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Content Matters: Perceptions of the Science-Religion Relationship

Carola Leicht[a], Carissa A. Sharp[b], Jordan P. LaBouff[c], Natalia Zarzeczna[d], and Fern Elsdon-Baker[b]

[a]Kent Business School, University of Kent, Canterbury, UK; [b]Department of Theology and Religion, University of Birmingham, Birmingham, UK; [c]Psychology Department, University of Maine, Orono, USA; [d]Faculty of Social and Behavioural Sciences, University of Amsterdam, Amsterdam, Netherlands

ABSTRACT

Science and religion are often portrayed as monolithic entities in perpetual and necessary conflict. We explore the extent to which perceptions of conflict or compatibility between science and religion are *content dependent* and are associated with participants' own religious or non-religious social identities. In doing so, we develop a novel Science and Religion Conflict/Compatibility Scale. Across three studies (n = 1,506), we consistently find group differences between atheists, agnostics or other non-religious individuals, and religious individuals. Religious individuals reported the highest levels of compatibility and atheists the highest levels of conflict between science and religion. Additionally, perceptions of conflict between science and religion were divided into two distinct content areas. The first included items concerning big-picture *explanations*, such as understanding the origins of human life. The second content area formed around items that describe interactions between humans and the world, such as treating mental illness. We conclude that research examining perceptions of conflict between science and religion needs to adopt a more nuanced approach, that takes into account individuals' identities and the context in which the relationship between science and religion is discussed.

> Well, science and religion are not competitors, they're two different languages trying to tell the same story. There's room in this world for both.
>
> (Brown, 2017)

Framing the relationship between science and religion as a contentious one – fighting for ultimate authority over the most fundamental questions of humanity, such as "where do we come from" and "where are we going," – has provided fuel for art, fiction and scientific debates for centuries. Classic plays such as *Life of Galileo* (Brecht, 1943/1966), popular fiction such as *Origin* (Brown, 2017), or popular science books such as *The God Delusion* (Dawkins, 2006) or *Darwin's Cathedral* (Wilson, 2002), use the "science-religion" relationship as a focal point within their narratives and have reached a diverse and wide range of audiences. This indicates a vast public interest in debating and understanding how science and religion relate to or oppose each other and how their relationship can be framed and understood. Despite this interest, there is a gap in social scientific research exploring the nuances of how publics may conceptualize the relationship between science and religion, rather than taking a position of conflict as a given (Baker, 2012; Elsdon-Baker, 2015).

CONTACT Carola Leicht acl23@kent.ac.uk Kent Business School, University of Kent, Canterbury, Sibson CT2 7FS.
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Over the past few decades, large-scale opinion polls have explored people's perceptions of the relationship between science, evolutionary science, and religion, the most notable example being Gallup's US-based survey which has been running since 1982 (Brenan, 2019). More recent research has suggested that these polls are likely to have over-inflated the number of religious people who see their beliefs as being in conflict with science due to the ways in which the questions have been worded; for example, utilizing binary questions forcing people to choose between scientific and religious explanations (Elsdon-Baker, 2015; Hill, 2014, 2019). The majority of surveys conducted to date have presented respondents with limited options to express their views on science, evolution, and religion, rather than using nuanced measures that indicate how people might be constructing and resolving their views on the relationship between science and religion in their day-to-day lives. An exemplar of this is the way in which survey respondents have traditionally been given limited options, which frame acceptance of evolutionary science as being atheistic (see Elsdon-Baker, 2015 for an overview). Elsdon-Baker (2015) concludes that this lack of nuance, combined with overgeneralizations in polling data collection and design, leaves social scientific research on public perceptions of the evolutionary science-religion relationship at risk of literally and figuratively "creating creationists."

Recent polls have taken a more nuanced approach. For example, in a large international survey (France, Hong Kong, India, Italy, Taiwan, Turkey, the United Kingdom, and the United States) researchers have investigated scientists' attitudes and have found that while they tend to be more secular than non-scientists, they do not necessarily believe that science and religion are in conflict (Ecklund et al., 2016). Furthermore, a recent poll of US publics by PEW highlights that whilst 59% of Americans think that science and religion are often in conflict, 68% indicate that they do not personally perceive a conflict between science and their own religious beliefs. Most surprisingly the same poll shows that it is those who are the least religious who state that science and religion are often in conflict (Pew, 2015). However, we still understand very little about the drivers of people's perceptions of conflict or compatibility between science and religion, and whether these perceptions are context-dependent. As a consequence, social scientists do not currently have sufficient insight as to how publics make sense of the science-religion relationship in their everyday lives. Moreover, there is currently no validated psychological measure of people's perceptions of the relationship between science and religion.

This paper aims to address this gap, by exploring individuals' beliefs about the science-religion relationship, in regard to a wide range of content areas, on which science and religion provide alternative approaches or explanations for natural phenomena. In doing this we not only provide new and more nuanced empirical data on the science-religion relationship, but also develop and refine a novel scale that measures people's perceptions of this relationship more precisely.

Research overview of science and religion

Within academia, the relationship between science and religion, as well as their roles within societies, have been areas of interest in a number of humanities disciplines, such as history (e.g., Brooke, 1991; Harrison, 2015; Lightman, 2001), and theology (e.g., McGrath, 1999; McGrath, 2015; Polkinghorne, 1998). For the most part the study of science and religion has primarily consisted of a myth busting approach to polarizing, monolithic or simplistic narratives about the relationship between science and religion. Though this has been predominantly undertaken through historical or epistemic lenses, over the past decade it has also increasingly become a subject of study in sociology (e.g., Ecklund, 2010; Evans & Evans, 2008) and more recently psychology (see below). Increasingly the relationship between "science" and "religion" has begun to be examined in terms of people's day-to-day lived experience, and sociological research has more recently been undertaken to better understand the views of both scientists and publics. This article builds on this growing field of social scientific work by exploring how people in Canada and the UK perceive the science–religion relationship with regards to several key issues. Additionally, we take participants' social identities and beliefs, which to some extent may be constructed around both science and religion, into account.

There are three main lines of research exploring psychological aspects of science and religion. The first of these has investigated how religion and science relate to each other as belief systems. Inherent in this research framing is the assumption that the two belief systems of science and religion are at odds – that as belief in one goes up, belief in the other goes down (Preston & Epley, 2009). This corresponds with the popular narrative that there is an inherent conflict between science and religion. A substantial body of social scientific research has explored whether religious belief and scientific reasoning are in opposition (Gervais & Norenzayan, 2012; Shenhav et al., 2012). The principal hypothesis of this research is that science and religion aim to explain the same phenomena (McCauley, 2000; Preston & Epley, 2009). As a consequence, this research argues that it will be difficult for individuals to combine science and religion as belief or knowledge systems. The logical conclusion of this line of reasoning is that one must prevail over the other. This area of research often builds on findings showing that individuals' cognitive styles vary depending on their (non)religiosity. For example, Shenhav et al. (2012) have shown that belief in God is associated with individual differences in cognitive style, as they showed that belief in God is positively related to giving intuitive answers on the Cognitive Reflection Test. Additionally, they showed that experimentally inducing a mind-set of intuition over reflection leads to higher self-reported beliefs in God. Overall, this line of research draws on the idea that religious thinking is natural, while scientific thinking is not and requires more elaborate thinking, and hence science needs to be taught and learned (McCauley, 2000). In other words, this work argues that religious explanations are intuitive (Järnefelt et al., 2015) and spring into mind easily, whilst scientific explanations for the same phenomena necessitate more systematic thinking and processing.

The second line of research investigates to what extent individuals hold science and religion in explanatory co-existence, showing that across cultures religiosity is not consistently associated with more negative attitudes toward science (McPhetres et al., 2020), and individuals do not automatically choose one belief system over the other (Legare & Visala, 2011) or their religious belief over the value of science (Payir et al., 2020). Although, as discussed previously, some research concludes that scientific and religious explanations are at odds, other research has shown that individuals can, and do, use both natural and supernatural explanations for the same phenomena (Legare et al., 2012; Legare & Visala, 2011). For example, when reasoning about illness and disease transmission in South Africa, people often use biological explanations (natural) *alongside* witchcraft explanations (supernatural; Legare & Gelman, 2008). In fact, in the highly religious Iranian context, while older children and adults expressed confidence in the existence of both scientific and religious "unobservable entities," they actually expressed greater confidence in the existence of *scientific* entities (Davoodi et al., 2018). Recent research suggests that people may attribute different kinds of virtues to scientific (epistemic, e.g., "objectivity") and religious (non-epistemic, e.g., "offering comfort") explanations. However, these effects are moderated by religiosity, with religious believers attributing both epistemic and non-epistemic virtues to religious explanations (Davoodi & Lombrozo, 2020). This suggests that (non)religious identity may be important in understanding how people interpret religious and scientific explanations.

