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Religious Americans Have Less Positive Attitudes Toward Science, but This Does Not Extend to Other Cultures

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Abstract

It is commonly claimed that science and religion are logically and psychologically at odds with one another. However, previous studies have mainly examined American samples; therefore, generalizations about antagonism between religion and science may be unwarranted. We examined the correlation between religiosity and attitudes toward science across 11 studies including representative data from 60 countries ($N = 66{,}438$), nine convenience samples from the United States ($N = 2{,}160$), and a cross-national panel sample from five understudied countries ($N = 1{,}048$). Results show that, within the United States, religiosity is consistently associated with lower interest in science topics and activities and less positive explicit and implicit attitudes toward science. However, this relationship is inconsistent around the world, with positive, negative, and null correlations being observed in various countries. Our findings are inconsistent with the idea that science and religion are necessarily at odds, undermining common theories of scientific advancement undermining religion.

Keywords

religion, science attitudes, cross cultural, religiosity, secularization

In 1875, Draper published his *History of the Conflict between Religion and Science*, and in 1896, White published in two volumes his *A History of the Warfare of Science With Theology in Christendom*: Ever since, the relationship between science and religion—Christianity in particular—has been widely seen as one of intrinsic antagonism. Just a few decades later, the events of the 1925 Scopes Trial over a law in Tennessee forbidding the teaching of evolution in state-funded schools seemed to illustrate the point well. The "conflict thesis" has since become the dominant description of the relationship between science and religion, assumed by many members of the general public and by the media (Ecklund et al., 2016; Funk & Alper, 2015; Rios et al., 2015).

Social and psychological scientists have also recently theorized in this direction, offering explanations for why such a conflict might exist. For example, because religious people tend to de-emphasize reflective cognitive styles (Pennycook et al., 2016), they may therefore find empirical science less attractive. Science and religion may also conflict epistemologically because both provide competing avenues for understanding the world (Evans & Evans, 2008). Additionally, secularization theories have proposed that, as people come to understand the world though science, they replace religious ideas and institutions with secular ones (Durkheim, 1915; Norris & Inglehart, 2011).

Although many of the events covered by Draper and White were European, both men worked in the United States, which has a unique religious history that might make the relationship between science and religion particularly difficult. For example, biblical literalism is rare in European Christianity, but commonplace throughout the United States from the 20th century onward (Scott, 2006). The pervasiveness of this aspect of religious fundamentalism has impacted policy decisions throughout the United States. There have been multiple court cases since the Scopes Trial concerning the teaching of evolution and creationism in public schools (Court of Appeals, 2016; Lewandowski, 2013), and several states have implemented policies to favor religious teachings over scientific teachings in the classroom (Agency, 2015; Baker, 2012; Mead & Mates, 2009;

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Selman et al., 2005). In contrast, this has not happened in the United Kingdom or other European countries including those for whom Christianity is the state religion. Additionally, there is some evidence that religious beliefs influence U.S. Senators' legislative behaviors more broadly (Arnon, 2018). Other studies have also found that religiosity is negatively correlated with science knowledge (McPhetres & Zuckerman, 2018; Sherkat, 2011) and that religious people are less likely to choose careers in science (Scheitle & Ecklund, 2016).

With few exceptions, almost all prior work on the relationship between religiosity and attitudes toward science has been conducted within the United States (Ecklund et al., 2016; Scheufele et al., 2009). It therefore remains unclear whether the antipathy toward science evinced by American Christians is a fundamental characteristic of religious belief or if it simply reflects a history and culture specific to the United States. Across 11 studies, we examined the relation between religiosity and attitudes toward science. We employed various measures of attitudes toward science and obtained data from the United States and 61 other countries.

The religiosity measures differ somewhat among studies but all incorporated belief and/or practice items that are common to most religions. In our opinion, such measures are preferable to questions of religious affiliation as the latter might depend on factors (e.g., religiosity of parents, social ties) that have little to do with religious *belief*. In addition, the meaning of any specific affiliation differs among cultures, which makes interpretation of results more difficult. Gathering data from a number of countries and using varied measures of science attitudes with preregistered direct replications will increase generalizability of the results.

