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How do people perceive the relationship between science and religion? The roles of epistemic and ontological cognition

Pinja Marin  | Marjaana Lindeman 

Department of Psychology and Logopedics,
University of Helsinki, Helsinki, Finland

Correspondence

Pinja Marin, Department of Psychology and
Logopedics, Faculty of Medicine, University of
Helsinki, P.O. Box 21, 00014 Helsinki, Finland.
Email: pinja.marin@helsinki.fi

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Summary

Although the relationship between religion and science has long been the subject of discussion, investigations into the how and why of people's science-religion perspectives are rare. This study examined how epistemic and ontological cognition predict agreement with four science-religion perspectives: conflict, independence, dialogue, and integration. Participants ($N = 3911$) were Finnish, Danish, and Dutch adults who had answered an online study. Most people held views that were not well captured by the commonly used four categories. When more specific perspectives were examined, differences were found especially in supernatural beliefs, over-mentalizing, and justifications for religious arguments and scientific knowledge. Thinking styles and epistemic sophistication played only a minor role. The results suggest that non-scientists evaluate the relationship between religion and science more based on their ontological beliefs than their epistemic reflection.

KEYWORDS

beliefs, epistemic cognition, ontological cognition, religion, science

1 | INTRODUCTION

Science is an integral part of the modern world with over \$2 trillion invested globally in research and development in 2017 (National Science Board, 2020). With the increasing popularization of science and easier access to scientific findings, this knowledge is available to more and more people. At the same time, religion remains highly influential in many societies: worldwide 84% of the world's population belonged to some religion in 2015 (Pew Research Center, 2017a). These two significant enterprises, science and religion, have often been pitted against each other and the (in)compatibility of religion and science has been debated for centuries.

Considering the influential roles of both, science and religion, it is not surprising that the way people relate them to each other is also significant. For example, uncertainty about the science-religion relationship can produce anxiety in students (Yasri & Mancy, 2014). Students' science-religion perspectives have also been associated with

learning about specific topics such as evolution, and the understanding of science more generally (e.g., Hansson & Redfors, 2007; Yasri & Mancy, 2014). Moreover, debates on potentially controversial issues such as abortion, stem cell research, and the rights of homosexuals are often rooted in people's perceptions of science and religion (e.g., Noy & O'Brien, 2016).

Overall, however, the way the general public perceives the relationship between science and religion is poorly understood. The few systematic studies have mainly focused on religiosity indicators and demographics, such as education. In addition, while some interview studies have addressed people's science-religion perspectives, the paucity and qualitative nature of the research call for more studies. This study is an attempt to learn more about people's science-religion perspectives. As a starting point, we follow common theoretical arguments that the perception of the relationship between science and religion is always a question of epistemology (the nature and justification of knowledge) and ontology, that is, the nature of reality

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(e.g., Barbour, 1990; Niiniluoto, 1999). In this study, we examine how different science-religion perspectives are related to epistemic cognition (i.e., thinking styles, views of knowledge and knowing, and justification for knowing in science and in religion), and ontological cognition (i.e., perceived importance of science and religion, religious and non-religious supernatural beliefs, and over-mentalizing).

1.1 | Four science-religion perspectives

Following the commonly used categorization, developed by Barbour (1990), we investigate four ways to relate science and religion: conflict, independence, dialogue, and integration (for other typologies, see Yasri et al., 2013). The following descriptions largely correspond to Barbour's definition of the views.

According to *the conflict view* science and religion are so incompatible that they both cannot exist peacefully. The so-called non-conflict views include the independence view, dialogue view, and integration view. *The independence view* holds that science and religion can be completely separated since they concern two mutually exclusive aspects of reality: the objective physical realm and the supernatural realm. *The dialogue view*, in turn, allows science and religion to interact while holding them distinct from each other. Science and religion are seen to address the same reality but from different perspectives: their explanations differ but both are needed to construct a more complete picture of reality. *The integration view* assumes that science and religion form a single explanation on a specific topic and that science and religion provide the same answers to the same questions. (e.g., "God used evolution").

These four perspectives have been found among differing populations, for example among Christians, Muslims, and Buddhists (Yasri et al., 2013). Prevalence of the views, however, has varied largely between studies. For example, the conflict view has been supported only by a minority in the United States (Baker, 2012) while higher rates (53%–74%) have been reported in Eastern Europe (Pew Research Center, 2017b), England (Stolberg, 2007), and also in the United States (Longest & Smith, 2011). Individuals' views are also often not as distinct and defined as the ones described in taxonomies: some people appear undecided about how science and religion relate, and others agree with more than one view (Baker, 2012; Stolberg, 2007; Yasri et al., 2013).

Perhaps the most important shortcoming is that we don't know what makes a person support a specific perspective. Although much debated, the arguments have been rather general and abstract. It has been proposed that one's science-religion perspective is based on one's view of reality and the way one can reach knowledge about reality (Hansson & Redfors, 2007), on one's view of the validity (Ecklund & Park, 2009) and value (Preston & Epley, 2009) of science and religion, and on the competing authorities and truth claims made by religion and science (O'Brien & Noy, 2018). In addition, some perspectives have been considered more appropriate than others. Niiniluoto (1999) has noted that modern scientific realism is fundamentally in conflict with religion due to differences in what is considered an acceptable explanation and what is justified as

sufficient evidence in religion versus modern science. In contrast, Barbour (2002), who is rightfully the most cited author in the area of science and religion, proposes that the dialogue and integration views are more adequate than the conflict and independence views. Similarly, Legare et al. (2012) have argued that integrating science and religion is a conceptual achievement. However, empirical evidence is needed to enable conclusions about the epistemological and ontological assumptions of people with different science-religion perspectives.

