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Humility and harmony: The influence of intellectual humility and religiousness on science-religion views☆

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A B S T R A C T

Views on the relationship between science and religion vary between conflict and compatibility. But compatibility views may be more common for those who are open to alternate viewpoints and who recognize the limits of their knowledge and understanding, characteristic of intellectual humility. Two studies (total $N = 978$) examined how science-religion attitudes are predicted by individual differences in intellectual humility and religiosity. Compatibility attitudes were strongly predicted by individual religiosity, and intellectual humility predicted greater compatibility beliefs when controlling for religiosity. In mediation analyses, there were negative indirect links between intellectual humility and compatibility views via greater religiosity, but the direct link was positive. This suggests that a positive link between intellectual humility and compatibility beliefs may be suppressed by the strong associations with general religiosity. Overall, these studies show intellectual humility is an important predictor of beliefs about the compatibility of science and religion, but this is entwined with the effects of religiosity.

1. Introduction

Science and religion have a complex relationship, with views ranging from harmonious to combative (Barbour, 1990; Rutjens & Preston, 2020). To some, science and religion may seem to be inherently conflicting because they provide different explanations for the same phenomena. Others view them as compatible belief systems, that they may address different questions and can coexist without contradiction. The nature of these views is important to understand, as the way people see science and religion carries implications for public health policies, personal wellbeing, and interpersonal attitudes (Mackey et al., 2023; Rutjens et al., 2018). But what underlies these differences in attitudes: who is likely to view science and religion as compatible versus in conflict?

1.1. Intellectual humility

One psychological trait that seems relevant to beliefs about the compatibility of science and religion is *intellectual humility*, characterized by a willingness to recognize the limits of one's knowledge and an openness to alternative beliefs or perspectives (Leary et al., 2017). Intellectual humility is related to greater tolerance and openness to different ideas (Krumrei-Mancuso et al., 2020; Porter, Elnakouri, et al., 2022), for example more openness to opposing views during disagreements and opposing political perspectives (Porter & Schumann, 2018), as well as greater religious tolerance and acceptance between religious faiths (Hook et al., 2017; Lubis & Sianipar, 2022).

Intellectual humility is also associated with characteristics that are central to scientific reasoning, such as reflective thinking, need for cognition, intellectual openness, and open-minded thinking (Krumrei-Mancuso et al., 2020). The willingness to revise beliefs aligns with values in science for objectivity and updating beliefs in correspondence with evidence. Likewise, intellectual humility also relates to belief and trust in science (Preston and Khan, 2024; Plohl & Musil, 2023)—for example, openness to revising one's viewpoint predicts general trust in science even after controlling for factors such as conservatism, religiousness, and general openness to experience (Plohl & Musil, 2023). Intellectual humility has also been found to be positively related to trust within specific science domains, such as vaccine acceptance (Huynh & Senger, 2021;; Preston & Khan, 2024), and lower susceptibility to anti-science misinformation (Koetke et al., 2022; Hotchin & Preston, 2025).

These findings strongly suggest that intellectual humility should be positively associated with belief in science-religion compatibility. The science-religion relationship is often linked to ideas that science and religion represent different ways of knowing (Preston & Epley, 2009): science being a system where knowledge is derived from empirical evidence, whereas religion is a system where belief depends more on experiences of faith and revelation. Compatibility between science and

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religion therefore requires an openness to different kinds of ideas and worldviews in order to reconcile qualitatively different knowledge systems. It is telling that conflict views on science and religion are more prevalent among those who see the two domains as fundamentally contradictory ways of knowing, e.g., those who take a more literal interpretation of religious texts (Baker, 2012) or who see religious explanations as opposed to scientific principles (Jackson et al., 2024). Meanwhile, people with compatibility views of science and religion are more inclined to reconcile these ways of knowing (Legare et al., 2012) and to perceive science and religion as operating independently and addressing different types of questions (Barbour, 1990; Davoodi & Lombrozo, 2022). Openness to alternate views would therefore be especially relevant to perspectives on the science-religion relationship to be able to reconcile two these different ways of knowing.

1.2. Religiosity and compatibility attitudes

So far, research suggests that intellectual humility would predict compatibility attitudes towards science and religion. However, the direct relationship between intellectual humility and science-religion attitudes may be complicated by their shared relationships with religiosity, which itself is a strong predictor of compatibility beliefs (Johnson et al., 2023; Leicht et al., 2022; Zarzeczna et al., 2024) and lower intellectual humility (Krumrei-Mancuso, 2018; Preston and Khan, 2024).

Religiosity may be related to stronger compatibility attitudes as by definition non-religious people already reject religious explanations, whereas more religious people may be motivated to reconcile religion and science as they must depend on science to live in modern culture. Indeed, highly religious individuals are the most likely to say science and religion are compatible (Pew Research Center, 2015), and non-religious people may be especially likely to see science and religion as in conflict as they see religious explanations as fundamentally inconsistent with science (Jackson et al., 2024). Notably, these relationships appear across cultures and religious groups: while some research focused on Western samples (Sharp et al., 2022; Leicht et al., 2022), other research recent work has replicated the findings on the religiosity-compatibility perceptions link in non-Christian populations (Zarzeczna et al., 2024).

Religiosity has also been shown to be negatively related to intellectual humility (Krumrei-Mancuso, 2018; Preston and Khan, 2024). A longitudinal study found that both individual spirituality and religiousness predicted lower levels of intellectual humility (Krumrei-Mancuso, 2018), largely due to overlap between religiosity and authoritarianism. Notably, the negative relation observed between religion and intellectual humility does not seem to be a function of differences in overall humility, as other kinds of humility can be positively related to religiousness (Preston & Shin, 2017; Van Tongeren et al., 2018). Rather, there may be a particular tension between religious faith and intellectual humility—faith often persists in the absence of evidence, which can be at odds with the value of changing beliefs with new evidence, that is central to intellectual humility. Although religious people may be generally humble on other dimensions, they tend to remain certain of religious beliefs and are unwilling to change those beliefs (see also Ruffing et al., 2018; 2020).