This leads us to the third line of research which has explored how individuals use religion and science to form social identities (Sharp & Leicht, 2020; Ysseldyk et al., 2010). For example, religion does not only function as a belief system but also as a clear group affiliation, providing safe spaces, norms, and group boundaries. Emerging research shows that non-religious social identities such as atheism may also have similar features (Doane & Elliot, 2015; Guenther et al., 2013). Because (non) religion can serve as a social identity, features of group processes such as social categorization, social identification, and social stereotyping are also associated with it. Similarly, just like (non)religious identification, identification with science has been shown to be associated with particular stereotypes and biases. For example, research relating to stereotype threat has shown that there are clear ideas as to who can be a scientist, which contributes to the underrepresentation of women and other minority groups in STEM fields (Alper, 1993; Cheryan et al., 2009).

Whilst research on science and religion as belief systems provides some insights as to why scientific and religious thinking or reasoning around big questions such as "human origins" may be perceived as being in opposition, research on social identities can also inform social scientific research on how salient group identities – for example, one's religious or non-religious identity – can contribute to a conflict narrative. It is well established that social identities can lead to inter-group tensions and tendencies to prefer individuals who belong to the same group (Tajfel, 1978; Turner et al., 1979). In line with the social identity approach, research has shown that religious identification can lead to either prejudice (Johnson et al., 2012; Verkuyten, 2007) or prosociality (Norenzayan et al., 2016; Saroglou et al., 2005) depending on the religious identities of the individuals in question (e.g., whether they are ingroup or outgroup members, or whether their group is viewed as being value-violating). Additionally, social identities relevant to the science-religion debate (e.g., "religious," "non-religious" or "atheist," and "scientist") are stereotyped in various ways. Religious individuals are often stereotyped as being less competent in science (Rios et al., 2015), atheists as being less trustworthy (Gervais et al., 2011, 2017), and scientists as being robot-like, lacking emotion, and valuing knowledge over morality (Rutjens et al., 2016). These stereotypes have real-world impacts as well – Rios and colleagues have shown that Christians in the US perform worse on science-related tasks when confronted with the conflict narrative between science and religion (Rios, 2020) or the stereotype that Christians are worse at science (Rios, 2020; Rios et al., 2015).

Additionally, while we know that religious people are stereotyped as being less competent in science, having the combined identity of "religious scientist" is not always seen by everyone to be problematic. Among a sample of the general public in the UK, the identity of "religious scientist" or "religious evolutionary biologist" is only consistently perceived as being counter-stereotypical by *atheists*, but not by religious or other non-religious (e.g., agnostic, "no religion") participants (Sharp et al., 2021). Additionally, a growing research field including a large-scale sociological research project gathering data from biologists and physicists in 8 countries around the world has revealed that many scientists and individuals do not necessarily believe in an inherent conflict between science and religion (Ecklund et al., 2016; Longest & Uecker, 2020). While the percentage of scientists in this study who were religious tended to be lower than the general population, this was not universal, and the percentage of these religious scientists even in less religious countries was not negligible (e.g., 27% of scientists surveyed in the UK were religious compared to circa 47% of the general population who identify as religious; Inglehart et al., 2014, as cited in Ecklund et al., 2016). This indicates that while the "conflict narrative" between science and religion is widespread, it is by no means universal in terms of lived experience, even among individuals whose identities may be stereotyped as being incompatible.

All three areas of research, the one focusing on opposition, the one focusing on explanatory co-existence and the one focusing on social identities, have produced findings that elucidate how people think of religion, science, and their relationship in terms of broad categorizations. However, they do not directly provide an indication as to how individuals perceive the relationship between science and religion within their everyday life. Additionally, this research does not explore how people's perception of the relationship between science and religion is related to their social identities. Thus, in our research we will be addressing people's identification with, as well as their beliefs about, both (non) religion and science in order to integrate these areas of research.

The role of content specificity and the science-religion relationship

A common theme within research exploring the relationship between science and religion is treating these categories as monolithic entities. However, the effect of (non)religiosity on other beliefs, behaviors, and performance is context-dependent. For example, religiousness is related to prosociality in certain contexts (Malhotra, 2008; Preston et al., 2010), but increases prejudice in others (Altemeyer & Hunsberger, 1992; Jackson & Hunsberger, 1999). Additionally, research in Science and Technology Studies indicates that perceptions of or trust in "science" can also be context and content contingent,

meaning that people may accept some aspects of science while rejecting others (Hildering et al., 2013). For example, people may see experts in evolutionary science as unreliable, while at the same time perceiving experts in other closely related fields of biological science or even genetics as reliable (Elsdon-Baker et al., 2017).

Thus, rather than a single, coherent (non)religious or scientific worldview, people may hold a host of positions in terms of religion and/or science that vary in terms of their perceived coherence, truth, and value. As a result, perceived conflict or compatibility between science and religion may depend not merely on (non)religiosity, or the extent to which someone identifies with science, but on the specific issue at hand. Ontological or moral questions such as "What happens at the end of life?" may be perceived differently from questions such as "How should we treat the environment?," and people may draw on different sources of meaning, that include (non)religious and scientific thinking, but may also include other social or cultural factors, to address them.

We therefore expect that perceptions of conflict between science and religion will similarly vary depending on the specific issue at hand. For example, although individuals may believe science and religion are in conflict with regards to questions around evolutionary theory, this may not be the case when it comes to issues relating to medical practice or understanding social/human behavior. The goal of this research is therefore to explore whether perceptions of the science-religion relationship vary depending on the specific content area that participants are asked about (Studies 1–3). Additionally, we take into account the extent to which individuals personally identify with religion (or not), and the extent to which they personally view that science is important to their life (personal identification with religion and/or science, Studies 1–3). We also explore whether we find group differences in people's perceptions of science and religion based on their (non)religious social identities (Studies 2–3). Finally, we examine whether specific perceptions of conflict or compatibility between science and religion are related to a number of underlying factors including beliefs about the nature, remit and role in society of science and/or religion (Study 3). We hypothesize that such beliefs (e.g., religious fundamentalism, belief in science/scientism) may fuel social and cultural narratives about the science-religion relationship. Altogether this research will provide a more nuanced and differentiated understanding of how individuals construct the science-religion relationship within their everyday lives.

Study 1: Exploring public perceptions of the science-religion relationship

This initial study aims to explore participants' perceptions of conflict or compatibility between science and religion on twelve items that vary in content area. The items were designed by a multi-disciplinary team of experts in the study of public perceptions of science and religion. We also took into account existing research which has shown differences in how people perceive the relationship between science and religion. For example, we included a range of questions on concepts that relate to evolutionary sciences due to the fact that this is a focal point within the conflict narrative between science and religion, as well as questions related to origins and endings. We also added items exploring content areas in which research has found evidence of explanatory coexistence, such as illnesses (Legare et al., 2012). Finally, a set of items explored societal issues that are or have been associated with science and religion – such as the relationship between humans and the environment (e.g., environmental stewardship; Hitzhusen & Tucker, 2013) and humans' relationships with each other (e.g., social/moral questions about human behavior that can be perceived as linked with scientific concepts, for example, "survival of the fittest" or social Darwinism). Additionally, we explore whether participants' personal (non)religious identities affect perceptions of conflict or compatibility.

Method

Participants

Two hundred and thirty-two UK residents (50.42% male; M_{age} = 49.03; Age Range 18– 65, 90.9% White European) were recruited using Qualtrics participant panels. Participants were screened so that approximately half of them identified as religious (n = 113), and half as non-religious (n = 119) in order to ensure that we collected a wide range of (non)religious identities. Using an additional demographic question, within the complete participant sample, we found that overal in our sample 57.3% identified as Christian, 5.6% as belonging to other religious traditions, 1.3% as Spiritual but not Religious, 11.2% as Agnostic, 16.4% as Atheist, and 8.2% as no religion. Participants received a small financial reward to complete the survey covering a wide range of variables (materials for all studies including full text of items, and all datasets, are available on the Open Science Framework website: DOI 10.17605/OSF.IO/YTZPE).

Materials

Measuring perceptions of the science-religion relationship

Participants were asked to indicate on a sliding scale (0 – *complete conflict*; 10 – *complete compatibility, with no midpoint labeled*), "To what extent do you PERSONALLY see science and religion as in CONFLICT or as COMPATIBLE?" on 12 specific issues.

Personal identification with religion

Using a seven-point scale (1 – *not at all*; 7 – *very much)* we measured personal identification with religion by asking participants to indicate to what extent they agreed with the statement, "religious beliefs or spirituality are important to my sense of who I am" (M = 2.08, SD = 1.44 for the "non-religious" participants; M = 5.42, SD = 1.27 for the "religious" participants).

