$, respectively; in Study 2, these correlations were reduced from −.29 and −.31, *ps* < .05 to −.25 and −.23, *ps* < .05, respectively. These results are consistent with the proposition that cognitive style mediates, at least in part, the negative relation between intelligence and religiosity.

Our proposition is also consistent with Stanovich and West's (2008) model, which links intelligence to bias override. We suggested hereinbefore that the rejection of religion does not necessarily require superior cognitive skills. In other words, neither bias override, according to Stanovich and West, nor religion override as stated above, depends that much on tools or ability that intelligent people are more likely to have. Instead, if one grows up in a religious community, rejecting theism probably requires a sustained cognitive effort. Intelligence may confer the ability to sustain such an effort (Stanovich & West, 2008).

## Functional Equivalence

In his introduction to the special *Personality and Social Psychology Review* issue on religion, Sedikides (2010) described a functional approach to religion that posits a "specific motive or need driving religious belief and practice" (p. 4). In this approach, religious beliefs and practices satisfy a number of needs, and need-fulfillment is a potential reason for adopting and maintaining religious beliefs. It is possible, however, that needs typically fulfilled through religion can also be fulfilled through other means. Specifically, some of the functions of religion may also be conferred by intelligence; that is, in some respects, religion and intelligence may be functionally equivalent.

We describe hereafter four functions that religion may provide: compensatory control, self-regulation, self-enhancement, and attachment. We propose that higher intelligence also provides these four benefits and, therefore, lowers one's need to be religious.

*Religiosity as compensatory control.* Religiosity can provide a sense of external control, that is, the perception that the world is orderly and predictable (as opposed to random and chaotic); religiosity can also provide a sense of personal control by empowering believers directly through their personal relations with God. In a series of studies, Kay and colleagues (Kay, Gaucher, Napier, Callan, & Laurin, 2008; Kay, Moscovitch, & Laurin, 2010; Laurin, Kay, & Moscovitch, 2008) showed that threatening a sense of personal control increased beliefs in God, particularly when the controlling nature of God was emphasized. According to these investigators, people who lose personal control take comfort in religion, because it suggests to them that the world is under God's control and, therefore, predictable and nonrandom. Kay, Gaucher, McGregor, and Nash (2010) also suggested that religiosity can confer a specific form of personal control when other forms of personal control are decreased. They cite evidence indicating that individuals whose personal control is threatened become more certain of the superiority of their religious beliefs, more determined to live in accordance with their faith, and more convinced that others would agree with their beliefs if they tried to understand them (McGregor, Haji, Nash, & Teper, 2008; McGregor, Nash, & Prentice, 2009). In sum, religiosity provides compensatory control when an individual's personal control beliefs are undermined.

Intelligence also confers a sense of personal control. We identified eight studies that reported correlations between intelligence and belief in personal control (Grover & Hertzog, 1991; Lachman, 1983; Lachman, Baltes, Nesselroade, & Willis, 1982; Martel, McKelvie, & Standing, 1987; Miller & Lachman, 2000; Prenda & Lachman, 2001; Tolor & Reznikoff, 1967; P. Wood & Englert, 2009). All eight correlations were positive, with a mean correlation (weighted by *df* of each study) of .29. In addition, higher intelligence is associated with greater self-efficacy—the belief in one's own ability to achieve valued goals (Bandura, 1997). This construct is similar to personal control beliefs but has been examined separately in the literature. In a meta-analysis of 26 studies, the mean correlation between intelligence and self-efficacy was .20 (Judge, Jackson, Shaw, Scott, & Rich, 2007).

If more intelligent people are higher in personal control beliefs or self-efficacy, then they may have less need for the sense of control offered by religion.