But important here, the strong relationships that religiosity holds with both intellectual humility and compatibility beliefs (respectively) creates a potential third-variable effect that may suppress the association between intellectual humility and compatibility beliefs. A suppression effect, also referred to as inconsistent mediation, occurs when the relationship between two variables is strengthened when a third variable, the suppressor, is taken into account (MacKinnon et al., 2000). Initially, the relationship may appear to be close to zero or non-significant, because the direct and indirect relationships have opposing signs, thus cancelling each other out. As religiousness is positively associated with science-religion compatibility but negatively linked to intellectual humility, this facilitates some negative link between intellectual humility and compatibility that could counteract any positive relationship between intellectual humility and compatibility attitudes, making the relationship appear non-significant, or negative. We have reason to therefore expect that intellectual humility should have a positive role in shaping compatibility views towards science and religion, but that the strong associations between religiosity and both variables may suppress this relationship. Additionally, religiosity might also function as a moderator of the relationship between intellectual humility and compatibility beliefs. Because of the known association between lower religiosity and lower compatibility beliefs, it may be the case that greater intellectual humility only contributes to greater compatibility beliefs among those who are higher in religiosity, and not those who are lower. The goal of the present research is to investigate a link between intellectual humility and compatibility attitudes towards science and religion, taking into account the role individual religiosity plays in that relationship.

1.3. Present research

Views of the science and religion relationship vary, but may be influenced by humility towards one's own beliefs and general respect for different ideas. This research examines intellectual humility and religiosity in their relationship to science-religion attitudes. To date no empirical work has tested for a relationship between intellectual humility and science-religion attitudes, though theory and research both suggest they should be positively associated. As we argue, such a relationship may be suppressed by underlying differences in religiosity which are negatively associated with intellectual humility. This raises key questions about how intellectual humility may predict science-religion attitudes, and the role of religiosity in that relationship, that we explored in two studies.

First, we are interested in how intellectual humility predicts science-religion compatibility, with and without accounting for overall religiosity effects. We expect that intellectual humility will be related to belief in science-religion compatibility when controlling for religiosity. However this may not hold for the direct relationship between intellectual humility and compatibility.

Second, we are interested in the specific role of religiosity between intellectual humility and science-religion attitudes. We test whether religiosity acts as a suppressor of the direct relationship between intellectual humility and compatibility, by observing change on the directionality of the direct and indirect relationships when religiosity is taken into account. This analysis would test the idea that the positive relationship between intellectual humility and compatibility beliefs is counteracted by a negative indirect relationship via general religiosity.

And finally, if intellectual humility does affect compatibility attitudes, we wondered if such an effect would be similar in more religious versus nonreligious people. We look at the potential interaction between religiousness and intellectual humility on compatibility attitudes. If non-religious people are more likely to reject compatibility in favour of greater conflict between science and religion this suggests a potential interaction such that intellectual humility may predict stronger compatibility beliefs among more religious people but have lesser impact among less religious people.

2. Study 1

Study 1 examined the relationship between intellectual humility and belief in compatibility between science and religion, and the role of religiosity in that relationship. Study 1 focused on a U.S. sample as the best context to test our predictions, as compared to other cultures there is more variation in attitudes towards science-religion (McPhetres, Jong, & Zuckerman, 2021). Because individual differences in religiousness are a key factor in this work, we aimed to recruit equal numbers of self-identified religious and nonreligious participants via pre-screening.

Belief in science-religion compatibility is expected to be positively

correlated with strength of religious attitudes and negatively correlated with science attitudes, as found in prior work. Our primary research question concerns the relation of intellectual humility to compatibility beliefs, with and without accounting for the involvement of religiosity. Intellectual Humility was expected to be positively related to Science-Religion Compatibility when controlling for General Religiosity. Moreover, we expected that any negative relationship between intellectual humility and Science-Religion Compatibility could be explained through the underlying relationships with General Religiosity, that is negatively associated with intellectual humility and positively associated with Science-Religion Compatibility, which may suppress a positive direct relationship. This was tested using an inconsistent mediation model, with general Religiosity as the suppressor variable. In the case of a suppression effect, we would expect the direct relationship between intellectual humility and Science-Religion Compatibility and the indirect relationship via Religiosity to have opposite signs, in this case positive and negative respectively. We would also expect the direct effect to be larger than the total effect, which may appear to be zero or non-significant. Although they are conceptually different (notably, suppression does not imply causal paths between the variables), suppression can be tested using the same statistical procedure as standard mediation (MacKinnon et al., 2000), and we used bootstrapping to estimate the indirect paths. Separately, we also tested a moderation model with general Religiosity as a moderator of the relationship between Intellectual Humility and Science-Religion Compatibility.

The study was pre-registered: https://osf.io/aq7rt/?view_only=4a7b545a712247569728728dd3ae3c0a. Materials, analysis code and anonymized data can be accessed at: https://osf.io/jdhym/?view_only=878f63bd5cd74c84af56619a6e4ad0f6.

2.1. Power analysis

The Monte Carlo Power Analysis for Indirect Effects program (Schoemann, Boulton, & Short, 2017) was used to calculate the sample size for the core hypotheses, with 5000 replications, 20,000 Monte Carlo Draws per replication, and 95 % confidence intervals. Based on conservative estimates of small-medium (0.2) correlations between the predictor (Intellectual Humility), suppressor (Religiosity) and outcome (Science-Religion Compatibility) variables, a sample size of 320 participants was required to achieve power of 0.80. To allow for exploratory moderation analyses, we aimed to recruit a larger sample size of 500 (250 Christian and 250 non-religious). This was intended to increase the possibility of being able to detect an interaction should one exist. A sensitivity analysis based on the obtained sample size indicated that it would allow for the detection of an interaction effect of $f^2 = 0.016$, with 0.80 power and an alpha level of 0.05.