Within the United States

Studies 1–5b

Initial evidence for the negative relation between religion and science within the United States comes from nine original studies (see Table S1 for complete demographics). These studies were conducted in an attempt to experimentally manipulate the relation between science and religion. These attempts were not successful likely because they relied on priming techniques that have been shown to be unreliable.

Particularly, the notion of priming in social psychology—that is, unconsciously activating one concept and then observing its influence on a subsequent concept—was a staple in social psychological research for many years. This body of evidence exists in an attempt to demonstrate that humans have little to no control over their thoughts, beliefs, and actions (Bargh, 1989). The basic assumptions of the technique are that the priming should be "incidental" and occur "without the person's awareness" (Bargh et al., 1996; Williams & Bargh, 2008), meaning that the two concepts should not *seem to be* related, but actually are. The participants' lack of awareness of the relation between the independent variable and the dependent variable is taken as evidence that the process is automatic (Bargh, 1989; Bargh et al., 1996).

A variety of studies relying on these priming techniques have been the subject of many recent replication attempts (e.g., Caruso et al., 2017; Chabris et al., 2019; Harris et al., 2013; McCarthy, 2014; O'Donnell et al., 2018; Pashler et al., 2013; Rohrer et al., 2015; Verschuere et al., 2018), none of which have been successful. Several further unsuccessful replication attempts focus specifically on priming concepts related to religion (Gervais, McKee, & Malik, 2018; Gomes & McCullough, 2015; Paulson et al., 2018; Sanchez et al., 2017; Saribay, 2020; Stagnaro et al., 2019; Verschuere et al., 2018). Thus, while not a focus of this article, these studies add to the mounting evidence that (behavioral or social) priming is unreliable and nonreplicable.

Despite the lack of experimental effects, a negative correlation between religiosity and attitudes toward science was consistently identified across the studies and it is this result that we focus on in this article. Full details of each experiment are described in Supplementary Materials.

Method and Materials

Each study (with the exception of Studies 1 and 2a) consists of an initial preregistered study (e.g., Study 3a) followed by a preregistered direct replication of that study (e.g., Study 3b). In each study, we used the same 6-item measure of religiosity (e.g., "I believe in God," "I consider myself religious"; Cohen et al., 2008) with higher scores indicating greater religiosity. The studies used a variety of techniques to "prime" either the concept of religion or science (see details in Supplementary Materials) and then to observe effects on attitudes toward science or religion. The measures of science attitudes varied across studies; details are displayed in Table 1

Results

For each study, the measure of science attitudes was regressed onto the religiosity measure, experimental condition, and their interactions simultaneously. As shown in Figure 1, greater religiosity scores were negatively related to interest in science-related activities and in reading or learning about science-related topics. Greater religiosity scores were also associated with more negative implicit and explicit attitudes toward science. These effects remained consistent while controlling for age, gender, education, and ethnicity. The main effect of religiosity and the partial correlations is depicted in Figure 1; regression coefficients are presented in Supplementary Materials (see Table S2). Additionally, zero-order correlations yield highly similar results (see Table S3).

Around the World

Study 6

To examine whether the relations observed within the United States held around the world, we accessed the World Values

Table 1. Descriptions of dependent variables used in Studies 1–5b.