*Religiosity as self-regulation.* McCullough and Willoughby (2009) presented evidence that religiosity is associated (albeit weakly) with positive outcomes, including well-being and academic achievement. They suggested that self-regulation (adjusting behavior in the pursuit of goals) and self-control (forgoing small, immediate rewards to increase the likelihood of obtaining larger, but delayed rewards) might

mediate the association between religiosity and positive outcomes. The researchers presented evidence from cross-sectional, longitudinal, and experimental studies showing that religiosity promotes self-control. They marshaled additional evidence indicating that religiosity facilitates the completion of each component of the self-regulation process, including goal setting, monitoring discrepancies between one's present state and one's goals, and correcting behavior to make it more compatible with one's goals. Finally, McCullough and Willoughby presented evidence indicating that self-control and/or self-regulation mediate the relation between religiosity and positive outcomes. Consistent with that review, Rounding, Lee, Jacobson, and Ji (2012) found that participants primed with religious concepts exercised better self-control; in addition, priming religious concepts renewed self-control in participants whose ability to exercise self-control had been depleted.

A more nuanced model of the relation between religiosity and self-control was proposed by Koole, McCullough, Kuhl, and Roelofsma (2010). They proposed that intrinsic religiosity facilitates implicit self-regulation whereas extrinsic religiosity (as well as fundamentalism) facilitates explicit self-regulation. Focusing on the implicit aspect of this dichotomy, Koole et al. argued that the components of intrinsic religiosity (holistic approach to well-being, integration of cognitive processing, and embodiment) draw on the same processes that are used in the service of implicit self-regulation. They reviewed a large number of findings consistent with this model. For example, the relation between intrinsic religiosity and implicit self-regulation of *action* was illustrated by evidence showing that priming religious concepts increases prosocial behavior (Randolph-Seng & Nielsen, 2007); and the relation between intrinsic religiosity and implicit self-regulation of *affect* was illustrated by evidence showing that praying for someone reduced anger after provocation (Bremner, Koole, & Bushman, 2011).

Intelligence is also associated with better self-regulation and self-control abilities. The classic test of such abilities is the delay of gratification paradigm in which participants choose between a small immediate reward and a large delayed reward (Block & Block, 1980). Choosing the large delayed reward serves as an indicator of self-control. Shamosh and Gray (2008) meta-analyzed the relation between intelligence and delay discounting (the latter construct is identical to delay of gratification except that high delay discounting indicates poor self-control). Their analysis, based on 26 studies, yielded a mean $r$ of −.23. This suggests that intelligent people are more likely to delay gratification (i.e., less likely to engage in delay discounting).

Two of the studies included in the Shamosh and Gray (2008) meta-analysis (de Wit, Flory, Acheson, McCloskey, & Mannuck, 2007; Dolan & Fullam, 2004), and a third study by Dom, De Wilde, Hulstijn, and Sabbe (2007), utilized the Barratt Impulsiveness Scale (BIS; Barratt, 1985; Patton, Stanford, & Barratt, 1995). All three studies reported negative correlations between intelligence and impulsiveness. In the Dolan and Fullam (2004) study, intelligence was negatively related to two other impulsiveness scales besides the BIS and to three behavioral measures of impulsiveness besides the delay of gratification task.

Shamosh and Gray (2008) offered a number of explanations for the relation between intelligence and self-control. They argued that delay of gratification may require working memory to maintain representations of delayed rewards while processing other types of information (e.g., opportunity costs of forgoing immediate rewards). More intelligent people have better working memories (for a review, see Ackerman, Beier, & Boyle, 2005), which may explain why they have better self-control. Alternatively, Shamosh and Gray proposed that delay of gratification requires "cool" (more rational) executive functioning rather than "hot" (more affective) executive functioning. More intelligent people, suggested Shamosh and Gray, are more likely to engage the cool system and may therefore be better able to exercise self-control. Regardless of the mechanism, if more intelligent people have better self-regulation and/or self-control capabilities, then they may have less need for the self-regulatory function of religiosity.

*Religiosity as self-enhancement.* As stated by Sedikides and Gebauer (2010), "people are motivated to see themselves favorably . . . Stated differently, people are motivated to self-enhance" (p. 17). Meta-analyses by Trimble (1997) and Sedikides and Gebauer indicated that intrinsic religiosity is positively related to self-enhancing responses although extrinsic religiosity is not. To explain these findings, Sedikides and Gebauer proposed that religious cultures approve of being religious as an end in itself, which can turn intrinsic religiosity into a source of self-worth. Religious cultures disapprove, however, of using religion as a means to secular ends, which may explain the disassociation between extrinsic religiosity and self-enhancement. In support of this model, Sedikides and Gebauer showed that in more religious cultures, (a) the positive relation between intrinsic religiosity and self-enhancement was more positive, whereas (b) the low or negative relation between extrinsic religiosity and self-enhancement was more negative. Yet another reason for the association between intrinsic religiosity and self-enhancement may be the elevated status that believers can derive from personal relationships with God (Sedikides & Gebauer, 2010; see also Batson, Schoenrade, & Ventis, 1993; Exline, 2002; Reiss, 2004).