2.2. Participants

A total of 509 participants were recruited via Prolific in exchange for £1.05 payment. Participants were all U.S. residents aged 18 or over. Two batches used demographic filters to screen for participants who self-identified as 1) Christian, and 2) non-religious (i.e., Agnostic, Atheist, No Religion). A total of 24 participants were excluded according to the criteria specified in the pre-registration (not providing any response to the free-text question, failing one or more attention checks, responses to the duplicate questions more than two scale points apart, or duplicate participant ID), leaving $N = 485$. The final sample was 56.5 % female (42.1 % male, 1.4 % other/chose not to disclose), and aged 18–80 ($M = 43.41$, $SD = 14.42$). Self-reported religion differed slightly from the demographic filters with 44.9 % of participants identifying as Christian; 41.2 % as 'none'; 10.7 % as spiritual but not religious; 1.6 % as 'other'; 0.2 % as Jewish and 0.2 % as Buddhist. The majority of the sample (59.8 %) listed their ethnicity as White (16.3 % African American; 12.4 % Asian; 6.6 % Hispanic; 0.6 % Native American; 4.1 % other).

2.3. Materials and procedure

All measures used have been established in previous research, and most have been used with both UK and US samples. All items were presented via Qualtrics online platform. Except where indicated, items were answered using a 7-point Likert scale, with endpoints 1 = *Strongly disagree* and 7 = *Strongly agree.*

2.3.1. Science-religion compatibility ($\alpha = 0.83$)

Four items assessing science-religion compatibility beliefs (Rios & Aveyard, 2019), with scale options corresponding to the item/question wording were used. Items include: "To what extent do you believe that science and religion are incompatible versus compatible?" (1 = *'Very incompatible'*; 7 = *'Very compatible'*). An additional free-text item asked participants to explain their view on the relationship between science and religion compatibility. This was not intended for analysis but functioned as an attention check: participants who left the box blank were excluded according to our pre-registered criteria.

2.3.2. Religious variables

General Religiosity ($\alpha = 0.98$) was measured with a seven-item scale (Preston & Ritter, 2013). Items include: "Religious beliefs are very important to me." Spirituality ($\alpha = 0.92$) was assessed with a 9-item scale adapted from the Spiritual Transcendence Scale (Piedmont, 1999), e.g., "I have had an experience in which I seemed to be deeply connected to everything". Religious Fundamentalism ($\alpha = 0.95$) was measured with eight items from the revised 12-item Religious Fundamentalism Scale (Altemeyer & Hunsberger, 2004). Items include: "To lead the best, most meaningful life, one must belong to the one fundamentally true religion."

2.3.3. Science attitudes

Four items from the Belief in Science scale (Preston, Coleman, & Shin, 2025, adapted from Farias et al., 2013) measured overall support for science as a way of knowing ($\alpha = 0.87$). Items include: "People should trust in science as a reliable source of knowledge." An attention check was included within this questionnaire ("If you are paying attention leave this question blank."). Mistrust of Science ($\alpha = 0.93$) was measured by the 6-item Credibility of Science Scale (Hartman et al., 2017). Items include: "People trust scientists a lot more than they should." (Note higher scores indicate greater skepticism towards science). Science Literacy was assessed with ten statements related to general science understanding, e.g., "Lasers work by focusing sound waves", with true or false responses (Zarzeczna et al., 2023). An additional attention check was included within this questionnaire ("If you are paying attention leave this question blank").

2.3.4. Intellectual humility

Intellectual Humility ($\alpha = 0.89$) was measured with the Comprehensive Intellectual Humility Scale (Krumrei-Mancuso & Rouse, 2016). This scale uses 22 items to capture four components of Intellectual Humility: willingness to change one's views, respect for other views, lack of defensiveness, and lack of arrogance. Items include: "I am open to revising my important beliefs in the face of new information". As an attention check, the first item was repeated at the end of the questionnaire. The items between the two identical questions appeared in a randomized order.

2.3.5. Demographic questions

Participants were asked demographic information regarding their age, religion, ethnicity, education, political orientation. Finally, participants were given an opportunity to provide comments on the survey, then debriefed.

2.4. Results and discussion

In accordance with the pre-registration, the main variables were assessed for univariate outliers (defined as +/− 3SD from the mean). One such outlier was found. The analyses were run with and without this outlier; they were not substantively different and so results reported below include this case.

2.4.1. Correlations

Bivariate correlations established direct relationships between all variables, see Table 1. For brevity we discuss only those correlations relevant to predictions. Science-Religion Compatibility was positively correlated with all religious variables (General Religiosity, Religious Fundamentalism, Spirituality). In contrast, Intellectual Humility was negatively associated with both General Religiosity and Religious Fundamentalism. Intellectual Humility was not directly related to Science-Religion Compatibility in zero-order correlations.

2.4.2. Regression with intellectual humility and religiosity

Two multiple linear regressions were used to test the relationships between Intellectual Humility and Science-Religion Compatibility when controlling for Religiosity. The first hierarchical model predicted Science-Religion Compatibility from all religious variables (General Religiosity, Spirituality, and Religious Fundamentalism) plus Intellectual Humility (see Table 2). All three religiosity variables were significant predictors in step one. Notably, Fundamentalism became a negative predictor in the regression, suggesting that its positive zero-order correlation with compatibility may be explained through overlap with General Religiosity.[1] Step two added Intellectual Humility, which was a significant positive predictor. Fundamentalism was no longer significant in step two. Collectively, the religiosity variables explained a significant amount of variance (29.5 %), with Intellectual Humility explaining an additional 1.6 % of the variance in step two.

To further test the prediction that Intellectual Humility will positively predict Science-Religion Compatibility when controlling for Religiosity, we conducted a multiple linear regression with just General Religiosity and Intellectual Humility as the predictors and Science-Religion Compatibility as the outcome. The model explained 28.7 % of the variance and significantly predicted Science-Religion Compatibility ($F(2,482) = 97.07$, $p < .001$, $R^2 = 0.287$, $R^2Adj = 0.284$). Intellectual Humility positively predicted Science-Religion Compatibility ($\beta = 0.16$, $p < .001$) independently of Religiosity ($\beta = 0.54$, $p < .001$), supporting the hypothesis. In both these analyses we see the robust effect Religiosity has in predicting compatibility beliefs, and the positive effects of Intellectual Humility when controlling for religiosity.