Results

Factor structure based on content specificity

To explore how participants responded to the wide diversity of issues we conducted an exploratory factor analysis. The Kaiser-Meyer-Olken measure verified the sampling adequacy (KMO = .93) and the Bartlett's test of sphericity was significant (p < .001), indicating that the necessary correlations between items were present. The principal components factor analysis without rotation suggested that two factors existed (Eigenvalue > 1). Therefore, a principal axis factor analyses with direct oblimin rotation was performed to explore these two factors.

The pattern matrix (see Table 1) supported a two-factor solution, suggesting that the two factors accurately represented the underlying structure of our 12 items, although there was one item ("explaining why people get sick") which loaded above the conservative critical value of .40 (Fabrigar et al., 1999) on both factors. The two factors were correlated, $r(232)$ = .548, p < .001, adding confidence to the oblique solution. Factor 1 explained 55.81% of the variance in participants' scores on the measure. It was labeled *explanations* as it mainly contained items that explore the science-religion relationship when trying to explain something about the origins or structure of life or the universe (e.g., "the origins of human life"). Factor 2 accounted for 11.16% of the variance in participants' scores on the measure, and was labeled *human↔ world interactions* as it mainly consisted of items that explored participants' perceptions of the science-religion relationship in regards to human behavior toward each other and the world around us (e.g., "how humans should behave towards each other" or "treating mental illness"). We calculated the sub-scores for our two factors after dropping the problematic item. A reliability analysis revealed that both factors were internally consistent (*explanations* α = .92; *human↔world interactions* α = .85).

Table 1. Pattern matrix showing the two-factor oblimin solution from Study 1 and 2, with abbreviated items.

	Factor loadings	
Item	Factor 1	Factor 2
Study 1		
Origins of human life	.93	
Origins of life other than human life	.87	
Origins of the universe	.85	
End of human life	.85	
Origins of geological or landscape formations	.80	
Natural disasters	.54	
Why people get sick	.44	.43
Promoting a sense of respect and tolerance		.91
How humans should behave toward each other		.85
How humans should behave toward the environment		.73
Treating mental illness		.53
Treating physical illness		.47
Study 2		
Origins of human life	−.85	
Origins of the universe	−.84	
Origins of life other than human life	−.75	
What happens at the end of human life	−.92	
Treating physical illness		.94
Treating mental illness		.95
Why people get sick		.76
Informing the relationship between humans and the environment		.70

Differences between the factors

To explore whether perceptions of the relationship between science and religion differed between the two factors we conducted a paired-subjects t-test between the mean scores of the two factors (higher scores = higher compatibility and lower scores = higher conflict, with a midpoint of 5). The results indicated that participants perceived more conflict on the *explanations* factor (M = 3.76, SD = 2.45) than the *human↔ world interaction* factor (M = 5.52, SD = 2.11), $t(232) = 14.33$, $p < .001$, $dz = .94$ (95% CI [.82, 1.06]). This indicates that on average people see science and religion as more in conflict on questions that have to do with explanations.

Differences based on religious identification

To identify whether participants' (non)religiosity affected perceptions of the relationship between science and religion, we looked at the correlations between people's personal religious identification and their average scores on the two factors. We found that personal religious identification was positively correlated with the average score on both factors (*explanations:* $r(230) = .46$ (95% CI [.35, .56]), $p < .001$; *human↔ world interactions:* $r(230) = .43$ (95% CI [.32, .53]), $p < .001$), with higher levels of religiosity being associated with higher perceptions of compatibility between science and religion.

Discussion

In Study 1, we explored whether people with a wide range of (non-)religious identities perceive a conflict between science and religion when they are asked about specific issues. Overall, our findings show that participants did perceive the science-religion relationship differently depending on the content of the issues addressed. The results show that there are two factors, which distinguish between responses, the first is around explanations of nature and the universe. The items on this factor related to topics around evolutionary sciences and other topics around "origins and endings." Items on the second factor have more to do with human behavior and our interaction with the world around us.

Importantly, we find that perceptions of the science-religion relationship tend more toward conflict on the *explanations* factor, whereas the relationship is seen as relatively more compatible on the *human↔world interactions* factor.

We also found a significant correlation between personal identification with religion (measured as a continuous variable from "not at all" to "very much") and conflict/compatibility. As this was the first study exploring whether content areas affect how participants perceive the relationship between science and religion, our goal in Study 2 was to replicate these results using a larger sample with more (non)religious diversity, primarily from the UK and Canada. Additionally, we aimed to further test this factor structure, investigating the impact of (non)religiosity by looking at group affiliation as well as level of religiosity.

Study 2: Replication of study 1

In Study 2, we aimed to further investigate the factor structure of the conflict/compatibility scale that emerged in Study 1. We collected the data as a part of a large participant recruitment scheme and therefore aimed to get more diversity in regard to participants' (non)religious identification and nationality. The larger dataset included additional questions related to people's beliefs and practices that were collected as part of an online survey to recruit participants for future qualitative and quantitative research related to science and religion. The full list of survey questions can be found at the OSF link for this paper.

Method

Participants

Seven hundred and thirty-one participants (55.3% female, 43.1% male, 1.5% other, 1.0% would rather not specify; M_{age} = 34.49, Age Range = 18–84; 78.2% White/European) completed a large online survey in return for being entered into a biweekly prize draw for gift vouchers. Participants covered a wide range of (non)belief positions (28.3% Christian, 28.3% Atheist, 10.9% Agnostic, 10.0% no religion, 5.9% Spiritual but not Religious, 5.5% Muslim, 5.5% Other), and were predominantly residents of Canada (20.2%) and the UK (65.4%).

Measures

Measuring perceptions of the science-religion relationship

Participants were asked to indicate on a 7 point Likert scale (1 – *complete conflict*; 7 – *complete compatibility; with the midpoint labeled as neutral*), "To what extent do you PERSONALLY see science and religion as in CONFLICT or as COMPATIBLE?" on the 12 items used in Study 1.

Personal identification with religion

As in Study 1, we measured personal identification with religion or spirituality by asking participants to indicate to what extent they agreed with the statement, "Religious beliefs or spirituality are important to my sense of who I am" on a 7-point Likert scale (this time on a scale from 1 – *strongly disagree* to 7 – *strongly agree*, with the midpoint labeled as neutral). Fifteen participants had missing data on this question.

Results

Full sample factor analysis

We first performed an exploratory factor analysis on the full sample, in order to determine if there were any problematic items that should be eliminated from the scale. Using the full, 12-item scale, the Kaiser-Meyer-Olken measure verified the sampling adequacy (KMO = .94), and the Bartlett's test of sphericity was significant ($p < .001$), indicating that the necessary correlations between items were present. The principal components factor analysis without rotation suggested that two factors existed (Eigenvalue > 1). Therefore, a principal axis factor analyses with direct oblimin rotation was performed to explore these two factors. However, within the pattern matrix, only two items emerged as belonging clearly to the second factor, "Promoting a sense of tolerance towards all human beings," and "Understanding how humans should behave towards each other (for example: which actions and behaviors are right/wrong)." As factors should be measured by at least three items (Costello & Osborne, 2005), we dropped these two items and re-ran the factor analysis with the remaining 10 items.

For the 10-item scale (KMO = .94, sphericity $p < .001$), we first ran an unrotated principle components analysis, which suggested that there was only one factor with an Eigenvalue greater than 1. However, given the consistent results across Study 1 and the first analysis of Study 2, we decided to run our follow-up principal components analysis with direct oblimin rotation, specifying two factors. The pattern matrix showed two items that cross-loaded on both factors: "Explaining the origin of geological or landscape formations" (Factor 1 = .52, Factor 2 = −.44) and "Explaining natural disasters" (Factor 1 = .64, Factor 2 = −.30). Therefore, we dropped these two items and once again re-ran the factor analysis, with the remaining 8 items. Finally, for the 8-item scale (KMO = .93, sphericity $p < .001$), we again first ran an unrotated principle components analysis, which suggested there was only one factor with an Eigenvalue greater than 1. However, when we ran a principal components analysis with direct oblimin rotation, specifying two factors, we found the same pattern as across all previous analyses. The pattern matrix indicated that there were no problematic, cross-loading items (see Table 1). The *explanations* factor explained 69.89% of the variance in participants' scores on the measure (α = .92), and *human↔ world interactions* explained 9.19% of the variance in participants' scores on the measure (α = .90). We then ran separate factor analyses for our largest religious and non-religious groups of participants (Christian and Atheist) in order to see if the factor structure held for these sub-groups, as these groups were large enough to support the analyses.