Study	Measure Name	Example Items	Scale Range	α Reliability
Study 1	Interest in Science Topics	Rated level of interest in 30 topics presented alphabetically: science topics (e.g., biology, physics, robotics) and neutral topics (e.g., books, cars, music)	1 (*not interested*) 7 (*extremely interested*)	Science: $\alpha = .94$ Neutral: $\alpha = .74$
Study 2a Study 2b	Explicit Science Attitudes	"It is not important to know about science in everyday life" (rev. coded) "The world is better because of science"	1 (*strongly disagree*) 7 (*strongly agree*)	2a: $\alpha = .78$ 2b: $\alpha = .68$
Study 2a Study 2b	Implicit Science Attitudes (IAT)	Single category IAT; rating science words (e.g., laboratory, experiment) as either good (e.g., positive, useful) or bad (useless, hurtful)	−2 (more negative) +2 (more positive)	—
Study 3a Study 3b	Interest in Science Topics	"We would like to get an idea of the kinds of topics you are interested in. Given the opportunity, would you like to read about the following topics?" Participants rated the same 30 topics from Study 2.	1 (*not interested*) 7 (*extremely interested*)	3a Science: $\alpha = .94$ Neutral: $\alpha = .79$ 3b Science: $\alpha = .95$ Neutral: $\alpha = .81$
Study 4a Study 4b	Interest in Science Topics	"We would like to get an idea of the kinds of topics you are interested in. Given the opportunity, would you like to read about the following topics?" Participants rated the same 30 topics from Study 2	1 (*not interested*) 7 (*extremely interested*)	4a Science: $\alpha = .94$ Neutral: $\alpha = .81$ 4b Science: $\alpha = .94$ Neutral: $\alpha = .81$
Study 5a Study 5b	Science Interest Scale	"I like to watch television programs about science" "I would like to learn more about the planets and stars"	1 (*strongly disagree*) 7 (*strongly agree*)	5a: $\alpha = .92$ 5b: $\alpha = .90$

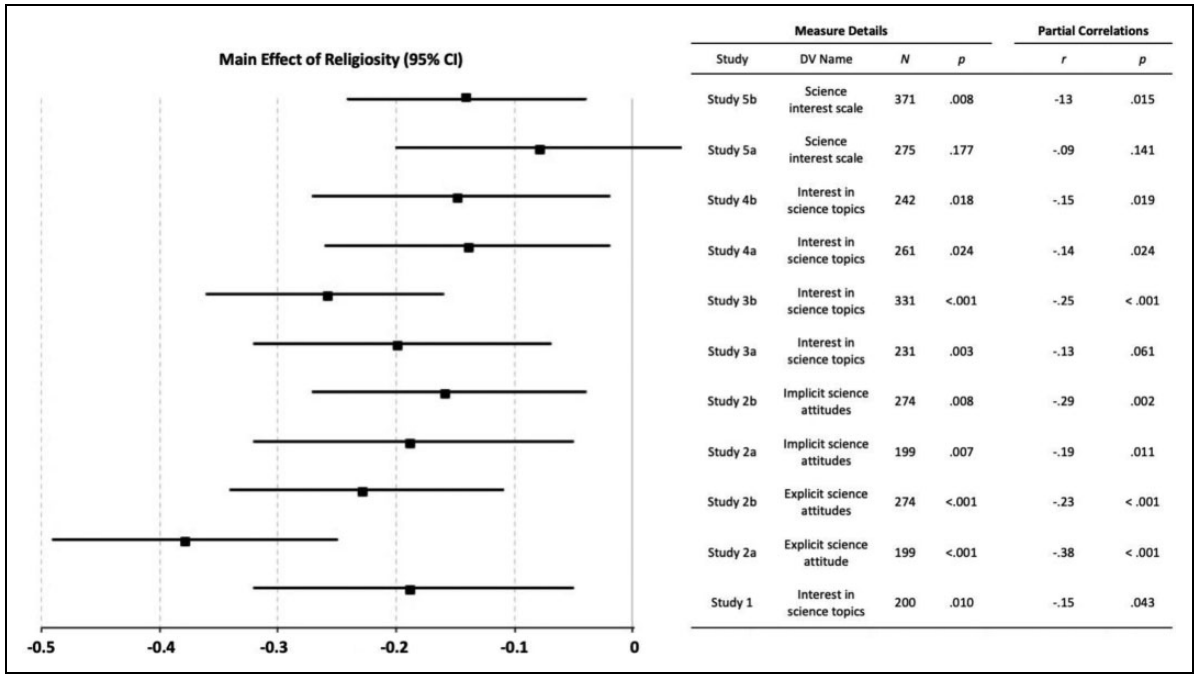

Figure 1. Correlations and confidence intervals for the relation between religiosity and various measures of science attitudes from nine studies within the United States. *Note*. The forest plot depicts correlation coefficients (Pearson's *r*) controlling only for experimental condition, while the partial correlations controlling for demographics (age, gender, education, and dummy codes for ethnicity) are reported on the right-hand side of the figure.

and European Values Survey (WEVS) data (Inglehart et al., 2016) as an initial investigation. Data were available from 66,438 participants from 60 countries.