2.4.3. Suppression effect of religiosity

We tested an inconsistent mediation model with General Religiosity as the suppressor variable, Intellectual Humility as the predictor, and Science-Religion Compatibility as the outcome (see Table 3 below), to test the idea that the positive relationship between Intellectual Humility and compatibility beliefs is suppressed by General Religiosity. The analyses were conducted using Process v4.0 (Hayes, 2018), Model 4, with 10,000 bootstrap samples, 95 % confidence intervals and standard error estimators robust to heteroscedasticity (HC3). As expected, there was a significant negative path between Intellectual Humility and General Religiosity, and a significant positive path between General Religiosity and Science-Religion Compatibility, resulting in a significant negative indirect path between Intellectual Humility and Science-Religion Compatibility, via Religiosity. Notably the direct path between Intellectual Humility and Science-Religion Compatibility was also significant, but here the direction was positive. The total effect was non-significant. These results are consistent with a suppression effect of Religiosity, supporting our predictions and accounting for why Intellectual Humility was not related to compatibility in zero-order correlations.

2.4.4. Moderation by religiosity

We also explored whether the strength of the relationship between Intellectual Humility and Science-Religion Compatibility depends on how religious a person may be. We used General Religiosity as the continuous moderator in this analysis, as there was ambiguity in classifying participants as religious or non-religious based on their self-reported status, and because of the loss of power with categorical vs continuous variables. We used Process Model 1 to conduct a moderation analysis with Intellectual Humility as the predictor, General Religiosity as the moderator and Science-Religion Compatibility as the outcome (see Table 4). In all moderation analyses we used 10,000 bootstrap samples, 95 % confidence intervals, standard error estimators robust to heteroscedasticity (HC3) and centered predictors before analysis. Religiosity was found to moderate the relationship between Intellectual Humility and Science-Religion Compatibility, such that there was a significant positive relationship only for those with average or high levels of Religiosity. Using the Johnson-Neyman technique, we found that the cut-off point for Religiosity where the *p*-value was significant at 0.05 was 2.12 on a scale of 1–7.

2.5. Summary

Study 1 supported our predictions that greater Intellectual Humility would be positively associated with compatibility attitudes when accounting for the effect of individual religiosity. Science-Religion Compatibility was positively associated with religious variables (General Religiosity, Spirituality, Fundamentalism). General Religiosity was the strongest predictor, consistent with recent work indicating more religious people are more inclined to view science and religion as compatible. Intellectual Humility was negatively correlated with Religiosity and was unrelated to compatibility beliefs in zero-order correlations. In regression analyses, however, Intellectual Humility was a positive predictor of compatibility when controlling for Religiosity. Moreover, mediation analyses indicate this was due to the negative indirect link between Intellectual Humility and compatibility attitudes via Religiosity, which suppressed the positive direct link. Religiosity also moderated the relationship between Intellectual Humility and compatibility beliefs: people moderate to high in Religiosity were especially likely to see science and religion as compatible if they were also higher in Intellectual Humility. This did not apply to people low in Religiosity, they were more likely to hold conflict beliefs towards science and religion and remained steadfast in this regardless of their Intellectual Humility. In sum, Study 1 provided strong evidence in support of our predictions, and showed the value of Intellectual Humility in predicting compatibility beliefs accounting for the relationship with Religiosity.

3. Study 2

Study 1 supported our predictions regarding the relationships between Intellectual Humility, Science-Religion Compatibility, and Religiosity. However, the study may be constrained by focusing exclusively on a U.S. sample. Study 2 adopted the same design and predictions, but with a UK sample, selected as it is similar to the U.S. in language and culture, but relatively lower in religiosity by comparison (Pew Research Center, 2018). Again, we expected that Science-Religion Compatibility would be positively correlated with General Religiosity. Intellectual Humility may not be related to compatibility beliefs in direct correlations but is expected to positively predict Science-Religion Compatibility

[1] The zero-order correlation between Religiosity and Fundamentalism was relatively large, indicating overlap between these variables. However the VIF values did not exceed the recommended limit of 5 for assessing multicollinearity. We also re-ran the analyses excluding Fundamentalism as a predictor and found that the pattern of results did not substantively differ.

Table 1
Bivariate correlations and descriptive statistics, U.S. sample (N = 485).

	Measure	1	2	3	4	5	6	7	8	9
1	Science-religion compatibility									
2	Intellectual humility	0.059								
3	General religiosity	0.512**	−0.189**							
4	Spirituality	0.425**	−0.022	0.585**						
5	Fundamentalism	0.374**	−0.259**	0.853**	0.427**					
6	Belief in science	−0.272**	0.272**	−0.574**	−0.334**	−0.626**				
7	Mistrust of science	0.277**	−0.268**	0.616**	0.338**	0.643**	−0.649**			
8	Science literacy (total score)	0.047	0.200**	−0.192	−0.086	−0.231**	0.164**	−0.268**		
9	Age	0.000	−0.018	0.206**	0.161**	0.120**	−0.133**	0.104*	0.168**	
	Mean	4.05	5.26	3.29	4.63	2.75	5.31	3.18	8.60	43.41
	SD	1.47	0.78	2.23	1.49	1.78	1.33	1.62	1.49	14.42
	Alpha	0.83	0.89	0.98	0.92	0.95	0.87	0.93	0.54	

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 2
Hierarchical regression analysis summary for the religiosity variables and Intellectual Humility predicting Science-Religion Compatibility, U.S. sample (N = 485).