Christian participants. The Kaiser-Meyer-Olken measure verified the sampling adequacy (KMO = .90) and the Bartlett's test of sphericity was significant ($p < .001$), indicating that the necessary correlations between items were present. We first ran an unrotated principal components analysis, which suggested that there were 2 factors (Eigenvalues > 1). A principal components analysis with direct oblimin rotation replicated the factor structure found with the whole sample. The *explanations* factor explained 61.20% of the variance in participants' scores on the measure (α = .90), and *human↔ world interactions* explained 13.83% of the variance in participants' scores on the measure (α = .86).

Atheist participants. The Kaiser-Meyer-Olken measure verified the sampling adequacy (KMO = .87) and the Bartlett's test of sphericity was significant ($p < .001$), indicating that the necessary correlations between items were present. We first ran an unrotated principal components analysis, which suggested that there were 2 factors (Eigenvalues > 1). A principal components analysis with direct oblimin rotation replicated the factor structure found with the whole sample. The *explanations* factor explained 58.00% of the variance in participants' scores on the measure (α = .85), and *human↔ world interactions* explained 12.51% of the variance in participants' scores on the measure (α = .85).

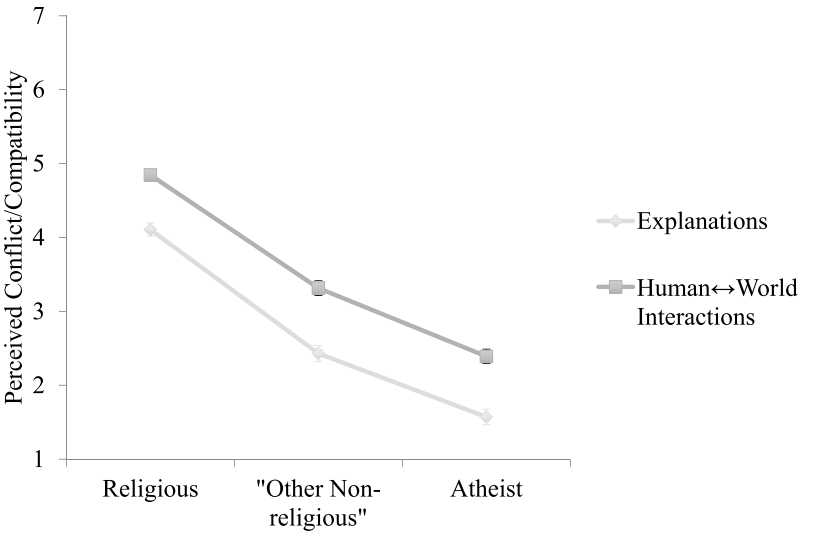

Figure 1. Perceived conflict and compatibility as a function of religious identity and content issue. Error bars show -/+1 SE (Study 2). 1 = complete conflict; 7 = complete compatibility.

Differences between the factors within and between (non)religious identities

Like in Study 1, we found significant positive correlations between people's personal identification with religion/spirituality and their answers on both the *explanations* factor, $r(714) = .60$ (95% CI [.55, .64]), $p < .001$ and the *human↔ world interactions* factor, $r(714) = .64$ (95% CI [.59, .68]), $p < .001$, indicating that those who scored higher on the personal identification with religion/spirituality scale saw more compatibility between science and religion.

Additionally, we ran a 2 (scale factor) x 3 ([non-]religious identity) mixed ANOVA with Religious ($n = 288$; including all religious identities), atheist ($n = 207$), and participants we might loosely categorize as "other non-religious" ("agnostic," "no religion" and "spiritual but not religious"; $n = 196$) as between subject factor and an aggregated score for each factor excluding the item that cross loaded as the repeated measure dependent variable (higher scores = higher compatibility and lower scores = higher conflict, with a midpoint of 4). We used Bonferroni corrections to adjust for multiple comparisons (see Figure 1).[1] We found a significant main effect of our repeated measure, the scale factor, $F(1, 688) = 292.59$, $p < .001$, with participants having lower scores on *explanations* ($M = 2.87$, $SD = 1.86$) than *human↔ world interactions* ($M = 3.67$, $SD = 1.74$). Additionally, there was a significant main effect of (non-)religious identity, $F(2, 688) = 230.40$, $p < .001$, with religious participants having significantly higher scores, that is, they perceived more compatibility ($M = 4.47$, $SD = 1.73$) than atheists ($M = 1.98$, $SD = 1.21$), t

[1]We separated out atheist and "other non-religious" participants for this analysis because previous research has found that atheists tend to respond differently from other non-religious participants. For example, there are notable differences within atheist subset groups when surveying non-religious publics in terms of endorsement or perceptions of evolutionary science (see Elsdon-Baker, 2020; Elsdon-Baker et al., 2017). Additionally, the "Spiritual but not Religious [SBNR]," religious identity might be seen as an "in between" category between religious and non-religious. Our research elsewhere has shown that those who self-identify as non-religious don't all adopt a fully materialistic stance and may still endorse supernatural explanations or phenomena e.g., life after death, which are more likely to be rejected by those who identify with atheistic materialism (Elsdon-Baker & Leicht, 2017). Both "SBNR" and "non-religious" are heterogenous categories. Therefore, we completed a separate analysis in order to see whether we would find differences between the identities we had grouped together for our "nonreligious" category. We ran a separate 2 (scale factor) x 3 (agnostic vs. no religion vs. SBNR) mixed ANOVA in order to investigate whether there were differences between these groups, and found that there was a main effect of scale factor, $F(1, 193) = 101.33$, $p < .001$, but no main effect of (non)religious identity, $F(2, 193) = 2.08$, $p = .128$, and no interaction, $F(2, 193) = .26$, $p = .77$. Therefore, we kept the composite category of "nonreligious" for this analysis. Finally, we ran a multi-level model accounting for country, which did not change the pattern of results, see supplementary material A.

(493) = 18.96 $p < .001$, (95% CI [2.91, 2.270), and non-religious participants (M = 2.87, SD = 1.43), $t(482) = 11.53$, $p < .001$, (95% CI [1.26, 1.79]). Non-religious participants perceived significantly more compatibility than atheists, $t(401) = -7.16$, $p < .001$, (95% CI [−1.18, −0.67]). The interaction between scale factor and (non)religious identity was not significant, $F(2, 688) = .40$, $p = .44$.

Discussion

Study 2 confirmed the 2-factor structure established in Study 1 and again demonstrated that perceptions of the science-religion relationship vary by content area. This study showed that using these 8 items provides a reliable measure of public perceptions of the science-religion relationship. Moreover, it suggests something interesting about the framing of the conflict narrative, in that we found that the *explanations* factor explains vastly more variance in perceptions of conflict/compatibility than *human↔ world interactions*. As expected, we found group differences in perceptions of conflict or compatibility, with religious individuals seeing more compatibility between science and religion than either atheists or other non-religious individuals. Additionally, the significant group differences found between atheists and other non-religious individuals on their perceptions of conflict or compatibility indicate that we should not treat "non-religious" as a homogenous group with regards to their attitudes toward science and religion.

We designed Study 3 to confirm the structure of this 8-item measure with a new sample with equal sample sizes of atheist, agnostic, and religious participants. In doing this, we aimed to assess whether the two underlying factors established in Study 1 and Study 2 are applicable across three major religious or non-religious identities. We chose to focus on atheists and agnostics specifically because the catch-all category of "other non-religious" could include people with a very wide variety of positions with regards to (non)religion (e.g., "spiritual but not religious" ["SBNR"] individuals). While we did not find any differences between the three identities that made up the "non-religious" category in this study (agnostic, no religion, and SBNR; see Footnote 1), our sample sizes were small, and previous research has indicated that SBNRs score differently than both religious and non-religious individuals on some measures of religious/spiritual belief (Johnson et al., 2018). We did not specify different kinds of religious identities because we did not have a theoretical reason to expect differences between specific religious traditions on these measures. Additionally, the body of literature on psychology of religion (compared to non-religion) is more extensive, and we are able to control for variables such as religious fundamentalism which we would expect would have more impact on perceptions of conflict or compatibility than differences between religious traditions would. We are not aware of any comparable scales of non-religiosity. Finally, we wanted to investigate the extent to which additional individual differences (religiosity-related, science-related, and personality variables) related to participants' answers on the scale.

Study 3: CFA and validity analyses

The purpose of Study 3 was two-fold. First, we wanted to confirm the factor structure of the 8-item measure derived from Study 2 and assess its applicability across participants who identified as atheist, agnostic, and religious. Second, we wanted to investigate the convergent validity of this new scale, investigating its relationship to associated constructs across our different participant groups. These convergent measures fell into three broad categories: religion-related variables, science-related variables, and personality variables. Given the consistent findings in Studies 1 and 2 that religious participants were more likely to perceive the science-religion relationship as compatible, we hypothesized that higher scores on most religion-related variables (e.g., personal identification with religion/spirituality, group identification with [non]religion) would be related to higher scores on both factors across all three groups.