Materials

Science attitudes were measured using a composite of 3 items: "Science and technology are making our lives healthier, easier, and more comfortable," "Because of science and technology, there will be more opportunities for the next generation," and "The world is better off, or worse off, because of science and technology." Items were answered on scales ranging from 1 to 10 and were recoded such that higher scores represent more positive attitudes. The items were standardized and averaged together ($\alpha = .74$). Religiosity was a composite of 3 items: "How important is religion in your life?" "How often do you attend religious services?" and "Do you consider yourself a religious person?" The items were standardized and averaged together ($\alpha = .73$).

Results

We conducted a multilevel regression analysis using HLM (Version 7). At Level 1, we used individual religiosity, age, sex, education, and political orientation to predict individual science attitudes. To investigate whether the link between religiosity and science attitudes depends on the country's average religiosity, we entered the average religiosity of each country at Level 2. Thus, we used country-level religiosity to predict the individual-level religiosity and science attitudes correlation.

On average, there was a small negative correlation between individual religious belief and science attitudes above demographic controls across all countries, $\beta = -.027$, $p < .001$. However, the strength of this relationship varied depending on the average religiosity of the country, $\beta = .034$, $p < .001$.

The slopes of each individual country are displayed in Figure 2, which is arranged in order of highest to lowest religiosity. While the correlation is associated with a p value of <.001 in the United States ($\beta = -.035$, 95% confidence interval [CI] [−.044, −.025], $p < .001$) and some other more secular countries (e.g., Sweden, $\beta = -.092$, 95% CI [−.108, −.076], $p < .001$), the correlation is highly variable in other countries.

To provide additional context to the present results, a previous paper (Chan, 2018) undertook the similar task of analyzing the data from the WEVS but using a very different analytic approach. Namely, Chan analyzed many items individually, used a different set of items to construct a religiosity measure, and also controlled for religious affiliation. It is reassuring that the results do not hinge on arbitrary analytic choices. Nonetheless, the present work replicates and extends these findings a great deal.

Study 7

To further examine the relations between religion and science attitudes outside of the United States, we collected additional data in an attempt to examine the replicability of the findings from the WEVS.

Participants

In total, 1,048 subjects were recruited from five countries using Qualtrics Panels. The countries were Brazil ($N = 210$), Czech Republic ($N = 210$), Philippines ($N = 208$), South Africa ($N = 210$), and Sweden ($N = 210$). The countries were selected to represent a range of average country religiosity scores as observed in the WEVS data. Furthermore, the Czech Republic was not included in the WEVS, so this represents the first investigation of that country.

Materials

We used the Science Interest Scale from Studies 5a and 5b and the explicit Science Attitudes Scale from Studies 2a and 2b. For each country, the surveys were translated into the dominant language, and a back translator verified the accuracy of each translation.

Analytic Plan

Our preregistered analysis plans included examining data from each country individually (https://osf.io/rfy7h/). Results from these analyses can be examined in Supplementary Materials (see Figure S1 and Tables S5–S6). During the review process, it was suggested that we use a mixed-effects model, similar to the analysis conducted in Study 6, so we focus on this analysis here for simplicity. However, the results from both sets of analyses lead to substantially similar conclusions.

Results

In two linear mixed-effects models, we predicted science attitudes and science interest using person-level religiosity and the average religiosity for each country. We included demographics as controls (education, parental education, socioeconomic status, age, gender, ethnicity, and political orientation) and random intercepts for each country. Full model results are available in Table S4.