Predictors	R^2	ΔR^2	B	SE	β	t	p	LLCI	ULCI
Model 1	0.30***	0.30***							
Religiosity			0.38*	0.06**	0.57	6.87	<0.001	0.268	0.483
Spirituality			0.17	0.05	0.17	3.58	<0.001	0.076	0.262
Fundamentalism			−0.15	0.06	−0.19	−2.48	0.013	−0.273	−0.032
Model 2	0.31***	0.02***							
Religiosity			0.37	0.05	0.56	6.88	<0.001	0.266	0.478
Spirituality			0.16	0.05	0.16	3.33	<0.001	0.064	0.248
Fundamentalism			−0.12	0.06	−0.14	−1.88	0.061	−0.237	0.005
Intellectual humility			0.25	0.08	0.13	3.37	<0.001	0.105	0.399

LLCI/ULCI = lower and upper limit 95 % confidence interval for *B*.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 3
Suppression effect of religiosity on the relationship between Intellectual Humility and Science-Religion Compatibility, US sample (N = 485).

Predictors	Path	R^2	B	SE	t	p	LLCI	ULCI
IH, Religiosity		0.29***						
	a (IH - > Religiosity)		−0.54	0.13	−4.11	0.000	−0.802	−0.283
	b (Religiosity - > SRC)		0.36	0.03	12.67	0.000	0.302	0.413
	a x b (Indirect)		−0.19	0.05			−0.292	−0.100
	c' (Direct)		0.31	0.08	3.79	0.000	0.147	0.466
	c (Total)		0.11	0.09	1.23	0.218	−0.067	0.292

*** $p < .001$; LLCI/ULCI = lower and upper limit 95 % confidence interval for *B*; SE and CIs for indirect paths are bootstrapped.

Table 4
Moderation analysis summary for Intellectual Humility and religiosity predicting Science-Religion Compatibility, U.S. sample (N = 485).

Predictors	R^2	ΔR^2	B	SE	t	p	LLCI	ULCI
Model	0.30***							
Intellectual humility			0.29	0.08	3.55	0.000	0.128	0.444
Religiosity			0.36**	0.03	12.72	0.000	0.304	0.415
Interaction term		0.01*	0.09	0.04	2.47	0.014	0.019	0.164
Simple slope estimates								
Low (-1SD) Religiosity			0.08	0.12	0.71	0.478	−0.145	0.309
Average Religiosity			0.29	0.08	3.55	0.000	0.128	0.444
High (+1SD) Religiosity			0.49	0.12	4.25	0.000	0.263	0.717

LLCI/ULCI = lower and upper limit 95 % confidence interval for *B*.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

when controlling for Religiosity. We also sought to replicate the finding in Study 1 that Religiosity would operate as a suppressor of the positive relationship between Intellectual Humility and compatibility views. Finally, we tested whether Religiosity would moderate the relationship between Intellectual Humility and Science-Religion Compatibility as in Study 1, such that the relationship would be stronger for participants with higher Religiosity. The study was pre-registered (see https://osf.io/pkd53/?view_only=c87ba8b93fee4bd4a7bcd9af8c1d7c69).

Materials, analysis code and anonymized data can be accessed at: https://osf.io/jdhym/?view_only=878f63bd5cd74c84af56619a6e4ad0f6.

3.1. Power analysis

We used G-Power 3.1.9.7 to determine the sample size, anticipating a small effect for the moderation analysis: an R^2 increase of 0.015 for the interaction term. This produced a required sample size of 526 participants to achieve 0.80 power, with an alpha level of 0.05.

3.2. Participants

Participants were recruited using Prolific and were paid £1.05 for their participation. Participants were all UK residents aged 18 or over. As in Study 1, demographic filters were applied such that the first batch of participants identified their religion as Christian, and the second batch as non-religious (e.g., Agnostic, Atheist, No Religion). A sample of 528 completed the study, and 35 participants were excluded according to the pre-registered criteria, leaving a final sample of 493. The sample were 56.4 % female (43.2 % male, 0.4 % other/chose not to disclose), and aged 20–88 ($M = 46.00$, $SD = 14.12$). Again, self-reported religion differed somewhat to the demographic filters with 37.5 % of participants identifying as Christian; 51.7 % as 'none'; 8.7 % as spiritual but not religious and 1.8 % as 'other'. Most participants (91.7 %) listed their ethnicity as White (3 % Black; 1.2 % South Asian; 1 % East Asian; 2.8 % other).

3.3. Materials and procedure

The materials and procedure were the same as those used in Study 1. Alpha coefficients for the measures in Study 2 are reported in Table 6 below.

3.4. Results

Note. As specified in the pre-registration, we identified potential outliers in the data (defined as + − 3SD from the mean on scales) to test for differences in results with and without these. Sixteen such outliers were found. For most analyses, the results did not differ substantively, and we report only results from the full sample. Where the results differed with the removal of outliers, both analyses are reported in the text.

3.4.1. Correlations

Zero-order correlations were run to establish direct relationships between all variables (see Table 5). For brevity we discuss only those relationships relevant to main predictions. Correlations supported our hypotheses and the results of Study 1. Science-Religion Compatibility was positively correlated with all religious variables (General Religiosity, Spirituality, and Fundamentalism), while Intellectual Humility was negatively related to General Religiosity and Religious Fundamentalism. As in Study 1, Intellectual Humility was not correlated with Science-Religion Compatibility at zero-order.

3.4.2. Regression with intellectual humility and religious factors

Two multiple linear regressions were used to test the relationship between Intellectual Humility and Science-Religion Compatibility when controlling for religious variables. The first hierarchical linear regression model predicted Science-Religion Compatibility from all religious variables (General Religiosity, Spirituality and Fundamentalism) in step one, with Intellectual Humility added in step two. The religious variables collectively explained 25.7 % of the variance, significantly predicting Science-Religion Compatibility (F (3,489) = 56.27, $p < .001$, $R^2 = 0.257$, $R^2Adj = 0.252$). General Religiosity ($\beta = 0.38$, $p < .001$) and Spirituality ($\beta = 0.17$, $p < .001$) were significant independent predictors, but Fundamentalism was not ($\beta = 0.01$, $p = .920$). Intellectual Humility was added in step two, but did not explain any additional variance ($F(1, 488) = 3.59$, $p = .059$, $\Delta R^2 = 0.005$), and Intellectual Humility was not a significant predictor ($\beta = 0.08$, $p = .059$). When the analysis was conducted without the 16 outliers, the pattern of results was the same but the addition of Intellectual Humility explained a larger and significant amount of variance ($F(1, 472) = 5.31$, $p = .022$, $\Delta R^2 = 0.008$), and Intellectual Humility was a significant independent predictor ($\beta = 0.10$, $p = .022$).