Like religiosity, intelligence may provide a sense of higher self-worth. Evidence for this comes from two lines of research. First, a number of studies examined the relation between intelligence and self-esteem. While one study (Gabriel, Critelli, & Ee, 1994) reported no association between the two constructs ($r$ = −.02), three other studies (Judge, Hurst, & Simon, 2009; Lynch & Clark, 1985; Pathare & Kanekar, 1990) reported significant albeit small positive

correlations (*r*s = .18, .27, and .16, respectively). A second line of research linking higher intelligence to higher self-worth concerns the relation between intelligence and general factors of personality. Harris (2004) reduced 10 personality scales to two factors—openness and achievement—that correlated .15 and .26, respectively, with intelligence. Schermer and Vernon (2010) reduced 20 personality scales to a single general factor of personality that correlated .27 with intelligence. These authors proposed that high scores on the general personality factor represent high self-esteem, emotional stability, agreeableness, conscientiousness, and openness—all strongly positive attributes. If intelligent individuals see themselves as possessing such attributes, then they might have less need for the self-enhancement function of religion.

*Religiosity as attachment.* Kirkpatrick (2005) proposed that religious beliefs can be conceptualized as an attachment system (Bowlby, 1980), which can confer security and safety in times of distress. Believers, suggested Kirkpatrick, experience personal love of God (or some other supernatural entity) whose omnipresence serves as refuge and safe haven. There are two models of the association between religiosity and attachment (Granqvist, Mikulincer, & Shaver, 2010; Kirkpatrick, 1998). According to the first, the compensation model, people turn to God as an attachment figure when they experience loss due to separation, death of loved ones, and other dire circumstances. According to the second, the correspondence model, people extend to God the same attachment system that they have developed with close others. This latter model does not posit a clear religious function and, therefore, is not relevant to the notion of functional equivalence.

There is strong support for the compensation model. For example, S. L. Brown, Nesse, House, and Utz (2004) found that religiosity increased following bereavement and, in turn, was associated with less grief. Evidence also indicates that religiosity increases after people are exposed to threat of loneliness (Epley, Akalis, Waytz, & Cacioppo, 2008). In two other studies (Kirkpatrick & Shaver, 1992; Kirkpatrick, Shillito, & Kellas, 1999), participants reporting a secure personal relationship with God also reported less loneliness.

Intelligence also lowers loneliness through its effects on marital relations. Specifically, evidence suggests that more intelligent people are more likely to marry and less likely to get divorced. Terman and Oden (1947) reported that, as of the 1930s, the prevalence of marriage in their high IQ sample exceeded that of the general population. Similarly, Quensel (1958) found that as intelligence increases, so does the likelihood of being married. Herrnstein and Murray (1994) found that by age 30, marriage rates are lower at high and low ends of the intelligence spectrum. However, the low marriage rate observed among highly intelligent people could reflect a tendency of more intelligent people to marry late. Blazys (2009) examined marriage rates up to an average age of 43 and found that more intelligent people are less likely to marry early but, as they become older, they are more likely to be married than less intelligent individuals.

Turning to divorce rates, Herrnstein and Murray (1994) and Holley, Yabiku, and Benin (2006) found negative associations between intelligence and the likelihood of divorce. Blazys (2009) reported the same negative association for Caucasians but found no significant relation for African Americans and Hispanics. Finally, Dronkers (2002) found a negative relation between intelligence and likelihood of divorce for a Dutch cohort born in 1958, but a positive relation for a cohort born in 1940. When the data on marriage and divorce rates are considered together, on balance more intelligent people appear more likely to be married.