1.2 | Epistemic cognition and the science-religion perspectives

General epistemic regulation in everyday life is first and foremost reflected in thinking styles, and in particular, in the commonly discussed *analytic and intuitive styles*. Analytic style refers to the tendency to collect information, to calibrate available evidence, and to seek various points of view before coming to a conclusion (Evans & Stanovich, 2013). Because analytic thinkers are less religious and can detect conflicts better than other people (a review: Pennycook et al., 2015), it has been suggested that analytic style may make people more sensitive to conflicts between scientific and religious explanations (Pennycook et al., 2014). We find this plausible and hypothesize that analytic thinking style raises the likelihood to view conflict between science and religion.

People with an intuitive style tend to trust their initial feelings, rely on their first impressions, and go by their instincts even for important decisions (Norris & Epstein, 2011). Like analytic thinkers, they can detect conflicts and recognize that their intuitive judgments are wrong. What distinguishes intuitive and analytic thinkers, however, is that intuitive thinkers don't care about the conflict but follow their intuitions nevertheless (Walco & Risen, 2017). This indifference towards conflicts could decrease the likelihood to hold a conflict view of science and religion.

Thinking styles are closely related to one's theory of knowledge (e.g., Eigenberger et al., 2007), which includes views about the appropriate ways to justify knowledge and views about knowledge per se. Having a complex view of knowledge and understanding that justification of knowledge requires evidence reflect high epistemic sophistication. For example, seeing knowledge as ambiguous, relative, and contextual leads to better learning strategies and higher comprehension than seeing knowledge as simple facts that need no elaboration (e.g., Muis & Franco, 2009). Similarly, understanding that knowledge is not just either correct or incorrect but that the legitimacy of a claim depends on evidence increases with education and expertise (Kuhn et al., 2000). Because this kind of epistemic sophistication is close to analytic thinking, we expect that having a *complex view of knowledge* and *higher epistemic understanding*, that is, acknowledging that claims can be evaluated based on their justification, increase the likelihood to view incompatibility between science and religion.

People's views on whether and how claims should be justified are not necessarily similar in different topics. Just as we may need

different justifications for government's health policy and for mathematical claims, we may need different justifications for religious and scientific arguments. Preliminary evidence indicates that scientists who do not trust personal experiences in the field of science (Ecklund et al., 2011) or the Bible (Ecklund & Park, 2009) support the conflict view. These findings call for a more comprehensive assessment of the ways non-scientists justify knowledge in the realms of science and religion. For this purpose, we will utilize Hofer's (2000) findings. She analyzed domain specificity of epistemological beliefs and found that people use two ways to justify knowledge in a subject domain, also found in philosophical writings: authority or personal justification. Important *religious epistemic authorities* are religious leaders and sacred texts, whereas the main sources of *scientific epistemic authorities* are scientific experts and scientific texts. *Personal justification* refers here to the propensity to prefer and to rely on personal experiences in the fields of religion and science.

1.3 | Ontological cognition and the science-religion perspectives

Besides epistemic cognition, ontological cognition could play an important role in people's science-religion perspectives. The division between epistemic and ontological cognition is close to the debated division between analytic thinking and motivated cognition. While several studies highlight the role of reason in belief formation and in judgment of information (e.g., Pennycook & Rand, 2019), the motivated cognition account states that individuals process information in ways that support and protect their core beliefs and world views (e.g., Lewandowsky & Oberauer, 2016).

The perceived importance of science and religion is one, although indirect and general, indicator of people's ontological views. Because the assumptions about what is real and what kind of beings exist are drastically different in science and religion, considering science or religion, or both, as important is an ontological statement. *Religious and non-religious supernatural beliefs* reflect more direct ontological assumptions about the world. In particular, belief in the existence of God is a rudimentary ontological assumption which likely impacts one's views about the relationship between science and religion. Indeed, American scientists (Ecklund & Park, 2009) and general public (Baker, 2012) are more likely to view conflict when they do not believe in God. For comparison, we also investigate the role of non-religious supernatural beliefs because most scholars consider the ontological assumptions underlying all supernatural beliefs false and contradicting scientific knowledge (a review: Lindeman & Svedholm, 2012). Based on these findings and arguments, we expect that religious and non-religious supernatural beliefs decrease the likelihood of conflict view.

In addition, *over-mentalizing* may be relevant in understanding how people relate science and religion. Over-mentalizing is an ontological confusion manifested in the tendency to assign mental processes (e.g., thoughts, intentions) to inanimate processes and entities (e.g., light, stones, air). Confusing the attributes of mental and physical

phenomena increases with religiosity (Lindeman & Svedholm-Häkkinen, 2016), and many cognitive scientists of religion see beliefs in gods as hyperactive mentalizing (e.g., Barrett, 2000). Over-mentalizing could hence make it easier to accept both religious concepts and unscientific reasoning alongside scientific theories, leading to a view that science and religion are not necessarily in conflict.