We also asked about science-related variables, including belief in science, personal identification with science, and group identification with science. We hypothesized that higher identification and engagement with science would be related to higher perceptions of compatibility for religious participants, and higher conflict for agnostic and atheist participants.

Finally, in regard to personality variables, we built upon research on religiosity/spirituality (Lockenhoff et al., 2009; Saroglou, 2002), and hypothesized that people who scored higher on the agreeableness dimension of the Big 5 personality inventory would show higher belief in compatibility on both factors across all participant groups. We hypothesized that personality variables related to open-mindedness and flexibility (e.g., lack of intellectual overconfidence, openness to experience) would be related to more perceived compatibility on both factors across all participant groups, while personality variables measuring the opposite side of that spectrum (e.g., closed-mindedness, discomfort with ambiguity) would be related to higher conflict on both factors across all participant groups, given that "black-and-white" thinking would suggest that people would not be able to reconcile two different viewpoints (Suedfeld et al., 1992).

Method

Participants and procedure

Scores on the 8-item measure were obtained from a sample of 543 UK resident participants who were recruited using Qualtrics participant panels (43.6% male, M_{age} = 45.87; Age Range 16– 84; 91.7% White European; 34.6% Religious, 31.1% Agnostic, and 34.3% Atheist). The participants received a small financial reward for completing the survey. As in Study 1 and 2 participants were asked to "indicate the extent to which you PERSONALLY see science and religion as in CONFLICT or COMPATIBLE on the following issues." Like in Study 1 the scale points ranged from 0 (*complete conflict*) to 10 (*complete compatibility*) on a sliding scale with no midpoint labeling. This was done in order to make it more intuitive, as it would more easily map onto percentages (e.g., a "5" might represent 50% conflict, 50% compatibility).

Validity measures

In addition to completing the 8-item science-religion relationship scale, participants were also asked to respond to a number of variables which were hypothesized to be related to their perceptions of the science-religion relationship.

Religiosity variables. We measured two variables related to participants' (non)religious identities. We first asked participants about their *Personal Religious Identification* using the single item "Religious beliefs or spirituality are important to my sense of who I am" (1, *not at all* – 7, *very much*). *(Non) religious Group Identification* was measured by answering four items that referred to their personal religious identification such as "I feel strong ties with others who feel this way about religious beliefs or spirituality" (1, *strongly disagree* – 7, *strongly agree*; α = .95). Additionally, we asked about participants' religious fundamentalism using two scales, the Intratextual Fundamentalism Scale with five items (Williamson et al., 2010), and the Religious Fundamentalism Scale with 12 items (Altemeyer & Hunsberger, 2004; both measured of a scale of 1, *strongly disagree* – 7, *strongly agree*, with participants having the option to mark *not applicable* if the items were not relevant to them [i.e., those who identified as agnostic and atheist]; Intratextual Fundamentalism Scale α = .91; Religious Fundamentalism Scale α = .93).

Science-related variables. Similar to religious identity, we first asked participants to indicate their level of *Personal Science Identification* by rating the item, "Scientific ideas or concepts are important to my sense of who I am" (1,*not at all* – 7,*very much)*. We then asked participants about their *Science Group Identification* using the same follow-up items as were used to measure religious group identification (α = .93). We also asked participants to answer a 10-item *Belief in Science* measure,

which assesses the extent to which individuals place their faith in science, scientists, and scientific research (α = .94; Farias et al., 2013). A 6-item measure adapted from an existing scale on *Understanding the Nature of Science* (Lombrozo et al., 2008) measured individuals' understanding regarding the methods and processes of science, including an understanding of the limitations of scientific research (1, *not at all* – 7, *very much*; α = .83).

Personality variables. We used the 10-item short version of the *Big 5 Personality Measure* (Rammstedt & John, 2007) to assess participants' personality characteristics. Additionally, we used three subscales of the *Need for Cognitive Closure Scale* (Webster & Kruglanski, 1994) – Decisiveness (6 items, α = .84), Discomfort with Ambiguity (9 items, α = .79), and Closed-mindedness (8 items, α = .69). Finally, we included the four subscales of the *Intellectual Humility Scale* (Krumrei-Mancuso & Rouse, 2016) – Independence of intellect and ego (5 items, α = .91), Openness of revising one's viewpoints (5 items; α = .82), Respect for others' viewpoints (6 items, α = .85), and Lack of intellectual overconfidence (6 items, α = .74).

Results

Confirmatory Factor Analysis (CFA)

We ran a confirmatory factor analysis based on the 8-items and two-factors structure of the scale derived from Study 2. The analysis was conducted in R (R Core Team, 2016) using package lavaan (Rosseel, 2012). We based this analysis on all participants collapsing across religious/non-religious identity groups (N = 543). We used maximum likelihood estimation with standardized latent factors, so that every factor loading was estimated freely. As expected, all latent variables loaded positively onto their respective factors with β-coefficients ranging from .78 to .94 (see Table 2). The factors were positively correlated (r = .735, SD = .023, z = 31.820, p < .001). We found that the estimated CFA provided an acceptable fit for our data, (RMSEA = .066 (90% CI [.049, .084]); CFI = .988; SRMR = 028; (Brown, 2015; Hu & Bentler, 1999). We compared the estimated model with a single-factor model. The two-factor model had a significantly better fit for our data than the single-factor model, $\chi^2(19)$ *difference* = 656, p < .001 ($AIC_{two\text{-}factor}$ = 18468; $AIC_{one\text{-}factor}$ = 19122).

Measurement invariance

Further, we tested whether our factor structure was equivalent across different participant groups. This was done to examine whether participants who identified as atheist, agnostic, and religious attributed the same meaning to the measured construct, that is, the perception of science-religion conflict or compatibility depending on the content issue.

First, we ran separate CFAs for each group of participants, i.e., atheist (n = 186), agnostic, (n = 169), and religious, (n = 188), to support the overall CFA. As expected the factor structure was supported in each participant group. That is, for agnostics, we found an acceptable model fit, RMSEA = .023 (90%

Table 2. Latent variables and their factor loadings onto two scale factors: Explanations and human↔world interactions (Study 3). Full text of items.

Factor	Latent variable	*B*	SE	*z*	*β*	*p*
Explanations	Explaining the origins of human life	3.07	.11	29.091	.94	.001
	Explaining the origins of the universe	2.95	.11	27.196	.91	.001
	Explaining the origins of life other than human life (for example: animals, plants)	3.00	.11	27.855	.92	.001
	Explaining what happens at the end of human life	2.58	.12	21.653	.79	.001
Human world interactions	Treating physical illness	2.78	.11	26.206	.89	.001
	Treating mental illness	2.54	.11	23.913	.85	.001
	Understanding why humans get sick	2.76	.11	25.497	.88	.001
	Informing the relationship between humans and the environment	2.22	.11	21.149	.78	.001

SE: Standard Error

CI [.001, .073]); CFI = .988; SRMR = .024, with the two factor-model fitting our data better than the single-factor model, $\chi^2(19)$ *difference* = 239, $p < .001$ ($AIC_{two\text{-}factor}$ = 5723; $AIC_{one\text{-}factor}$ = 5960). For atheists, the RMSEA parameter indicated that the model was a poor fit for the data, however, other parameters showed an acceptable model fit, RMSEA = .093 (90% CI [.062, .126]); CFI = .976; SRMR = .044. Even though the RMSEA value indicated a poor fit, Kenny et al. (2015) suggest that RMSEA might not be an appropriate indicator of a model fit when small sample sizes are considered, so we based our conclusions on the other parameters (SRMR and CFI). Again, the two-factor model represented a better fit for the data than the single-factor one, $\chi^2(19)$ *difference* = 224, $p < .001$ ($AIC_{two\text{-}factor}$ = 6241; $AIC_{one\text{-}factor}$ = 6463). We found the same pattern of results for religious participants, RMSEA = .074 (90% CI [.040, .108]); CFI = .981; SRMR = .037, with the two-factor model being a better fit for the data than the single-factor model, $\chi^2(19)$ *difference* = 185, $p < .001$ ($AIC_{two\text{-}factor}$ = 6393; $AIC_{one\text{-}factor}$ = 6576).