Overall, religiosity was weakly and *positively* associated with science attitudes ($\beta = .07$, $p = .044$, 95% CI [.010, .157]) and science interest ($\beta = .10$, $p = .003$, 95% CI [.078, .208]). However, person-level religiosity did not interact with country-level religiosity for either science attitudes ($\beta = -.09$, $p = .093$, 95% CI [−.201, .025]) or science interest ($\beta = .04$, $p = .504$, 95% CI [−.053, .154]). The slopes and distribution of the data can be viewed in Figure 3.

Discussion

In the United States, religiosity is consistently associated with more negative attitudes about (and less interest in) science. This was measured using various metrics: interest in science-related activities, selection of science-related topics, general

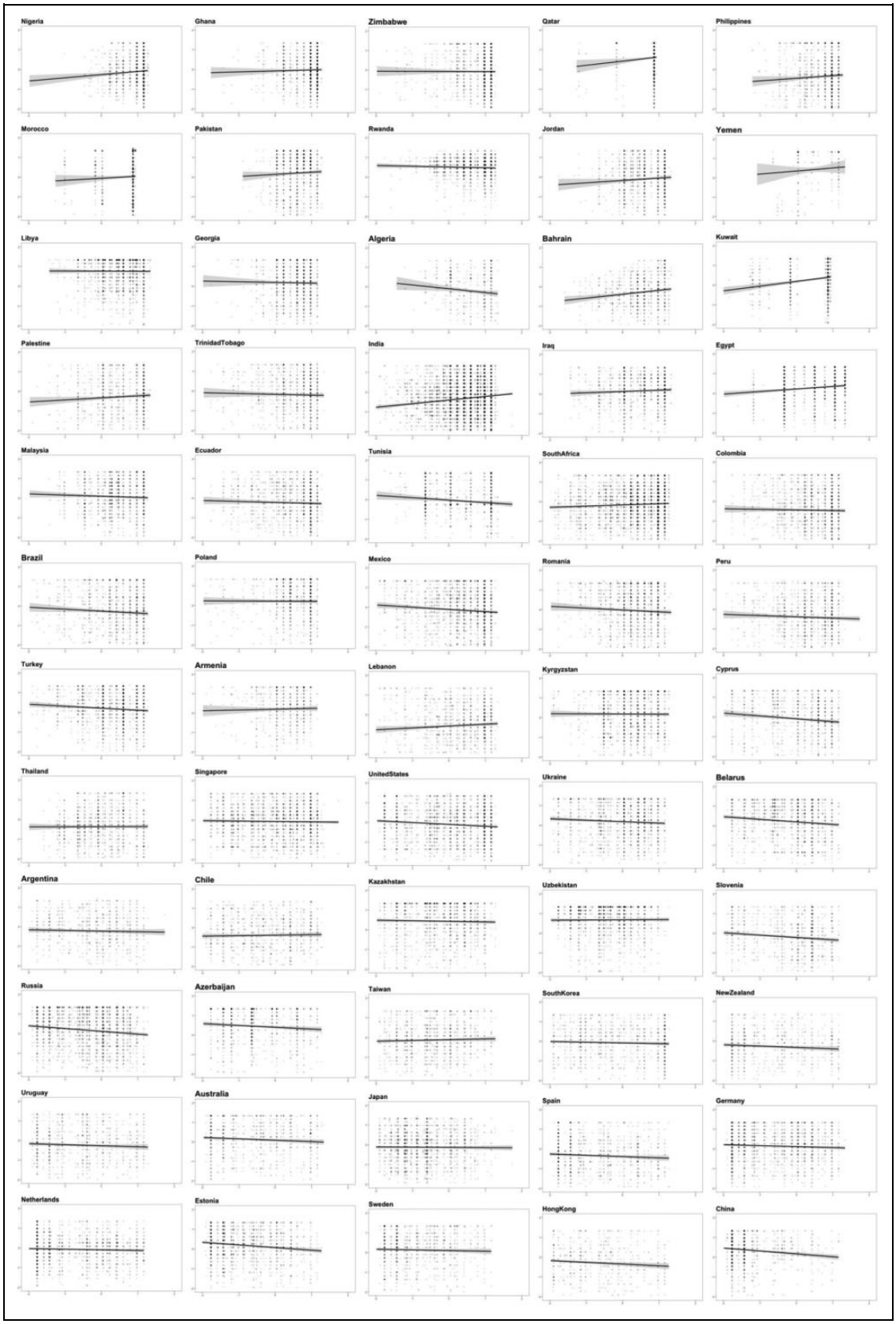

Figure 2. Distributions and slopes of religiosity predicting science attitudes for each country. *Note*. The *x*-axis refers to religiosity, and the *y*-axis refers to science attitudes; slopes are controlling for sex, income, political orientation, education, and age; shaded band is 95% confidence interval; panels are arranged from highest to lowest average country-level religiosity.