1.4 | The present study

This study focuses on three Western European countries: Finland, Denmark, and the Netherlands. The purpose is to analyze what makes people adopt the view that science and religion are in conflict, or the view that they are not in conflict due to independence, dialogue, or integration. The conflict view is hypothesized to be positively related to analytic thinking style (H1), complex view of knowledge (H2), and understanding that knowing requires justification (H3), and to be negatively related to intuitive thinking style (H4), over-mentalizing (H5), and religious and non-religious supernatural beliefs (H6). In addition, the way the science-religion views relate to perceived importance of science and religion, and to justification of knowledge in science and in religion are examined.

2 | METHOD

2.1 | Participants and procedure

The participants ($N = 3911$) were male (49.7%), female (48.6%), and other (1.3%), and their ages varied between 18 and 84 ($M = 39.71$, $SD = 14.14$). Full-time occupations were 24.4% studying, 53.8% working, and 20.9% other. Most of the participants (69.6%) did not belong to any religious denomination, and the rest belonged to Evangelical Lutheran Church (20.8%) or to other denominations (9.1%). Due to missing values the percentages don't add up to 100%. These variables were similarly distributed among the original sample of 4404 individuals, of whom 493 did not answer the conflict question.

Identical surveys were conducted online in Finland, Denmark, and the Netherlands. All participants were told that the study investigates how people think about religious beliefs, unbelief, science, and knowledge. In Finland ($N = 2268$), participants were recruited via numerous open university and college student mailing lists, a pool of participants (over 600 people) who had expressed interest in taking part in our studies, and different social media sites (e.g., Facebook, Twitter, and the Finnish association of skeptics). Also in Denmark ($N = 1208$), online social forums (e.g., the Danish Humanist Society) and student mailing lists were used. In the Netherlands ($N = 928$), two samples were taken. The first sample consisted of first-year psychology students ($N = 293$), and the second of a representative sample ($N = 635$) obtained via an online research agency.

Two articles have been published using the same data set (Lindeman et al., 2020, 2019). Although there is some overlap in the examined variables, the previous papers focus on different topics,

report different results, and are not theoretically overlapping with the present study in any way.

2.2 | Materials

Views of the science-religion relationship were first assessed with a statement regarding the conflict view: “Religion and science are not in conflict with each other” (1 = *agree*, 2 = *moderately agree*, 3 = *disagree*). If a participant agreed or moderately agreed with the item, a text appeared on the screen: “Religion and science are not in conflict with each other, because...,” followed by three statements (1 = *strongly disagree*, 5 = *strongly agree*): 1. “They focus on different topics” (independence view), 2. “One can have many perspectives on the same issue” (dialogue view), and 3. “They give similar answers to questions” (integration view).

Intuitive thinking style was measured with a 5-item Faith in Intuition Scale ($\alpha = .74$, e.g., “I like to rely on my intuitive impressions”). Analytic thinking style was measured with a 6-item *Need for Cognition* Scale ($\alpha = .80$, e.g., “I enjoy problems that require hard thinking”). The items were responded on a four-point scale (1 = *strongly disagree*, 4 = *strongly agree*), and they were derived from the Rational/Experiential Multimodal Inventory (Norris & Epstein, 2011) so that items with highest loadings on the two factors were chosen.

The *cognitive reflection* aspect of analytic thinking was examined with the CRT-2 version of the Cognitive Reflection Test (Thomson & Oppenheimer, 2016). An example item is “If you’re running a race and you pass the person in second place, what place are you in?” The number of correct responses to four items was used as an index of cognitive reflection ($\alpha = .51$). The fifth item was not included because unlike the other items it was a verbal conundrum and was answered wrong by most.

The perceived simplicity versus complexity of knowledge (in short, *view of knowledge complexity*) was evaluated with seven items ($\alpha = .76$), such as “Things are simpler than most experts would have you believe” (1 = *strongly disagree*, 5 = *strongly agree*). The items were modified after the Epistemic Belief Inventory (Schraw et al., 2002) and the Epistemological Questionnaire (Schommer, 1990).

Epistemic understanding was investigated using the modified version (Lindeman & Lipsanen, 2017) of the Epistemic Understanding Questionnaire (Kuhn et al., 2000). Participants were shown ten pairs ($\alpha = .80$) of contrasting claims made by two fictional individuals (e.g., “Robin thinks people should take responsibility for themselves. Chris thinks people should work together to take care of each other”), and after each pair of claims, they were told that both may have some rightness and asked: “Could one view be better or more right than the other?” The response options were “*One could not be more right than the other*” (reflecting the lower level, scored as 1) and “*One could be more right*” (reflecting the higher level, scored as 2).

The way people justify knowledge in the realms of science and religion was measured with four 3-item subscales modified from the Discipline-Focused Epistemological Beliefs Questionnaire (Hofer, 2000). Trust in religious epistemic authorities (in short, *authority in religion*, $\alpha = .77$) and trust in scientific epistemic authorities

(in short, *authority in science*, $\alpha = .74$) were asked using items such as “If you read something in a scientific book [alternatively: in sacred writings, e.g., the Bible] you can be sure it’s true.” Trusting personal justification regarding religious propositions (in short, *personal religion*, $\alpha = .74$) and trusting personal justification regarding scientific propositions (in short, *personal science*, $\alpha = .86$) were measured with items such as “First-hand experience, rather than scientific knowledge, is the best way of knowing something” and “First-hand experience, rather than religious knowledge, is the best way of getting answers to religious questions” (1 = *strongly disagree*, 5 = *strongly agree*).