Second, we conducted a multilevel measurement invariance test. Following suggestions by Kim et al. (2017), we estimated configural, metric, and scalar invariance models. Each model was estimated for all of our participant groups, as the groups were considered as random with a pooled within-group covariance matrix. Each model was compared with the previously estimated one (metric vs. configural, scalar vs. metric; see Table 3). The results indicated that our items were associated with the same construct and meaning across participant groups. Finally, there was no measurement bias.

Comparisons across groups

We tested whether there were mean differences in perceptions of science-religion conflict or compatibility across participant groups (atheist, agnostic, and religious; higher scores = higher compatibility and lower scores = higher conflict, with a midpoint of 5). To examine this, we conducted a mixed ANOVA, with (non)religious identity treated as a between-subjects factor, and the scale factor

Table 3. Measurement invariance tests (Study 3).

Model	CFI	RMSEA	Df	*χ2*	AIC	BIC	*P*
Configural	.985	.071	57	109	18357	18679	-
Metric	.985	.064	69	120	18343	18614	.569
Scalar	.985	.057	81	129	18328	18548	.683

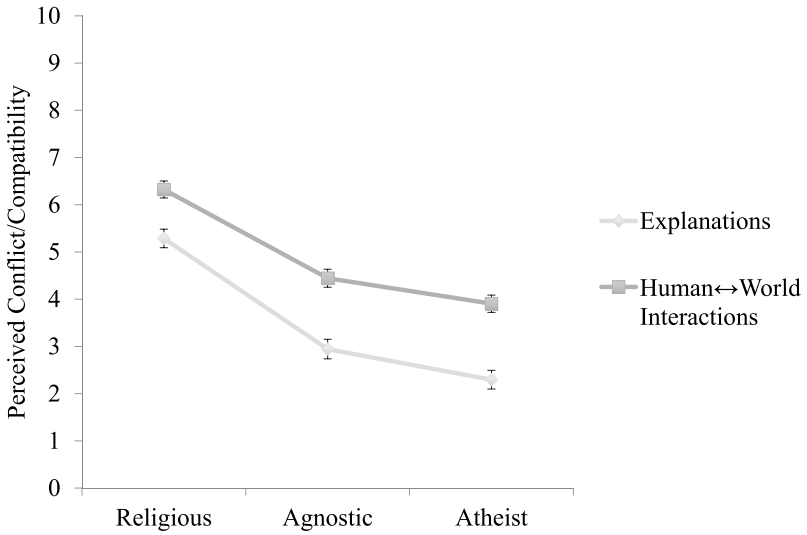

Figure 2. Perceived conflict and compatibility as a function of religious identity and content issue. Error bars show -/+1 SE (Study 3). 0 = complete conflict; 10 = complete compatibility.

(*explanations* vs. *human↔ world interactions*) as a within-subjects factor (see Figure 2). We found that a main effect of scale factor was significant, $F(1, 540) = 21.25$, $p < .001$, $dz = .61$ (95% CI [.55, .69]) such that participants perceived more compatibility when rating the *human↔ world interactions* factor ($M = 4.89$, $SD = 2.69$) than the *explanation* factor ($M = 3.51$, $SD = 3.00$). The main effect of (non) religious identity was also significant, $F(2, 540) = 68.40$, $p < .001$. The post-hoc comparisons indicated that atheists perceived more conflict ($M = 3.10$, $SD = 2.76$) than religious participants ($M = 5.80$, $SD = 2.55$), $t(540) = 11.153$, $p < .001$, $d = 1.53$ (95% CI [1.30, 1.76]). Similarly, agnostics perceived more conflict ($M = 3.69$, $SD = .2.74$) than religious participants, $t(540) = 8.49$, $p < .001$, $d = .90$ (95% CI [.68, 1.12]). Finally, agnostics perceived marginally less conflict than atheists, $t(540) = 2.38$, $p = .053$, $d = .25$ (95% CI [.04, .45]). The interaction between scale factor and (non)religious identity was significant, $F(2, 540) = 3.48$, $p < .031$. We found that each participant group (religious, agnostic, atheist) perceived significantly more conflict in the case of *explanations* in contrast to *human↔ world interactions*. For religious participants (*explanations:* $M = 5.29$, $SD = 2.77$; *human↔ world interactions:* $M = 6.32$, $SD = 2.19$): $t(540) = 6.41$, $p < .001$, $dz = .47$. (95% CI [.34, .60]). For agnostics (*explanations:* $M = 2.94$, $SD = 2.71$; *human↔ world interactions:* $M = 4.44$, $SD = 2.57$): $t(540) = 8.79$, $p < .001$, $dz = .65$ (95% CI [.50, .79]). Finally, for atheists (*explanations:* $M = 2.30$, $SD = 2.62$; *human↔ world interactions:* $M = 3.90$, $SD = 2.67$): $t(540) = 9.89$, $p < .001$, $dz = .75$ (95% CI [.62, .88]). We corrected for multiple comparisons using Bonferroni adjustment. Atheists perceived significantly more conflict than religious participants in the case of *explanations* (atheists: $M = 2.30$; $SD = 2.62$; religious: $M = 5.29$; $SD = 2.77$), $t(770) = 11.15$, $p < .001$, $dz = 2.05$ (95% CI [1.62, 2.47], and *human↔ world interactions* (atheists: $M = 3.90$; $SD = 2.62$; religious: $M = 6.32$; $SD = 2.19$), $t(770) = 9.02$, $p < .001$, $d = 1.66$ (95% CI [1.26, 2.06]. The same was true for agnostics. They perceived significantly more conflict than religious participants across both factors, for *explanations* (agnostics: $M = 2.94$; $SD = 2.71$), $t(770) = 8.52$, $p < .001$, $d = 1.43$ (95% CI [1.07, 1.79]) and *human↔ world interactions* (agnostics: $M = 4.44$; $SD = 2.57$), $t(770) = 6.84$, $p < .001$, $d = 1.15$ (95% CI [.80, 1.50]. The differences between agnostics and atheists were not significant across both factors, $ps > .11$.

Regressions. Please note correlations between the two factors and the various measures of religiosity, science-related and personality variables are available in supplementary material B. We regressed participants' science and religion compatibility/conflict ratings on a number of individual differences variables (see Table 4 for the *explanations* outcome and Table 5 for *human↔world interactions*). We chose the measures that were significantly correlated with these ratings (see supplemental material). We conducted six regression analyses in total, two for each participant group, one predicting scores on the *explanations* factor and the other predicting scores on the *human↔ world interactions* factor. In addition to individual difference predictors we included demographic variables associated with gender, age, and education. We also included personal identification with both religion/spirituality and science in all regressions. Moreover, while personal identification with religion/spirituality was positively correlated with Science and Religion Conflict/Compatibility ratings for all participant groups, we found different patterns with regards to science identification. This variable was significantly positively correlated with the Science and Religion Conflict/Compatibility ratings, but only for religious participants; for agnostics it was not correlated with either scale factor, and for atheists it was only significantly (negatively) correlated with the *human↔ world interactions* factor. As this was an interesting pattern that differed across participant group, we decided to also include the interaction between science and religious identification in the regression analysis. All predictors were centered on the mean and wherever there was multi-collinearity we excluded the predictors from the analysis.[2]

[2]This was the case for personal and group identification with both science ($r(543) = .72$, $p < .001$) and religion ($r(543) = .74$, $p < .001$), and the Religious Fundamentalism Scale and the Intratextual Fundamentalism Scale ($r(417) = .87$, $p < .001$), so we excluded the group identification variables and the Religious Fundamentalism Scale from the regression analyses.

Overall, we found that the estimated models for the *explanations* factor represented a good fit for our data, for religious participants: $F(9, 154) = 4.21$, $p < .001$, $R^2 = .20$, atheists: $F(9, 167) = 5.42$, $p < .001$, $R^2 = .23$, and agnostics, $F(8, 153) = 4.59$, $p < .001$, $R^2 = .19$. Similarly, our models predicting the *human↔ world interactions* factor represented a good fit for our data (for religious: $F(10, 149) = 3.67$, $p < .001$, $R^2 = .20$; for atheists: $F(8, 177) = 3.42$, $p = .001$, $R^2 = .13$, and agnostics: $F(8, 153) = 4.67$, $p < .001$, $R^2 = .20$.