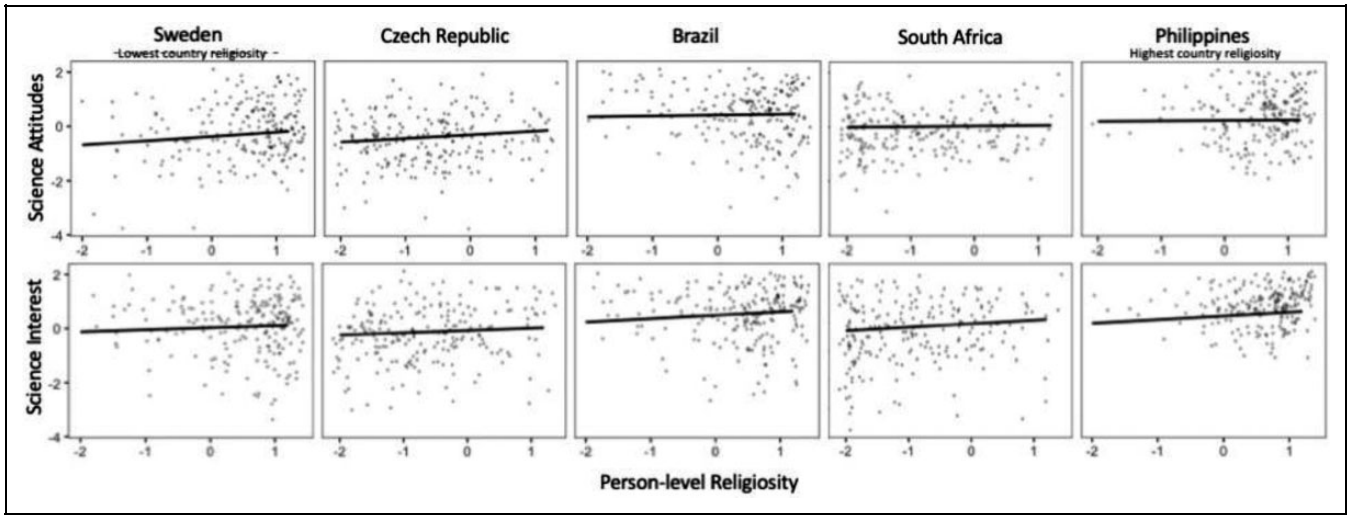

Figure 3. Distributions and slopes of personal-level and country-level religiosity predicting science attitudes and science interest in Study 7.

attitudes toward science, and implicit attitudes toward science. However, outside of the United States, these associations are inconsistent (with religion and science being *positively* correlated with some cases) and many are too small to be meaningful. Thus, while religion and science may have a unique relation within the United States, this apparent conflict is not at all generalizable to many countries around the world. This severely undermines the hypothesis that science and religion are necessarily in conflict.

To put the present results in context, past research suggests that few descriptive effects of religiosity reliably replicate outside of the United States. For example, a negative relation between reflective thinking and religiosity is widely replicated within the United States (Pennycook et al., 2016). However, one large-scale study found this effect to be clearly apparent in 3 of 13 countries (Gervais, van Elk, et al., 2018) while another found it to replicate in India and the United Kingdom (Stagnaro et al., 2019). Further, some features of religiosity vary across cultures, such as prosocial behaviors resulting from beliefs in moralizing gods (Purzycki et al., 2016). On the other hand, moral prejudice against atheists seems to be a cross-culturally robust phenomenon (Gervais et al., 2017). The results of the present study suggest that correlations between religion and attitudes toward science may be unique to the United States.