The second multiple linear regression model tested whether Intellectual Humility would positively predict Science-Religion Compatibility when controlling for General Religiosity only (see Table 6). The model explained 24.6 % of the variance and significantly predicted Science-Religion Compatibility ($F(2,490) = 80.10$, $p < .001$, $R^2 = 0.246$, $R^2Adj = 0.243$). Intellectual Humility positively predicted Science-Religion Compatibility ($\beta = 0.09$, $p = .022$) independently of Religiosity ($\beta = 0.50$, $p < .001$), supporting the hypothesis.

3.4.3. Suppression effect of religiosity

As in Study 1, we tested General Religiosity as a suppressor of the relationship between Intellectual Humility and Science-Religion Compatibility, see Table 7. The model explained 24.6 % of the variance in Science-Religion Compatibility ($R^2 = 0.246$, $F(2,490) = 65.02$, $p < .001$). The path between Intellectual Humility and Religiosity was significant and negative ($b = -0.29$, $SE = 0.113$, $p = .012$, 95 % $CI = -0.512, -0.064$), while the path between Religiosity and Science-Religion Compatibility was significant and positive ($b = 0.35$, $SE = 0.031$, $p < .001$, 95 % $CI = 0.292, 0.414$). As in Study 1, there was a significant negative indirect path between Intellectual Humility and Science-Religion Compatibility via General Religiosity ($b = -0.10$, $SE = 0.041$, 95 % $CI = -0.182, -0.023$), and the direct path between Intellectual Humility and Science-Religion Compatibility was significant and positive ($b = 0.16$, $SE = 0.073$, $p = .028$, 95 % $CI = 0.017, 0.302$). The

Table 5
Bivariate correlations and descriptive statistics, UK Sample (N = 493).

	Measure	1	2	3	4	5	6	7	8	9
1	Science-religion compatibility									
2	Intellectual humility	0.033								
3	General religiosity	0.488**	−0.116**							
4	Spirituality	0.410**	0.044	0.624**						
5	Fundamentalism	0.377**	−0.245**	0.776**	0.459**					
6	Belief in science	−0.277**	0.211**	−0.480**	−0.291**	−0.532**				
7	Mistrust of science	0.173**	−0.194**	0.407**	0.343**	0.431**	−0.535**			
8	Science literacy (total score)	−0.017	0.118**	−0.071	−0.009	−0.163**	0.188**	−0.142**		
9	Age	0.033	0.053	0.082	0.091*	−0.020	−0.037	0.091*	0.061	
	Mean	3.67	5.31	2.40	3.92	2.15	5.32	3.15	8.54	46.00
	SD	1.24	0.70	1.75	1.36	1.19	1.15	1.23	1.28	14.12
	Alpha	0.78	0.89	0.98	0.91	0.90	0.86	0.91	0.34	

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 6
Regression analysis summary for religiosity and Intellectual Humility predicting Science-Religion Compatibility, UK sample (N = 493).

Predictors	R^2	B	SE	β	t	p	LLCI	ULCI
Model	0.25***							
Religiosity		0.35**	0.03	0.50	12.63	<0.001	0.298	0.408
Intellectual humility		0.16*	0.07	0.09	2.29	0.022	0.023	0.296

LLCI/ULCI = lower and upper limit 95 % confidence interval for B.
* p < .05.
** p < .01.
*** p < .001.

Table 7
Suppression effect of Religiosity on the relationship between Intellectual Humility and Science-Religion Compatibility, UK sample (N = 493).

Predictors	Path	R^2	B	SE	t	p	LLCI	ULCI
IH, Religiosity		0.25***						
	a (IH - > Religiosity)		−0.29**	0.11	−2.53	0.012	−0.512	−0.064
	b (Religiosity - > SRC)		0.35*	0.03	11.38	0.000	0.292	0.414
	a x b (Indirect)		−0.10	0.04			−0.182	−0.023
	c' (Direct)		0.16	0.07	2.20	0.028	0.017	0.302
	c (Total)		0.06	0.08	0.71	0.476	−0.101	0.217

LLCI/ULCI = lower and upper limit 95 % confidence interval for *B*; SE and CIs for indirect paths are bootstrapped.
* p < .05.
** p < .01.
*** p < .001.

total effect was again non-significant. These findings are consistent with a suppression effect and again indicate that a positive link between Intellectual Humility and compatibility beliefs is counteracted by the negative indirect relationship via General Religiosity, becoming apparent only when the suppressor is included in the model.

3.4.4. Moderation by religiosity

We conducted a moderation analysis with Intellectual Humility as the predictor, Science-Religion Compatibility as the outcome, and General Religiosity as a continuous moderator. The model explained 24.6 % of the variance and significantly predicted the outcome ($F(3,489) = 43.54$, $p < .001$) and both Intellectual Humility ($b = 0.16$, $SE = 0.074$, $p = .030$, 95 % $CI = 0.015, 0.305$) and Religiosity ($b = 0.35$, $SE = 0.032$, $p < .001$, 95 % $CI = 0.291, 0.416$) were significant predictors, as in Study 1. Unlike Study 1, Intellectual Humility and Religiosity did not interact to predict the outcome ($b = 0.00$, $SE = 0.045$, $p = .930$, 95 % $CI = -0.085, 0.093$) and the relationship between Intellectual Humility and Science-Religion Compatibility was similar across levels of Religiosity. This suggests that Intellectual Humility contributed to higher compatibility beliefs for all participants, not only those higher in Religiosity.

3.5. Summary

The results of Study 2 replicate those observed in Study 1, and further support our predictions that Intellectual Humility is related to Science-Religion Compatibility when controlling for Religiosity. Again, when Religiosity was tested as a suppressor variable, we found evidence for a positive direct relationship between Intellectual Humility and Science-Religion Compatibility, and a negative indirect relationship via Religiosity. As in Study 1, this shows that Religiosity is responsible for suppressing the direct relationship between Intellectual Humility and compatibility beliefs. When the strong associations with Religiosity are accounted for, we can see the positive relationship between Intellectual Humility and compatibility attitudes. Given the size of the samples involved and the replicated pattern of results, these findings can be considered relatively robust.