Most explanations for the association between intelligence and marital status focus on the ability of intelligent people to plan more effectively, to act less impulsively, to adapt to changes, and so on. Regardless of the mediator, if intelligent people are more likely to be married, then they may have less of a need to seek religion as a refuge from loneliness.

## The Focus on Intrinsic Religiosity

A common theme in most, although not all, of the interpretations hereinbefore is that they focus on intrinsic religiosity. Sometimes this focus is stated explicitly. Other times, the focus is described as religious beliefs, which (as noted hereinbefore) are more strongly related to intrinsic religiosity than is religious behavior. For example, analytic thinking (a possible mediator of the relation between intelligence and religiosity) has been shown to undermine religious beliefs. Of the four functions that are associated with religiosity and intelligence, self-enhancement was exclusively related to intrinsic religiosity. The remaining functions—compensatory control, self-regulation, and attachment—are mostly functions of religious beliefs. Only the conceptualization of atheism as nonconformity stands out in this regard. One can certainly resist religious practice as much as one can resist religious beliefs. Of course, resisting religious practice can signal a search for a higher level, "purer" form of religion as much as it can signal a step toward atheism.

Measures of religious behavior do not elucidate the reason for attending church, belonging to religious organizations, or engaging in other religious practices. We argued earlier that because these reasons can be extrinsic to faith, the behaviors measured might reflect extrinsic religiosity. Because most of the proposed interpretations focus on intrinsic religiosity and/or religious beliefs, they lead to the prediction that intelligence would be more negatively related to religious beliefs than to religious behavior. The results are consistent with this prediction.

However, it has been noted that viewing religious beliefs as the more genuine or as the intrinsic component of religiosity characterizes American Protestant religion (Cohen et al., 2005). Judaism and "catholic" Christianity, Cohen et al.

(2005) argued, view religious rituals and practice at least as important or central as religious beliefs. Perhaps, then, the stronger negative relation between intelligence and religious beliefs (relative to religious behavior) may be less true for Judaism and Catholicism. That is, when Judaism and Catholicism are concerned, perhaps the concept of functional equivalence might encompass not only the function of religious beliefs, but also the functions of religious practice. This issue is left for future research.[7]

### Other Interpretations

As mentioned in the introduction, Kanazawa (2010a) and Sherkat (2010) proposed two additional interpretations of the negative relation between intelligence and religiosity. Kanazawa (2010a) argued that more intelligent people are better equipped to deal with evolutionarily novel phenomena, including atheism. Sherkat suggested that sectarian affiliations and Christian fundamentalism block access to secular knowledge and, thereby negatively impact verbal ability. We comment briefly on these views below.

Kanazawa's (2010a) interpretation is based on the assumption that evolution favored the development of religion. This assumption is readily acceptable, particularly in view of the functions that religion seems to provide. He also argued that atheism is evolutionarily novel because, except for former communist societies, it is not mentioned in the description of any culture in *The Encyclopedia of World Cultures*. However, it is rather difficult to write about atheism because, unlike theism, it does not produce (religious) relics and is not associated with (religious) customs. Thus, although it is not mentioned in the *Encyclopedia*, atheism could have existed all along, together with theism. In addition, it is possible to consider monotheism as evolutionarily novel instead of part and parcel of all preceding beliefs in the supernatural; this will negate the basic rationale of Kanazawa's (2010a) approach. Finally, it is not clear that atheism belongs to the category of evolutionarily novel *problems* that intelligence addresses (unless atheism is considered problematic because it does not provide the functions that religion does).

On the other hand and in line with Kanazawa's (2010a) model, genetic influences have been implicated not only in intelligence (cf., Nisbett et al., 2012b), but also in religiosity (D'Onofrio, Eaves, Murrelle, Maes, & Spilka, 1999; Koenig, McGue, & Iacono, 2008). Furthermore, the model was used to predict other correlates of intelligence (e.g., political liberalism and, for men, monogamy), and those predictions received empirical support. In conclusion, Kanazawa's (2010a) interpretation remains an intriguing possibility.