The perceived *importance of religion* (five items, $\alpha = .87$) and *importance of science* (five items, $\alpha = .96$) were assessed with a modified version of the Importance of Science scale (Kind et al., 2007). An example item is “Science [alternatively: Religion] is important for society” (1 = *strongly disagree*, 5 = *strongly agree*).

Belief in God was studied with the item “I believe in God” (1 = *strongly disagree*, 5 = *strongly agree*). Non-religious supernatural beliefs were examined with four statements (1 = *strongly disagree*, 5 = *strongly agree*): “Spiritual healing is possible”, “I believe in fate,” “In the universe, everything is connected in a way that cannot be explained scientifically,” and “Telepathic mind reading is possible” ($\alpha = .81$). Three statements, addressing intelligent design, ultimate purpose of the universe, and spiritual energy in the universe, were not included in the sum variable because they resulted in too high collinearity due to their correlations ($r > .50$) with God belief.

Over-mentalizing was investigated with a scale created by Lindeman and Svedholm-Häkkinen (2016). The scale ($\alpha = .92$) asked participants to evaluate 24 words as mental or non-mental (1 = *not at all mental*, 4 = *mental*). The scale included 16 stimulus words that were physical processes, lifeless matter, artificial objects, or living but inanimate phenomena (e.g., electricity, water, paper, and moss). Rest of the words were fillers such as justice, fish, and goal.

If a participant had 25% or more of the items missing on any scale, the sum variable for that scale was not calculated for the participant. Many participants skipped some items, probably because the survey was long. At least one sum variable was missing from 12% of the participants. Five of the variables had a skewness value greater than |1|: the conflict view question (-1.33), authority in religion (1.26), importance of science (-1.65), belief in God (1.18), and over-mentalizing (1.69).

3 | RESULTS

Of the 3911 participants who answered the conflict question, 32.1% agreed or moderately agreed that science and religion are not in conflict. Among these, 64.3% strongly or moderately agreed with the independence view, 65.6% with the dialogue view, and 16.2% with the integration view. For detailed response distributions, separately in the three countries, see Table S1.

Spearman correlations between the four science-religion views and the predictor variables are shown in Table 1. For all correlations, see Table S2. For country-specific correlations, see Table S3.

	Conflict	Non-conflict views		
		Independence	Dialogue	Integration
Independence	-			
Dialogue	-	.02		
Integration	-	-.26***	.20***	
Need for cognition	.05**	.15***	-.04	-.18***
Cognitive reflection	.03*	.04	-.12***	-.12***
Faith in intuition	-.12***	-.09**	.23***	.18***
View of knowledge complexity	-.13***	.21***	-.03	-.24***
Epistemic understanding	.08**	.12***	-.11***	-.13***
Personal religion	.17***	.09**	.09**	-.24***
Authority in religion	-.29***	-.12***	.06*	.36***
Personal science	-.15***	-.22***	.16***	.32***
Authority in science	.15***	.17***	-.10***	-.14***
Importance of religion	-.48***	-.01	.26***	.26***
Importance of science	.17***	.26***	-.02	-.23***
Belief in God	-.47***	-.09**	.27***	.37***
Other supernatural beliefs	-.31***	-.20***	.32***	.35***
Over-mentalizing	-.24***	-.14***	.12***	.27***

TABLE 1 Spearman correlations between the four science-religion views and the predictor variables

Note: *** $p < .001$. ** $p < .01$. * $p < .05$. According to the Bonferroni criterion, correlations $> |.09|$ are significant at $p < .05$. Correlations $> |.30|$ are bolded. Higher values of the conflict view denote more conflict: The response options to the statement "Religion and science are not in conflict with each other" were Agree (scored 1), Moderately agree (2), and Disagree (3). The conflict statement was answered by all participants, and the statements regarding the three non-conflict views were answered only by participants who agreed or moderately agreed with the conflict statement. The non-conflict statements ranged from Strongly disagree (1) to Strongly agree (5). The number of participants that each pairwise correlation is based on is shown in Table S2.

The results showed that the non-conflict views were not independent and that most of the epistemological and ontological variables were poor predictors of the science-religion views. It is possible that the results were blurred because participants with the conflict view were not separated based on whether they sided with science or religion. Therefore, we divided the people with a conflict view (i.e., those who disagreed that there is no conflict) into two groups. Those who rated science as at least equally important as religion formed the pro-science conflict group ($N = 2549$; 1393 in Finland, 682 in Denmark, and 474 in the Netherlands), and those who rated religion as more important than science formed the pro-religion conflict group ($N = 100$; 24 in Finland and Denmark, and 52 in the Netherlands). See Table S4 for these views' correlations. In addition, examining the non-conflict views separately may have obscured relations. Thus, to identify groups of participants with specific non-conflict view combinations, we conducted a K-means cluster analysis for four clusters on the non-conflict view statements. Because the analysis is sensitive to outliers, a couple multivariate outliers, detected by Mahalanobis distance with $p < .001$, were not included in the analyses. Otherwise the analyses included all participants without missing values on the non-conflict view statements ($N = 810$ in Finland, $N = 249$ in the Netherlands, and $N = 167$ in Denmark). Cluster analysis is an explorative method which clusters data irrespective of whether it includes natural clusters. Thus, to validate cluster stability,

the analysis was conducted separately in the three countries and only clusters that were similar in every country were considered valid. In addition, because the main aim was to find general patterns in the way people view the science-religion relations and examine how cognitive factors are related to these general views, our main interest focused on the clusters found in each country.