Prevailing theories (Durkheim, n.d.; Norris & Inglehart, 2011) and narratives (Coyne, 2016; Dawkins, 2016; Hitchens, 2008) suggest that religious belief necessarily leads to rejection of science. While the two accounts may sometimes offer contradicting narratives about some subjects, the present studies undermine these previous accounts and broader sociological accounts of scientific advancement undermining religion. Instead, the results suggest that apparent conflicts may be the product of other sociocultural and historical features of specific countries. Future research should continue to explore the historical and cultural narratives that may explain this pattern of findings. For example, the differential influence of biblical literalism (Scott, 2006), the overlap between fundamental religiosity and political conservatism (Gauchat, 2012), or various other patterns of cultural influence may be at work here.

There are strengths and limitations to consider. In this research, we used many large samples, several preregistered analysis plans, and several direct and conceptual replications to arrive at our results. However, the data used here include both probability samples (the WEVS) and convenience samples (Studies 1–5b). These limitations should be kept in mind. Still, the results we find are consistent across each data set used, suggesting that these results are easily replicable, at least within the United States.

Much attention has been given to the questions of whether (and how) religious and scientific cognition differ, and whether these differences or similarities are responsible for favoring one worldview over another. Clearly, there are religious scientists (Ecklund & Scheitle, 2007), and some research suggests that the fundamental elements underlying religious belief and scientific thinking are both natural and similar (Legare et al., 2012; Legare & Visala, 2011). However, other research suggests that the foundations of scientific and religious belief seem to diverge in many important ways (McPhetres & Nguyen, 2018; Shtulman, 2013). Thus, it is important to take a comprehensive approach when examining whether religiosity is indeed predictive of one's orientation toward science.

One particular strength of the present studies is that we utilized a wide variety of different measurements tapping into science attitudes in order to aid broad generalization about exactly what science interest and attitudes mean. For example, science interest was measured by asking participants to choose various topics they found generally interesting—the list of topics comprised both scientific and nonscientific content. Further, we also asked participants to choose from a list of different topics they would like to read about. While such measures seem to be face-valid assessment of general interest, we also employed a Science Interest Scale (Harty & Beall, 1984) used in previous research (McPhetres, 2019), which measures one's interest in

specific science-related activities (e.g., going to science museums).

General attitudes toward science were measured via scales that are commonly employed in sociological research (Inglehart et al., 2016; Smith et al., 2017). However, we also employed a widely used technique to assess implicit belief: the single-category implicit association test (Jong et al., 2012; Karpinski & Steinman, 2006; Nosek et al., 2014). At the least, implicit measures are claimed to be less subject to presentation effects. Practically, however, an implicit measure may be no more than a much faster measure of attitudes which either can introduce noise or could help to reduce presentation effects. In the present studies, the implicit measure of attitudes toward science correlated positively with the explicit measure, suggesting it is at least similar.

Therefore, by taking such a broad approach, we are confident that we have accurately assessed both science interest and attitudes adequately. However, it is also important to note that we obviously did not measure actual behaviors, and it remains unclear whether interest and attitudes as operationalized in the present studies would correspond to physical behaviors.

In conclusion, it appears that religious Americans have less positive attitudes toward, and less interest in, science. However, this does not appear to be a feature of religiosity, per se, as the effect is not clearly generalizable outside of the United States. This research provides valuable evidence to inform applied approaches to science communication by understanding lay attitudes toward science. In countries where such a conflict narrative does exist, science communicators may benefit from knowing who distrusts science and why so that attitudes can be changed.

Authors' Note

Jonathon McPhetres is responsible for data collection, analysis, and drafting the manuscript; Jonathan Jong contributed to writing the manuscript, planned and oversaw data collection for Study 7; and Miron Zuckerman supervised McPhetres and provided feedback for the manuscript. All data, syntax, and links to preregistrations are available on the Open Science Framework (https://osf.io/t7w6x/).

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Supplemental Material

The supplemental material is available in the online version of the article.

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