Sherkat's (2010) interpretation, while limited to Christian fundamentalism and verbal ability, alerts us to some potential effects of religiosity on intelligence. It is likely that such effects take time to develop, as those who are denied learning fall more and more behind, over time, in comparison with those with access to knowledge. A test of these effects requires a longitudinal study.

### Trajectory of the Intelligence–Religiosity Connection

The mechanisms through which intelligence affects religiosity may vary across the life span. At college, for example, more intelligent students may be more likely to embrace atheism as a form of nonconformity; at a more advanced age, intelligent people may be more likely to embrace atheism because they are more likely to be married and, therefore, may be less reliant on the attachment function that religion provides. We address in the following section, the question of when mediators of the intelligence–religiosity relation come into play. Importantly, this section does *not* review the life span trajectory of religiosity; rather, we focus only on the relation of religiosity with intelligence. In addition, much of the following discussion is speculative.

Human beings are psychologically predisposed to develop religious beliefs (Barrett, 2004; Boyer, 2001; Guthrie, 1993). Biases or tendencies of the human mind that support religiosity include misattributions of intent to naturally occurring events (Kelemen, 2004; Kelemen & Rosset, 2009) and belief in disembodied mind as an attribute of supernatural deities (Bering, 2006; Bloom, 2007; Norenzayan, Gervais, & Trzesniewski, 2012). As noted hereinbefore, however, Gervais, Willard, et al. (2011) argued convincingly that variations in beliefs across societies depend heavily on social contexts. That is, an individual is likely to believe only in supernatural entities that are espoused in that person's surroundings; in religious societies, those who do otherwise risk being labeled as heretics. This context-bound approach might explain the weak relation between intelligence and religiosity in precollege populations.

During adolescence, there is a strong relation between religiosity of parents and that of their children (Cavalli-Sforza, Feldman, Chen, & Dornbusch, 1982; Gibson, Francis, & Pearson, 1990; Hoge, Petrillo, & Smith, 1982). As adolescents grow older, these associations decrease such that correlations between childhood religious socialization and religiosity in adulthood are weak or nonexistent (Arnett & Jensen, 2002; Hoge, Johnson, & Luidens, 1993; Willits & Crider, 1989). If religiosity in adolescence is largely a function of parental instructions and example, then it will be only minimally influenced by attributes of the person, including intelligence.

College exposes people to new ideas and influences, which can impact religious beliefs. Students' beliefs become more secular in college (Funk & Willits, 1987; Madsen & Vernon, 1983), and religious service attendance decreases (Hunsberger, 1978; Lefkowitz, 2005). However, there are also reports of an increase in religious commitment and intrinsic religiosity during this period (De Haan & Schulenberg, 1997; Stolzenberg, Blair-Loy, & Waite, 1995).

These changes are often a consequence of the self-exploration that typifies emerging adulthood and that is often observed in college students (Arnett, 1997, 1998; Greene, Wheatley, & Aldava, 1992; Lefkowitz, 2005). The separation from home and the exposure to a context that encourages questioning may allow intelligence to impact religious beliefs. Using analytic (as opposed to intuitive) thinking, more intelligent college students may be more likely to eschew religion. If atheism is disapproved of at home, higher intelligence may facilitate resistance to conformity pressure. These mechanisms might explain why the negative relation between intelligence and religiosity increases in college. However, as noted by Kosa and Schommer (1961), religious colleges may offer an exception to this trend.

The exploration that characterizes the college years continues later (Arnett & Jensen, 2002). However, those who transition to atheism during college may face unanticipated challenges. Outside of academic contexts, most societies are religious, and atheists are viewed with distrust (Gervais, Shariff, et al., 2011). We speculate that more intelligent people are better able to address these challenges through some of the aforementioned intelligence-related functions. These functions may take time to develop. For example, intelligent people typically spend more time in school—a form of self-regulation that may yield long-term benefits. More intelligent people get higher level jobs (Herrnstein & Murray, 1994), and better employment (and higher salary) may lead to higher self-esteem, and encourage personal control beliefs. Last, more intelligent people are more likely to get and stay married (greater attachment), though for intelligent people, that too comes later in life (Blazys, 2009). We therefore suggest that as intelligent people move from young adulthood to adulthood and then to middle age, the benefits of intelligence may continue to accrue. Thus, after college, the degree to which intelligence obviates the functions of religion may gradually increase over time.