Two similar clusters were found in Finland, the Netherlands, and Denmark. The first cluster consisted of participants who supported, at least to some extent, all three non-conflict views, and it was labeled *general non-conflict group*. The second cluster was labeled *independence-dialogue group* because it consisted of participants who disagreed with the integration view but agreed with both the independence and dialogue views. Table 2 shows the sizes of the found clusters and the values of a typical case in each of them (i.e., final cluster centers). Only participants in the two common clusters, the general non-conflict group and independence-dialogue group, were included in the subsequent analyses.

A discriminant analysis was performed to find the dimensions, that is, linear combinations of variables, along which the four groups (two conflict view groups and two non-conflict view groups) differed. Because discriminant analysis is quite robust to normality violations whenever the number of participants in the smallest group is noticeably larger than the amount of predictor variables (Tabachnick & Fidell, 2014, p. 426), original variables were used. The analysis is,

TABLE 2 Final cluster centers for each non-conflict view statement (scale range 1–5) among those not viewing conflict

Variable	Valid clusters		Other clusters		
	General non-conflict ^a	Independence-dialogue ^b	Independence ^c	Dialogue ^d	Unclear ^e
Independence view: Religion and science are not in conflict with each other because they focus on different topics					
Finland	4	4	4		2
Netherlands	4	4			23
Denmark	4	4	4	2	
Dialogue view: One can have many perspectives on the same issue					
Finland	4	4	2		4
Netherlands	4	4			33
Denmark	5	5	2	4	
Integration view: Religion and science give similar answers to questions					
Finland	4	2	1		3
Netherlands	4	2			43
Denmark	3	1	1	2	

Note: The general non-conflict cluster in Finland is bolded as an example and consists of Finnish participants who scored high on statements regarding independence, dialogue, and integration.

^aN = 203 in Finland, 67 in the Netherlands, 30 in Denmark.

^bN = 253 in Finland, 66 in the Netherlands, 74 in Denmark.

^cN = 207 in Finland, 17 in Denmark.

^dN = 46 in Denmark.

^eN = 147 in Finland, and in order 20 and 96 in the Netherlands.

^aThe other clusters included 42.3% of Finnish, 46.4% of Dutch, and 37.7% of Danish participants with the view that religion and science are not in conflict.

however, sensitive to outliers, and they were thus excluded from the groups ($p < .001$ for Mahalanobis distance). Multicollinearity statistics were acceptable (Tolerance $> .40$ and VIF < 2.5) between the predictors and original science-religion perspectives.

Differences between the groups were found along two discriminant functions. The third dimension was not significant, $p = .06$, Wilks' Lambda = .99, $\chi^2(10) = 17.66$, and explained only 0.8% of the variance, so it is not discussed further. The two significant dimensions (Table 3) were named Religiosity (because of the top loading of belief in God) and Complexity of knowledge (because of the top loading of knowledge complexity). The Religiosity dimension accounted for 92.7% of the explained variance between the groups, Wilks' Lambda = .55, $\chi^2(36) = 1732.65$, $p < .001$. The Complexity of knowledge dimension accounted for 6.5% of the variance, Wilks' Lambda = .95, $\chi^2(22) = 161.22$, $p < .001$. The discriminant functions classified 80.1% of the participants correctly. Only the pro-science conflict group scored low on the Religiosity dimension. After controlling for the variation explained by the Religiosity dimension, the pro-religion conflict group differed from others with its low score on the Complexity of knowledge dimension. For more detailed information about the dimensions and group differences, see Table 3.

Because the importance of science and religion variables were used to form the pro-science and pro-religion conflict views, these variables were not included in the discriminant analysis but examined

separately. Kruskal–Wallis test showed group differences ($p < .001$) in both, perceived importance of religion, $H(3) = 873.85$, and perceived importance of science, $H(3) = 322.44$. Bonferroni corrected pairwise comparisons revealed that all four groups differed significantly in perceived importance of science ($p < .01$), and except for a lack of difference between the pro-religion and general non-conflict groups ($p = .42$), in importance of religion ($p < .02$). Group medians are shown in Table 3. Of the groups, the pro-science conflict group considered religion markedly the least important while the pro-religion conflict group rated the importance of science notably the lowest.

4 | DISCUSSION

This study addressed a question that most people have pondered at some point during their lives: what is the relationship between religion and science? Four views were examined: the view that science and religion are in conflict, and the views that science and religion are not in conflict because they concern separate aspects of reality (the independence view), because they address the same reality but from different perspectives (the dialogue view), or because science and religion provide the same knowledge (the integration view).