We also examined a potential moderation effect, to provide further insight into the relationships. Unlike Study 1, Religiosity did not moderate the effects of Intellectual Humility, which was a significant predictor across levels of Religiosity. This suggests a difference in attitudes of non-religious people between these two countries: non-religious people in the UK may be more open to compatibility views if they are more intellectually humble, but non-religious people in the U.S. may have more conflict attitudes regardless of their degree of intellectual humility. This may also be due to differences in religiosity between the U.S. and UK samples, as the U.S. participants reported higher religiosity compared to the UK religious participants. Overall, Study 2 provides more evidence that intellectual humility is positively involved in the belief that science and religion are compatible, when considering the strong role of religiosity.

4. General discussion

The science-religion relationship is complex, and often linked to ideas that science and religion reflect different "ways of knowing". Holding such qualitatively different systems as compatible necessitates that one have respect for other views and humility in one's own beliefs. The present research examined the relationships between intellectual humility and science-religion attitudes, with consideration to the role of religiosity. As found in recent prior work (e.g., Johnson et al., 2023; Zarzeczna et al., 2024), individual religiosity was a robust factor contributing to perceptions of compatibility. After accounting for the positive association between religiosity and compatibility beliefs, and the tendency for people high in religiosity to be lower in intellectual humility, people higher in intellectual humility were more likely to view science and religion as compatible. This can be thought of in terms of a suppression effect; the negative indirect relationship between intellectual humility and compatibility beliefs via religiosity counteracted the positive direct relationship, resulting in non-significant zero-order correlations. These findings were robust across studies and suggest that those who can balance their religious beliefs with a willingness to acknowledge the limitations of their knowledge are more likely to reconcile science and religion.

4.1. Benefits of humility in science and religion

Belief in science-religion compatibility carries some important personal and interpersonal benefits, that may be enhanced by greater intellectual humility. On a personal level, compatibility attitudes are

associated with better well-being (Price & Johnson, 2024). Further, Rios (2021) found that conflict between science and religion can negatively impact Christians' science performance due to stereotype threat, highlighting the benefits of compatibility beliefs for religious individuals. Atheists are more likely to hold conflict attitudes (Zarzeczna et al., 2024), but atheists who adopt compatibility views are also more likely to perceive religious individuals as intelligent, breaking down stereotypes of irrationality often associated with faith (Mackey et al., 2023). In both instances intellectual humility may improve these benefits though an openness to multiple viewpoints, and through respect for others.

Science-religion views also hold implications for public health and public adherence to science advice. At the institutional level, Lionardo et al. (2024) show that Indonesian government officials' belief in evidence-based policy was significantly mediated by their views on religion-science compatibility. Yet, this harmonious perspective is not without its challenges. Belief in conflict or compatibility is motivated by epistemological and moral concerns (Rutjens and Preston, 2020), and motivations to satisfy these concerns (Zein et al., 2024). Compatibility attitudes in religious groups could foster a perception that both religious and scientific explanations hold equal legitimacy in areas where scientific evidence should be the guiding force. There are serious implications where religious beliefs may be taught in science classrooms, in the name of providing a balanced perspective. In such cases we can see why intellectual humility would be especially important in tempering beliefs, knowing when to defer to scientific expertise over religious ideas where it is suitable. As noted by Porter and colleagues in their review (Porter, Baldwin, et al., 2022), a common theme in the literature of intellectual humility is that it is not enough to merely recognize the limits of one's own knowledge (as though to chastise one's own ignorance) but to "recognize their limitations in the right amount and for the right reason" (pg. 574). In other words, intellectual humility involves a healthy skeptical approach to knowledge, but is not inherently self-deprecating. So where others' ideas are flawed, intellectual humility should help to reject that information, as with pseudoscience or misinformation (Hotchin & Preston, 2025). As applied to the science-religion relationship, intellectual humility should promote compatibility to the extent that it acknowledges diversity in views, but not to the extent that science becomes subservient to religious doctrine.

Our findings also have broader implications for ideological polarization in the context of right-wing populism and Christian nationalism. Intellectual humility has been shown to be linked to greater tolerance and lower prejudice generally (Porter & Schumann, 2018), whereas links between religiosity and tolerance can be mixed (Preston & Ritter, 2013), or negatively associated when examining fundamentalist and orthodox religious views (Rowatt & Franklin, 2004). The present results show intellectual humility predicts science-religion compatibility when accounting for overall religiosity, suggesting that intellectual humility may help to foster openness to diverse perspectives more generally. Likewise intellectual humility may also predict openness to other kinds of pluralistic viewpoints, and counteract rigid ideological divides. Future research should explore how these dynamics contribute to broader ideological trends, particularly how intellectual humility might buffer against dogmatism and nationalist or authoritarian ideologies.

4.2. Cultural considerations

Studies here focused on the U.S. (Study 1) and the UK (Study 2). We were interested in the US population as it is generally higher in religiosity (Pew Research Center, 2018) and has more varied science-religion attitudes, with the U.S. having more conflict attitudes (lower compatibility attitudes) compared to other Western countries (McPhetres et al., 2021). These conditions constrain the effects we predict, thereby making the U.S. an especially strong context in which to test our predictions. The UK was selected for Study 2 as it differs from the U.S. on degree of religiosity and in science-religion attitudes, but is similar to the U.S. as a Western nation with predominantly English-speaking populations. Results between the two studies were largely similar, except for the moderation effect by Religiosity observed in Study 1 which is likely due to cultural differences in overall religiosity.