The religious practices and beliefs adopted during college and in subsequent years are often retained for the remainder of the life span. McCullough et al. (2005) reported that (unlike the weak relation between religiosity in the precollege years and religiosity in adulthood) there is considerable rank-order stability in religiosity from the early 20s to the end of life. However, these investigators also noted that in addition to interindividual stability, there are also intraindividual changes as people increase and decrease in religiosity over time. For example, most people become more religious when they get married and have children, but become less religious when their children leave home (Ingersoll-Dayton, Krause, & Morgan, 2002; McCullough et al., 2005; Sherkat & Wilson, 1995; Stolzenberg et al., 1995). If the rank order of religiosity is stable, then its relation to intelligence should also be stable.

However, aging (particularly if accompanied by declining health) is likely to increase awareness of mortality. Religious beliefs can help manage the terror of one's impending death (for a review, see Vail et al., 2010). This function was not included in our discussion of functional equivalence because, to the best of our knowledge, there is no evidence pertaining to the relation between intelligence and death anxiety. Although this logic suggests that the negative relation between intelligence and religiosity might decline at the end of life, the relevant evidence we have indicates otherwise. The highly intelligent members of Terman's sample retained lower religiosity scores (relative to the general population) even at 75 to 91 years of age (Table 9). Additional research is needed to resolve this issue.

### *Limitations*

The available data did not allow adequate consideration of the role of religion type and of culture. As mentioned hereinbefore, the articles included in the meta-analysis did not provide enough information to code religion type as a potential moderator. There was also not enough information to consider the role of culture in the intelligence–religiosity association. Of the 41 studies in the college and no-college groups (the populations on which we base most of our conclusions), 33 were conducted in the United States; the remainder were conducted in Canada (3), Australia (2), Belgium and Holland (1 each); finally, one study was conducted in several countries but primarily (87% of participants) in the United States, Canada, and the United Kingdom. Clearly, the present results are limited to Western societies.

Earlier we alluded to some possible effects of religion type and culture. Specifically, it was mentioned that the emphasis on beliefs as the intrinsic component of religiosity (and, as such, the component with stronger negative relation to intelligence) might be an attribute of American Protestant religion, and may be less true of Judaism and Catholicism (Cohen et al., 2005). Stated differently, the stronger negative relation of intelligence with religious beliefs may also be limited to American Protestant population.

We also mentioned above that atheism is not likely to be considered nonconformist in majority atheist societies, like Scandinavian societies (P. Zuckerman, 2008). Atheism may also lose its association with nonconformity in majority atheist subcultures, such as the subculture of scientists (Larson & Witham, 1998). One might even speculate that in majority atheist societies, atheism is associated with conformity rather than nonconformity. Even in these societies, however, several other proposed causes of the negative relation between intelligence and religiosity remain intact. First, religion remains negatively linked to analytic style, which characterized more intelligent people. Second, although religion in atheist society is not likely to be self-enhancing, it probably continues to provide functions such as compensatory control, better self-regulation, and a means of reducing loneliness through attachment to God. To the extent that intelligent people have less need for these functions, they are less likely to be religious. Obviously, these conclusions are a topic for future research.

One last limitation of the present work is the lack of evidence supporting our explanations for the intelligence–religiosity association. Except for the extreme case of religious fundamentalism (Sherkat, 2010), we clearly posited a causal relation from intelligence to religion and identified specific mechanisms to account for it. As described below, the edifice we built is in need of empirical testing.

## Conclusion

The present work comprises two parts. The first part was a meta-analysis of the relation between intelligence and religiosity. The second part examined possible explanations for the relation that was observed.

Results of the meta-analysis established a reliable negative relation between intelligence and religiosity. It was also shown that this relation is weaker in precollege populations relative to college and non-college populations. Additional analyses demonstrated that the relation is more negative when religiosity measures assessed religious beliefs as opposed to religious behaviors. It was proposed that religious beliefs are more likely to represent intrinsic religiosity (and perhaps "truer" religion), at least for the samples examined herein. At the precollege level, the mean correlation (unweighted and weighted) between intelligence and beliefs-based measures of religiosity was −.08; at college and non-college levels, the corresponding unweighted and weighted mean correlations ranged from −.20 to −.25.