In all three countries, Finland, Denmark, and the Netherlands, the integration view was held by a minority and the conflict view was

TABLE 3 Results of the discriminant analysis, and medians of the importance variables

VARIABLE	Discriminant analysis		Medians	
	Dimension 1 Religiosity	Dimension 2 Complexity of knowledge	Importance of religion	Importance of science
Belief in God	.93	.03		
Other supernatural beliefs	.55	-.11		
Authority in religion	.50	-.40		
Over-mentalizing	.36	-.10		
Faith in intuition	.24	-.18		
View of knowledge complexity	.05	.83		
Personal science	.33	-.51		
Need for cognition	-.14	.46		
Epistemic understanding	-.16	.27		
Personal religion	-.23	.24		
Authority in science	-.21	.11		
Cognitive reflection	-.08	.15		
GROUP				
Pro-science conflict (N = 2197)	-0.46	-0.01	2.00	4.80
Pro-religion conflict (N = 74)	1.51	-1.16	4.00	3.20
Independence-dialogue (N = 342)	1.08	0.37	3.20	4.60
General non-conflict (N = 264)	2.01	-0.04	3.80	4.40

Note: Loadings of the variables on the latent discriminant dimensions are presented at the upper part of the table. The lower part shows the mean scores ($M = 0$) of the groups on these dimensions as well as the medians of perceived importance of religion and science in the groups (scale range 1–5). Loadings $> |.30|$ are bolded.

supported by a majority. Moreover, among people who viewed conflict, those who considered science more important than religion (i.e., the pro-science conflict group) formed a much larger group than those who considered religion more important than science (the pro-religion conflict group). Relatedly, O'Brien and Noy (2018) have also found that the majority of people in these countries disagree that science is trusted too much compared to religion, and Stolberg (2007) has reported low support for the integration view in England.

However, the questions, viewpoints, and methodologies have varied so vastly from study to study that it is difficult to compare reported prevalences, among other things. Moreover, earlier research has seldom addressed cognitive determinants underlying people's perception of the relationship between science and religion. Due to this, most of the present results are new.

4.1 | Cognitive profiles of people with different science-religion views

Two similar non-conflict view groups were found in the three countries: people who supported the independence and dialogue views (the independence-dialogue group), and people who supported the independence, dialogue, and integration views (the general non-

conflict group). When these groups and the pro-religion and pro-science conflict groups were compared to one another, important differences emerged in cognitive profiles.

The discriminant analysis illustrated that the four groups were by far best separated by the Religiosity dimension, particularly their level of God belief. All other groups except the pro-science conflict group scored high on this dimension. That is, participants in the pro-religion conflict group, the general non-conflict group, and the independence-dialogue group believed in God and they also tended to believe in non-religious supernatural phenomena, trust the Bible and other religious epistemic authorities, endorse over-mentalizing biases, and view relying on personal experiences as the best way to gain knowledge on matters which belong to the realm of science. Since the pro-science conflict group had the lowest level of supernatural beliefs and over-mentalizing, the results support hypotheses 5 and 6 for this conflict view.

The few empirical studies that have investigated non-scientists' views have shown that higher religiosity increases the view that religion and science can be integrated (Longest & Smith, 2011; Uecker & Longest, 2017). In addition, Baker (2012) found that taking the Bible literally is common among people who privilege religion over science and see science and religion as incompatible. The present results extend and integrate these findings in the following ways.

First, religiosity and trusting the Bible and other religious authorities were here most typical for the pro-religion conflict and general non-conflict views. Second, a self-ascribed epistemic authority of science also united the pro-religion conflict and general non-conflict groups, likely leading individuals with these views to rarely take scientific statements seriously because of a sense that there is little in science that can contribute over and above one's own ability to process information (Kruglanski et al., 2009). Third, the results imply that it is not only religious ontology but a more general supernatural ontology that shapes how the science-religion relation is perceived in the general population. That believing in God, telepathy, and other supernatural phenomena, and confusing the attributes of mental and physical phenomena were linked on the same dimension is consistent with earlier observations that they are all positively related (e.g., Lindeman & Svedholm-Häkkinen, 2016; Lobato et al., 2014).

Apart from the associations of the Religiosity dimension, the Complexity of knowledge dimension explained a small amount of variation between the groups. This dimension mainly consisted of viewing knowledge as complex but also reflected cognitive complexity somewhat more broadly. The pro-religion conflict group had the lowest score on this dimension: They had the simplest view of knowledge, lowest need for cognition, and most trust in religious authorities and in personal experiences on scientific matters. Although the independence-dialogue group had slightly higher cognitive complexity than the pro-science conflict and general non-conflict groups, no group stood out with high analytic thinking and cognitive sophistication.

How, then, can the differences between the four groups be summarized? When the way the participants evaluated importance of science and religion was also taken into account, the following picture emerged.

The pro-science conflict group members stood out from the rest by responding like scientists. They attached little importance to religion and high importance to science (inevitably reflecting the way the group was defined). They also scored markedly the lowest on the Religiosity dimension, implying especially low supernatural beliefs but also mistrust in religious authorities and in personal experiences over scientific research, among others. This is exactly what many scientists have been found to think about the relationship between science and religion (Ecklund et al., 2011; Ecklund & Park, 2009). This groups' views also align with Baker's (2012) and Scheitle's (2011) reports that non-scientists with a pro-science conflict view display the lowest religiosity.

The other groups shared a cognitive profile characterized by the above described supernatural ontology, especially belief in God. They can therefore be called religious believers. For them, our results were surprisingly similar to what Uecker and Longest (2017) observed among American participants. They found that lower religious commitment was likely when science and religion were seen as independent, whereas religious commitment was strongest among those who rejected scientific knowledge and among those who integrated scientific knowledge into their religious worldview. Furthermore, that most our participants believed science to be important is also in good

agreement with Uecker and Longest's finding that mere knowledge of science does not typically weaken religious commitment.