Interestingly, we found different sets of predictor variables for each of our participant groups. For religious participants, we found that two of the same variables predicted both factors. As we hypothesized, we found that high religion/spirituality identification predicted perceptions of higher compatibility. Additionally, the interaction between religious/spirituality and science identification significantly predicted conflict/compatibility ratings. To further explore this interaction we split participants based on whether they scored low (scores of 1–3; $n = 41$), medium (scores of 4; $n = 47$), or high (scores of 5–7; $n = 100$) on personal identification with science. The correlation between personal identification with religion/spirituality and conflict/compatibility was only significant for those who were high in science identification, with higher identification with religion/spirituality associated with higher compatibility ratings *(explanations:* $r(100) = .48$, $p < .001$; *human↔ world interactions:* $r(100) = .42$, $p < .001$). This correlation was not significant for those with either medium (*explanations:* $r(47) = -.06$, $p = .70$; *human↔ world interactions:* $r(47) = -.01$, $p = .97$) or low identification with science *(explanations:* $r(41) = .05$, $p = .76$; *human↔ world interactions:* $r(41) = .12$, $p = .47$). Additionally, we found that higher intellectual overconfidence predicted higher compatibility ratings on the *explanations* factor. Contrary to our hypotheses, we did not find that any other science, religion, or personality variables predicted religious participants' conflict/compatibility ratings.

For atheists, we again found similar patterns of results across the two Science and Religion Conflict/Compatibility Scale factors. As predicted, higher scores on Understanding of the Nature of Science significantly predicted higher conflict ratings for both factors. None of the other science, religion, or personality variables predicted conflict/compatibility ratings.

Finally, for agnostic participants, we again found similar results across both factors. For both *explanations* and *human↔ world interactions*, as predicted, higher personal identification with religion/spirituality, higher agreeableness, and higher intellectual overconfidence predicted higher compatibility ratings. Additionally, for the *human↔ world interactions* factor, higher levels of education predicted higher compatibility ratings. However, none of the other science, religion, or personality variables predicted conflict/compatibility ratings.

Discussion

The CFA analyses on the revised, 8-item measure showed that the same factor structure emerged across our three participant groups (religious, agnostic, and atheist). This suggests that the two factors and the scale were perceived by all groups in the same way. The results of Study 3 show that all three participant groups perceived more conflict on *explanations* than *human↔ world interactions*. However, as we found in Studies 1– 2, the perceptions of conflict were also dependent on (non) religious identities, with religious participants seeing science and religion as more compatible than atheists and agnostic participants. Overall, our results do not support the conflict narrative between science and religion, which often frames religious people as having a problem with science based on perceived conflict with their religious beliefs.

We found that across the six regression analyses run, different sets of variables predicted people's perceptions of the religion-science relationship, although these were largely the same across the scale factors for each participant group. These differences highlight and support the supposition that perceptions of the science-religion relationship are nuanced and related to different variables depending on individuals' identities. This underscores the need for a more nuanced understanding of people's perceptions. For atheists, we found that the only significant predictor of conflict/compatibility was higher scores on the Understanding the Nature of Science measure, which tests peoples understanding of scientific processes (Lombrozo et al., 2008). Personal identification with science and with religion/

Table 4. Multiple regression model predicting conflict-compatibility scores regarding explanations in Study 3.

	Religious *n* = *164*		Atheists *n* = 176		Agnostics *n* = 162	
Predictor	*β* [95% CI]	*p*	*β* [95% CI]	*p*	*β* [95% CI]	*p*
Gender	.05 [−.79, .90]	.90	.19 [−.57, .95]	.62	−.02 [−.83, .80]	.97
Age	.00 [−.03, .03]	.94	−.01 [−.04, .01]	.27	−.00 [−.03, .03]	.90
Education	−.20 [−.41, .04]	.10	.09 [−.13, .30]	.41	.04 [−.20, .27]	.77
Science ID	−.08 [−.70, .55]	.81	−.72 [−1.52, .08]	.08^{+}	.33 [−.26, .92]	.27
Religion ID	.90 [.24, 1.57]	.008**	.47 [−.17, 1.12]	.15	.61 [.01, 1.22]	.05*
Belief in Science	-	-	−.00 [−.59, .58]	.99	-	-
Understanding Science	-	-	−.91 [−1.40, −.42]	.001***	-	-
Intratext fundamentalism	.25 [−.28, .77]	.36	-	-	-	-
Agreeableness	-	-	-	-	.79 [.38, 1.20]	.001***
NFCC: Closeminded	−.26 [−.72, .20]	.27	-	-	-	-
IH: Open	-	-	-	-	-	-
IH: respect	-	-	−.01 [−.39, .36]	.94	-	-
IH:overconf	−.48 [−.85, −.10]	.013*	-	-	−.82 [−1.28, −.36]	.001***
Sci ID * Rel ID	.35 [.16, 1.14]	.01**	−.69 [−1.51, .13]	.10^{+}	.49 [−.18, 1.17]	.15

Science ID: Personal identification with science; Religion ID: Personal identification with religion; Understanding Science: Understanding the Nature of Science;

Intratext fund: Intertextual religious fundamentalism; Rel fund: Religious fundamentalism; NFCC: Closeminded: Need for cognitive closure: Closemindedness; IH: Open: Openness of revising one's viewpoint; IH: respect: Intellectual humility: Respect for others' viewpoints; IH:overconf: Intellectual humility: Lack of intellectual overconfidence; Sci ID * Rel ID: the interaction between identification with science and identification with religion. +p < .10, *p* < .05, * *p* < .01, ** *p* < .001***

Table 5. Multiple regression model predicting conflict-compatibility scores regarding human↔world interactions in Study 3.

	Religious *n* = *160*		Atheists *n* = 185		Agnostics *n* = 162	
Predictor	*β* [95% CI]	*p*	*β* [95% CI]	*p*	*β* [95% CI]	*p*
Gender	−.06 [−.76, .64]	.87	.42 [−.38, 1.22]	.30	−.14 [−.91, .62]	.71
Age	.02 [−.01, .04]	.14	−.02 [−.04, .01]	.22	.02 [−.01, .04]	.22
Education	−.01 [−.21, .18]	.90	.08 [−.14, .30]	.48	.23 [.01, .45]	.04*
Science ID	−.10 [−.57, .37]	.69	−.05 [−.90, .79]	.91	−.03 [−.58, .52]	.92
Religion ID	.85 [.38, 1.32]	.001***	.38 [−.28, 1.04]	.26	.64 [.08, 1.21]	.03*
Belief in Science	-	-	−.26 [−.89, .37]	.42	-	-
Understanding Science	.30 [−.10, .70]	.14	−.50 [−.96, −.03]	.04*	-	-
Intratext fundamentalism	-	-	-	-	-	-
Rel fundamentalism	-	-	-	-	-	-
Agreeableness	-	-	-	-	.73 [.34, 1.11]	.001***
Neuroticism	−.02 [−.41, .37]	.93	-	-	-	-
NFCC: Closeminded	−.26 [−.66, .14]	.20	-	-	-	-
IH: Open	.09 [−.27, .44]	.62	-	-	-	-
IH:overconf	-	-	-	-	−.61 [−1.03, −.18]	.01**
Sci ID * Rel ID	.46 [.08, .84]	.019*	.10 [−.77, .97]	.82	.49 [−.15, 1.12]	.13

Science ID: Identification with science; Religion ID: Identification with religion; Understanding Science: Understanding the Nature of Science;

Intratext fund: Intertextual religious fundamentalism; Rel fund: Religious fundamentalism; NFCC: Closeminded: Need for cognitive closure: Closemindedness; IH: Open: Openness of revising one's viewpoint; IH:overconf: Intellectual humility: Lack of intellectual overconfidence; Sci ID * Rel ID: the interaction between identification with science and identification with religion. +p < .10, * *p* < .05, ** *p* < .01, *** *p* < .001.

spirituality, and other personality variables did not predict people's beliefs about conflict/compatibility. For agnostics we found that a different subset of variables predicted conflict/compatibility. For these participants, science related variables did not predict perceptions of conflict/compatibility, but religious/spiritual identification did, as well as the personality variables of agreeableness and lack of intellectual overconfidence, all of which predicted higher perceptions of compatibility.

Finally, for religious participants, we found that with the exception of the lack of intellectual overconfidence for the *explanations* factor, personality variables did not predict conflict/compatibility; however, higher identification with religion/spirituality predicted higher perceptions of compatibility. Interestingly, we also found an interaction between personal identification with religion/spirituality and personal identification with science when predicting conflict/compatibility ratings. For religious participants, higher identification with religion predicted higher compatibility ratings on both factors, but only for participants who also highly identified with science. This is striking and provides us with a deeper understanding as to when and how religious individuals may perceive a conflict between science and religion, which would render them susceptible to reject scientific evidence. Our findings show that as long as religious individuals also feel a sense of identification with science, they are likely to perceive compatibility between science and religion, which may in turn facilitate acceptance of science. We also found differences between agnostic and atheist participants' results, indicating that using the general category of "non-religious" may obfuscate some important differences in how people think about the relationship between science and religion. Although these results provide interesting first insights to the psychological variables that might contribute to people's understanding and perception of the science-religion relationship, we recognize that our sample sizes are relatively small, and therefore the inferences from our analyses have to be made cautiously.