Future research would benefit from investigating non-Western cultures and expanding the scope to include religions such as Islam, Hinduism, and Buddhism. Non-Western cultures may have more compatibility attitudes in general (Price & Johnson, 2024), and compatibility between science and religion may seem more normative in other religions as compared with Christianity (Pew Research Center, 2020). In these groups it may be that religiosity is a weaker predictor of compatibility beliefs, which could strengthen the positive direct effect of intellectual humility as it is less dependent on religious factors. But overall, we anticipate that the effects of intellectual humility observed in our research are likely to replicate in other cultural contexts, and if anything, the role of intellectual humility would be stronger where compatibility attitudes are more common.

4.3. Limitations and future research

This research is important in helping to understand the relationship between intellectual humility and views on the compatibility between science and religion, but there are some limitations that may be addressed in future work. First, research on intellectual humility has experienced a surge of interest in psychology and other disciplines in recent years, but that body of research still lacks strong consensus on the best definition and measures to use (Porter, Baldwin, et al., 2022). In these studies, we made use of the CIHS scale developed by Krumrei-Mancuso and Rouse (2016), as it consists of a broad range of items with four distinct subscales, which in our view encapsulates a broad definition of intellectual humility as it is commonly intended and understood, while also capturing its nuances through the different subscales. Future research might employ other measures to investigate these questions, that we would expect would yield similar results. But moreover, we recognize a greater issue in the study of intellectual humility is the limited interdisciplinary dialogue regarding its role in religious contexts, and that it has predominantly been examined from a psychological and philosophical perspective (Porter, Baldwin, et al., 2022), with relatively little discussion in theological scholarship (Choe et al., 2023). This disciplinary gap suggests that further collaboration between psychologists, theologians, and philosophers could yield a deeper understanding of how intellectual humility operates within religious frameworks. The issue of how intellectual humility is interpreted and expressed by religious people is also a topic of some debate within psychology (Van Tongeren et al., 2018). But one reason that the negative link between religiosity and intellectual humility may arise as it is difficult to hold strong personal religious beliefs while simultaneously being willing to reconsider them (Ruffing et al., 2018). Using alternate measures of intellectual humility from the religious perspective may be fruitful for future research, and indeed may find that there would be no suppression effect through religiosity as the direct link between religiosity and intellectual humility would already be more positive.

These findings may also be qualified by general social desirability responding, wherein people may enhance their actual attitudes on self-report measures to feel good about themselves or appear good to others. This may potentially affect self-reported intellectual humility, as individuals may be motivated to present themselves as more open-minded or intellectually humble than they truly are. Likewise, people may enhance self-reported religiosity and compatibility views, to the extent that these are perceived as positive beliefs to hold. Though we acknowledge social desirability may play some role, we think that this is a minimal concern in the current studies, as religious participants are most likely to enhance here, and religiosity is what we sought to account for in these relationships. But future research may address this as well, in adopting more implicit measures, or by studying relationships where compatibility is framed as negative. Indeed, we may observe the direct relationship between intellectual humility and compatibility to become

stronger in such cases, as reversing the social desirability may weaken the suppression effect of religiosity.

Additionally, in these studies we focus on the role of general religiosity over alternative measurements of religious belief. We did so because we wanted to capture a generalized pro-religious attitude, as this was hypothesized to underlie the suppression effect. Importantly, we also included measures of general spirituality and religious fundamentalism, as these reflect more compassionate vs. dogmatic approaches to religious belief, to take into account these differences in belief. This was done to demonstrate the hypothesized suppression effect was due to general religious belief rather than other kinds of religious belief. But we note there are many other dimensions and kinds of religious belief not measured in these studies (e.g., intrinsic vs extrinsic orientations), that could be examined in future studies. Though all measures have been used extensively in previous research, our measures of Science-Religion Compatibility and General Religiosity have not yet undergone formal validation procedures by the original authors, and so future research could examine how their predictive validity compares to alternative measures in cross-cultural samples.

Finally, we note that the present studies used cross-sectional data, which limits us from making strong directional claims about interrelationships between variables. As noted by Choe et al. (2023), overreliance on cross-sectional methods used to study intellectual humility constrains interpretations of its relationship with religion-spirituality. Future research might make use of longitudinal methods to examine any causal influence that intellectual humility may have on compatibility beliefs. Longitudinal designs could likewise help with gaining a deeper understanding of the nature of the suppression effects we observe. Our suppression model was informed by previous research findings and theory, and as suppression does not imply causal paths between the variables it was not necessary to establish temporal ordering (MacKinnon et al., 2000). However, longitudinal methods could shed light on the relationship between intellectual humility and compatibility beliefs, for example whether one precedes the other or whether the relationship is bidirectional. The suppression effects found are unlikely to represent statistical artefacts, i.e., spurious or empirical suppression, as the relationships between the predictor and suppressor variables were relatively small and the measures do not contain conceptual overlap, which has been problematic in previous research (Mavor et al., 2009). Additionally, we did not expect or find complete mediation, which can lead to spurious results (Shrout & Bolger, 2002). We were also able to replicate the finding across two well-powered studies, which further supports this reflecting a true suppression effect. However, future research could include additional mediating or suppressing variables which may enhance the predictive validity of the model.

4.4. Conclusion

Beliefs about science and religion provide people with a sense of understanding and greater meaning, but people vary in the extent that they find these sources of understanding to be compatible with each other. This work shows that intellectual humility – characterized by understanding the limits of one's own knowledge and respect for other views—serves as an important predictor of beliefs about the compatibility of science and religion. But this relationship may be obscured by the links both variables have with religiosity. Intellectual humility has a positive effect on compatibility attitudes, but only when accounting for the negative indirect relationship via religiosity, which suppressed the direct relationship. These findings show the contribution of intellectual humility in reconciling scientific and religious perspectives beyond its negative association with religiosity. Intellectual humility helps people to appreciate the unknowns of knowledge itself, and thereby to accept science and religion as different means in that pursuit.

CRediT authorship contribution statement

Jesse L. Preston: Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Methodology, Conceptualization. **Victoria Hotchin:** Writing – review & editing, Methodology, Investigation, Formal analysis. **Natalia Zarzeczna:** Writing – review & editing.

Declaration of competing interest

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Data availability

Data will be made available on request.

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