In the present study, the independence-dialogue group regarded science as more important and religion as less important than the other religious groups did, and their supernatural ontology was not as pronounced as that of the other religious groups. Because their thinking was also cognitively somewhat more complex, what appeared to be essential to this group is moderation and open-mindedness. The pro-religion conflict group, in turn, was distinct from the other religious groups, not only because of low cognitive complexity but also because they valued science the least. It is hence possible that lower scientific literacy describes this group more than others, at least if we agree with Čavojská et al.'s (2020) notion that understanding the impact of science in everyday life is one aspect of scientific literacy. Finally, the general non-conflict group was distinguished from the other religious groups by its highest mean on the Religiosity dimension.

These findings speak to the characterizations that have been made regarding people with the integration view. Barbour (1990, 2002), who in his own words is primarily interested in the cognitive aspects of religion, holds the dialogue and integration views as most advanced. Similarly, according to Legare et al. (2012) the integration of scientific and religious explanations requires metacognitive skills and cognitive flexibility and is thus a conceptual achievement. This study does not provide much support for these proposals. Participants in the general non-conflict group, in which the integration statement received the highest values, did not show stronger analytic thinking or higher epistemic sophistication than others, and they endorsed supernatural beliefs and over-mentalization biases more than others.

Besides contributing to descriptions of people with the integration view, this study has implications for discussing people with the other science-religion views. Most notably, the results indicated that the type of people who see conflict should not be discussed as a homogeneous group since people with distinct conflict views had different cognitive characteristics. In addition, that people could support two or even all three of the non-conflict views fits Barbour's (1990) proposal that the perspectives are not necessarily exclusive and reports that people can agree with more than one view (Stolberg, 2007; Yasri et al., 2013). The results also showed that the factors that could express cognitive advancement had at best a minor role in separating the groups.

Contrary to our hypotheses 1–4, domain general epistemic factors had little effect on people's science-religions views. People with high epistemic understanding, strong cognitive reflection, or low faith in intuitive impressions did not favor any conflict or non-conflict view more than others did. Although need for cognition and the perceived complexity of knowledge slightly distinguished between the groups, even the effect of the stronger predictor (complexity of knowledge) was very small. If anything, their relations were opposite to those expected in hypothesis 1 and 2 since they were the least typical for the pro-religion conflict group. Thus, whereas previous work has evinced that analytic thinking increases and intuitive thinking decreases sensitivity to conflicts (Pennycook et al., 2014; Walco &

Risen, 2017), this does not appear to apply to detecting conflicts between scientific and religious claims.

Overall, the results bear on the debate concerning the relative roles that analytic thinking and ideologically motivated cognition play in reasoning. Considering the irrelevance of most epistemological factors and the strong influence (un)religiosity had on the science-religion views, our results corroborate findings that people seek, view, and recall information in a way that is consistent with their prior commitments, such as religious and political worldviews (Drummond & Fischhoff, 2017; Lewandowsky & Oberauer, 2016). The relationship between science and religion seems to thus be one of the topics where people are most likely to form conclusions that are compatible with their core beliefs.

4.2 | Limitations and proposals for future studies

This study was conducted in countries where secularity and low religious diversity are typical. This is characteristic of Western Europe: most people say that religion is unimportant in their lives, and most of the affiliated people identify as Christian (Pew Research Center, 2018a, 2018b). Given that most of the participants were religiously unaffiliated, the present samples were even more secular than the countries' general populations. Future studies are therefore needed to investigate how the results replicate in more religious samples from secular countries, in more religious countries (e.g., the United States), and in overall religiously more diverse countries. Additional studies are also important because Finnish participants were overrepresented in the discriminant analysis, which may limit the generalizability of the results.

Although certain cognitive characteristics typified Finnish, Danish, and Dutch people with a particular view of the science-religion relationship, there was notable variation between the countries in the way the three non-conflict views were supported. Information about the ways epistemic and ontological cognition predict agreement with the four science-religion perspectives was therefore obtained only for roughly a half of those who supported the non-conflict view. Also in earlier studies, agreement with the views has varied largely between studies conducted in different countries (e.g., Baker, 2012; Stolberg, 2007; Yasri et al., 2013). The present results imply that even in as similar countries as Finland, Denmark, and the Netherlands, people differ in the way they assimilate and differentiate between the independence, dialogue, and integration views of science and religion. One possible explanation is that the results illustrate country differences in religiosity and religion-state relations. Although Finland, Denmark, and the Netherlands are all countries where religion does not commonly have a central role in people's lives, only in the Netherlands church and state are officially separated, the Netherlands has the most nonbelievers, and religious commitment is lower in Denmark than in Finland (Pew Research Center, 2018a).

However, a more plausible explanation is that the questions regarding the relationship between science and religion were problematic because they were, as in most previous studies, in no way

specified. Different people can interpret the questions differently, and the questions may be difficult to answer if one does not know which topic the questions refer to. This may partly explain the in-country and cross-country variation, the overlap in the non-conflict views, and why many of the correlations between epistemic and ontological cognition and the science-religion views were weak here. Moreover, the uncertainty and undecidedness of many people about how science and religion relate (Baker, 2012; Stolberg, 2007) may also reflect the usage of too broad questions that can be understood in various ways. After all, thinking of the science-religion relation regarding, for instance, values or evolution are not equivalent. While some may think that values and moral issues are only related to religion, scientific worldview and religions allow the same values and moral rules to be upheld. The same person may hence think that religious and scientific views are in conflict regarding afterlife but not regarding the values that are important in one's life, for example.