General discussion

In the present research, we aimed to explore whether people endorse the view that science and religion are incompatible. Popular debates suggest that science and religion attempt to answer similar questions with competing explanations, and hence they must intrinsically be in conflict (Dawkins, 2006; Wilson, 2002). Therefore, we investigated people's endorsement of such narratives. As expected, we found that support for the conflict narrative is dependent on the content of the issues addressed and also on people's (non)religious identities.

Across three studies we showed that everyday perceptions of the relationship between science and religion are dependent on a number of factors. Firstly, when asking about how individuals personally perceive the science-religion relationship we have to take into account which particular aspects of the relationship they may be considering. Are they thinking about explanations such as human origins, or are they thinking about something to do with people's interactions with the world, such as how people should behave toward the environment or how we treat physical and mental illness? In this paper, we have developed a measure of the perceived relationship between science and religion by evaluating whether participants perceive science and religion as being in conflict or compatible on various issues. The findings support our hypothesis that perceptions of the levels of conflict/compatibility that exist between science and religion are content dependent.

Additionally, there are some particularly interesting findings which can help to further elucidate our understanding of people's perceptions of science and religion. First of all, our results indicate that perceptions of the science-religion relationship are informed by people's *(non)religious identities*. Across our three studies religious participants on average, and contrary to the "conflict narrative," reported compatibility between science and religion. Additionally, we found that non-religious individuals tended to report higher conflict perceptions, with notable differences between different non-religious social identities. In Study 2, we found that atheists perceived higher levels of conflict than "other non-religious" participants, and in Study 3, they perceived higher levels of conflict than agnostic participants. Recent research may be able to shed some light onto these findings. A series of studies have shown that the stereotypes that are associated with religious scientists and atheist scientists are also dependent on participant's religious identity, revealing that for non-religious and atheist participants, a religious scientist is perceived as counter-stereotypical or as having a less intuitive combination of identities (Sharp et al., 2021). This suggests that atheist and non-religious individuals have a tendency to find the association between science and religion as atypical, which could contribute to the tendency to see more conflict between science and religion in general.

Another interesting finding across all studies is that participants reported perceiving more conflict in regard to the *explanation* factor. For issues concerning *human↔world interactions*, such as treating physical illness and informing how humans should relate to the environment, science and religion were perceived to be more compatible. This finding may be a result of differences in the types of questions that lie within each of these factors and the extent to which religion is seen as relevant to those questions. Whilst religion is often perceived as providing answers to questions that are assessed within the explanations factor (e.g., the origins of human life), the items assessed within the human↔-world interactions factor may be seen as being further outside the domain of religiosity for some individuals more than others (e.g., treating mental illness).

In addition to the potential differences in religious relevance, higher conflict on the explanations factor may correspond with the legacy of high-profile creationist, intelligent design and new atheist debates that continue to influence public narratives around the conflict between science and religion and can lead to the erroneous conflation of levels of acceptance of evolutionary science amongst religious communities with a broader conflict between science and religion. Given that a number of our items are related to evolutionary science, higher perceptions of a conflict between science and religion may be in part driven by these associations within popular discourse. Our research suggests that for some issues it is easier for people to combine religion and science frameworks than for others. As has been suggested elsewhere, a lack of trust in evolutionary science does not necessarily even imply a lack of trust in research in genetics let alone wider biological sciences (Elsdon-Baker & Leicht, 2017). Thus, these findings further support the argument that it may often be more valuable to focus on more specific topics, rather than describing the "science and religion" debate in general and abstract terms, for example, when it comes to science communication practices. It is also indicates that further more nuanced research that explores the differences between religious, SBNR, non-religious and atheist positions (alongside other intersectional lenses), in relation to content or context specific concerns regarding localized points of public conflict or contention in relation to "science" should also be undertaken (e.g., stem cell research, vaccinations, climate crisis, etc.).

Finally, our regression analysis shows that different religion-related, science-related, and personality variables predicted the levels of conflict/compatibility experienced by these different religious and non-religious groups. For example, religious participants were the only group for whom the interaction between science identification and religious identification predicted ratings of compatibility. This finding has important implications for deepening an understanding as to when and how religious individuals may see more conflict between science and religion, and as a consequence might be more prone to reject scientific evidence and practice. In order to further increase perceptions of compatibility between science and religion among religious individuals, it therefore may be important to consider how *scientific identification* amongst religious individuals could be increased.

Implications

To the best of our knowledge, this research is the first to develop a two-dimensional scale of the extent to which people see conflict or compatibility between science and religion. By developing this scale, we have shown that people's views on the relationship between science and religion do not always reflect popular culture or media debates that suggest a conflict narrative. A number of previous surveys have used wording that suggest binary divisions and/or conflict between science and religion-related beliefs or explanations (e.g., the World Values Survey [Inglehart et al., 2014]; the Eurobarometer [European Commission, 2010]). However, recent research shows that this understanding is superficial and needs to be addressed by more in depth social scientific research on perceptions of the relationship between science and religion (Elsdon-Baker, 2015, 2020). Our data demonstrate that these perceptions vary depending on the content issue. Most importantly, in contrast to stereotypical assumptions, religious people in fact endorse the highest levels of compatibility between science and religion. Overall, we show that stereotypes about religious people necessarily rejecting science because of their religious beliefs are incorrect.

Our findings provide insight into the intricacies of the "conflict narrative." It is notable that not only is the perceived conflict between science and religion more prevalent in nonreligious, rather than religious, participants, but also that this perception of conflict is more prevalent in atheist participants than "other non-religious" or agnostic participants. It may not be surprising that religious individuals consistently perceive less conflict than other groups (in fact, they on average perceive compatibility between science and religion across Studies 2 and 3). People who identify as religious may be motivated to balance their religious identity with scientific perspectives especially within western societies such as Canada and the UK, where these studies were primarily based. People who are non-religious, on the other hand, may have no motivation to consider religious perspectives alongside scientific ones. However, while these results may not be surprising from this perspective, we feel that they are important to highlight given the pervasiveness of the conflict narrative between science and religion – a narrative that posits that *religious individuals* have a tendency to reject science. In fact, what we find here, is that religious individuals on average perceive compatibility between science and religion, and that non-religious individuals (who make up the majority of those working in the sciences in the UK and many other Western countries) are the ones who perceive conflict. This suggests that there may be a mismatch between our cultural perceptions of how people of different (non)religious identities engage with science and religion and how they actually do, and that additionally the culture of science (which is predominantly non-religious in Western contexts) may be hostile toward religion and religious individuals.

Limitations and future research

Our research did have some limitations. First of all, bipolar scales can be difficult to respond to and interpret, and there is a possibility that participants could have interpreted the term "compatibility" in different ways (e.g., the absence of conflict; independence). However, the fact that we found the same pattern of results across three studies and with different religious/non-religious participant groups may mitigate this concern to some degree. We would be very interested in future adaptations of this scale which use different framings than conflict/compatibility. Furthermore, the fact that our samples were comprised mainly of Western, English-speaking participants is another limitation. Given the content-dependence we found in our studies, we might expect cultural-dependence, as well – that is, the content that matters with regards to narratives about science and religion might be different in different cultural contexts. This expectation is supported by recent research showing that even across western, educated, industrialized, rich and democratic countries, the relationship between individuals' religious, spirituality and science beliefs as well as acceptance of science varies (Rutjens et al., 2021). We therefore recommend that this scale should be used with caution outside of the UK context and especially outside a western non-English speaking context. Additionally, the majority of our religious participants in Study 1 and 2 came from Christian religious traditions. This may limit the extent to which the results reflect the perceived relationship between science and religion outside of these populations. As such, we recommend further research in varied contexts to investigate the validity of our findings across more diverse populations and cultural contexts.

Overall, our research highlights the need for further research exploring which identities do in fact drive the conflict narrative between science and religion.

Conclusion

This research shows that across different countries (the UK and Canada) and different forms of (non)religiosity, individuals' understanding about the relationship between science and religion is much more nuanced than current social scientific research suggests. Across three studies we show that overall individuals indicate that they perceive more conflict between science and religion when it comes to explanations (e.g., those relating to origins) than when it comes to issues regarding interactions between humans and the world around them (e.g., treating physical illness). This research speaks to a narrative within science and science communication that hinges on the stereotype that religious belief causes a "problem" for people in understanding and accepting scientific information. This stereotype may as a result have negative impacts on outcomes such as

science engagement or uptake of STEMM education for religious individuals. However, what we have found is that this is an inaccurate portrayal of religious individuals, at least in the contexts studied here.

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ORCID

Carola Leicht http://orcid.org/0000-0002-4117-1215

Data availability statement

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