We reviewed a number of explanations for the negative relation between intelligence and religiosity, as well as the reasons that this association changes with age. All of the proposed explanations involve mediators that are linked to intelligence and religiosity. For example, one of the functional interpretations was that intelligence and religiosity allow the individual to exercise better self-regulation, and that intelligence leads to lower religiosity because it obviates the need for the self-regulatory function of religion. However, with the exception of Shenhav et al. (2011) and Pennycook et al. (2012), the meta-analyzed studies did not measure the proposed mediators, thus precluding the possibility of mediation analyses. In addition, we found no longitudinal research that examined the relation between intelligence and religiosity at several time points. These limitations can be overcome through future research that utilizes a longitudinal design and assesses intelligence, religiosity, and the proposed mediators. Such research might shed light on the causal direction of the intelligence–religiosity relation and on our proposed explanations for this relation.

On a more general level, the functional approach to religion (Sedikides, 2010) is in its infancy. In future, the list of functions is likely to be expanded and the relations among functions are likely to be elaborated. It remains to be seen whether higher intelligence confers not only the functions discussed in this paper but also functions that are yet to be discovered. In addition, the concept of functional equivalence might also be expanded to explain lower religiosity of other distinct groups who are in less need of the functions that religion provides. Finally, functional equivalence might be complemented by a concept of functional deficiency. Inasmuch as people possessing the functions that religion provides are likely to adopt atheism, people lacking these very functions (e.g., the poor, the helpless) are likely to adopt theism.

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### Notes

1. Kanazawa conducted these analyses in response to our request (S. Kanazawa, personal communication, April 2012).
2. The formula for correcting $r$ for range restriction is (Sackett & Yang, 2000):

$$\hat{\rho}_{xy} = \frac{(S_x / s_x) r_{xy}}{[1 + r_{xy}^2 (S_x^2 / s_x^2 - 1)]^{1/2}},$$

   where $S_x$ and $s_x$ are standard deviations of the unrestricted and restricted $x$ distributions, respectively; $r_{xy}$ is the correlation between $x$ and $y$ for the restricted $x$ distribution (see Sackett & Yang, 2000, for a general discussion of range restriction and a classification scheme of range-restriction scenarios).
3. In the meta-analysis, we used the raw "uncorrected" correlation that Bertsch and Pesta (2009) reported.
4. The formula for converting $r$ to Cohen's $d$ is (Rosenthal, 1991):

$$d = \frac{2r}{\sqrt{1 - r^2}}.$$

5. The trim and fill method identified $r = -.23$ for the college group, which becomes $r = -.33$, after correction for range restriction. This latter value is higher than weighted and unweighted mean correlations in the non-college group. However, this value is hypothetical and should be treated with caution.
6. Means on the 1-to-3 scale were rescaled to means on the 0-to-4 scale by subtracting one point from each mean and multiplying the difference by 2 (e.g., a mean of 3 on the 1-to-3 scale will become a mean of 4 on the 0-to-4 scale); standard deviations

of scores on the 1-to-3 scale were multiplied by 2 to accomplish the same rescaling procedure.

7. Note also the paradox that our emphasis on intrinsic religiosity creates. On one hand, we suggest that it is intrinsic religiosity (aka religious beliefs) that provides the functions common to religiosity and intelligence. On the other hand, any discussion of the functions that religion may provide, treats religiosity as extrinsic rather than intrinsic. Additional complications arise because of the proposed distinction between two forms of extrinsic religiosity—social extrinsic orientation (attainment of social benefits) and personal extrinsic orientation (overcoming personal problems; Gorsuch &McPherson, 1989). Interestingly, Flere and Lavric (2008) showed that in religious groups other than American Protestant sample, personal extrinsic and intrinsic religious orientations form a single dimension that is distinct from social extrinsic orientation. Clearly, intrinsic and extrinsic religious orientations are not as distinct as they appeared to be in Allport and Ross's (1967) original conceptualization.

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