It is hence important in future studies to specify which aspects of religion are in question. It should at least be made clear whether the question is about topics belonging to the realm of science, that is, statements about the world that have general truth value such as evolution, or other topics such as one's personal values and morals. Specification of these issues could help us identify the topics in which the conflict, independence, dialogue, and integration stances are common, and why some people feel uncertainty or anxiety about science-religion relations (e.g., Yasri & Mancy, 2014).

It would also be important to ask people who view conflict whether they think that science trumps religion or vice versa, because people with a conflict view do not form a homogeneous group (see also Baker, 2012; O'Brien & Noy, 2015; Preston & Epley, 2009; Scheitle, 2011). A major limitation of this study was that this question was not asked. Although the perceived importance of science versus religion can be expected to roughly capture the pro-science and pro-religion conflict views, perhaps not everyone designated to a specific conflict group would have chosen it themselves.

Because the pro-religion conflict group was very small here, the results regarding it are particularly tentative. Although most Western Europeans think that it is science that makes religion unnecessary in their lives (O'Brien & Noy, 2018; Pew Research Center, 2018a), the pro-religion group was probably underrepresented in this study. One of the reasons for this assumption is that parts of the Finnish and Danish samples were recruited via social media sites, including some skeptic organizations but not religious organizations. Previous studies have shown that social media samples, overall, are more liberal than the representative samples (Mellon & Prosser, 2017), and that liberalism is typically associated with non-religiosity (Saroglou et al., 2004). Thus, due to recruitment decisions, the samples were probably biased towards non-religiosity and liberalism.

It should also be noted that religiosity is not a unitary concept. The present sample and religion measures did not adequately capture diversity in religiosity and religious traditions. Studies actually indicate that distinct forms of religiosity are differently related to people's science-religion views (Baker, 2012; Scheitle, 2011), to people's level of trust in science (Rutjens et al., 2018), and to epistemic

(e.g., Bahçekapili & Yilmaz, 2017) and ontological sophistication (e.g., Hathcoat & Habashi, 2013). Upcoming research should thus consider different types of religiosity, such as modest religiosity, religious conservatism, and religious fundamentalism, to better understand the ways people relate science and religion.

One further limitation was to not give all participants the possibility to rate all four views. In addition, the narrow 3-point scale of the conflict question inevitably simplified the data. Future studies should thus use 5- or 7-point scales and show all science-religion statements to everyone. The negative framing of the conflict item ("Religion and science are not in conflict with each other") may have also been confusing, and upcoming studies should utilize positively worded items. Together with more specific science-religion statements, these modifications should make answering easier, and maximize the reliability and information value of the measures.

Finally, although we aimed to use validated measures for all constructs, the results overall are inevitably approximate. Assessment methods for everyday ontological assumptions are not easily available, and measures of adult epistemic cognition are typically domain-general and limited mainly to thinking styles. Given that justifying knowledge in science and religion were important predictors of people's science-religion views, our findings encourage focusing on and advancing measures of domain-specific epistemic sophistication in future studies. Moreover, the reliability of the Cognitive Reflection Test was low, as usual (Primi et al., 2016). Further development of these methods could help us examine not only science-religion perspectives but also the cognitive foundations of individual and cultural worldviews in more detail.

4.3 | Conclusions

In the present study we have specified and exemplified the cognitive underpinnings of non-scientists' viewpoints on the relationship between science and religion. We found that ontology mattered more than epistemology, and that domain-specific epistemological criteria for science and religion mattered more than domain-general epistemic sophistication. We also suggested new avenues for research in this important but underresearched field of study.

The strong role that ontological assumptions played in people's science-religion views helps us understand why attitudes towards science and religion can become polarized. The growing secularization has led to new anti-religious movements and parody religions (e.g., Pastafarianism), and science-religion views have led people to ignore scientific evidence and to participate in heated political and public debates on topics such as abortion, climate change, homosexuals, and vaccination (e.g., Noy & O'Brien, 2016; Rutjens et al., 2018). As Yasri et al. (2013) have noted, beliefs about the relationship between science and religion can also explain differences in students' learning outcomes, understandings of the nature of science, and the ways different sources of information are sought out.

Since the understanding of scientific arguments develops later than basic ontological assumptions, discussing students' opinions and

questions regarding the relationships between religion and science in school is vital. In particular, it would be important to talk about students' science-religion views regarding specific topics (e.g., abortion, evolution) and in light of scientific findings as well as students' understandings of the natures of science and religion, including their limits, benefits, and conceptions of knowledge and truth. Together these discussions could increase scientific literacy, decrease negative stereotypes, and lower the polarization some feel between science and religion.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that supports the findings of this study are openly available at <https://osf.io/6dz3v>, Understanding Unbelief Study Finland, Denmark & the Netherlands.

ORCID

Pinja Marin  <https://orcid.org/0000-0002-9676-1861>

Marjaana Lindeman  <https://orcid.org/0000-0003-4176-3736>

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