

How do people perceive the relationship between science and religion?
The role of epistemic cognition, ontological confusions,
and social importance judgments

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Tiivistelmä – Referat – Abstract <p><i>Tavoitteet.</i> Tieteen ja uskonnon välisestä suhteesta on keskusteltu ja väitelty hartaasti, mutta sitä on tutkittu vasta vähän. Näin ollen ihmisten näkemyksiä tieteen ja uskonnon välisestä yhteydestä ei ymmärretä hyvin. Yksilöiden näkemykset on kuitenkin alustavasti liitetty heidän mielipiteisiinsä, asenteisiinsa ja valintoihinsa. Tämän tutkimuksen tavoitteena oli tutkia episteemisen kognition, ontologisten ydintiedon sekaannusten sekä tieteen ja uskonnon arvioidun yhteiskunnallisen tärkeyden vaikutusta neljän tiede-uskonto-näkemyksen kannatukseen: konflikti, erillisuus, dialogi ja integraatio.</p> <p><i>Menetelmät.</i> Koehenkilöt (N=2256) olivat aikuisia suomalaisia, jotka olivat vastanneet väittämään uskonnon ja tieteen välisestä konfliktista internet-kyselyssä. Otos oli suureksi osaksi uskonnoton: 67.2% osallistujista ei kuulunut mihinkään uskontokuntaan. Konflikti-, dialogi- ja integraationäkemyksiä ennustettiin logistisella regressioanalyysillä ja erillisyyšnäkemyksiä ordinaalisella regressioanalyysillä. Ikkä, sukupuoli ja koulutus vakioitiin analyysissä.</p> <p><i>Tulokset.</i> Intuitiivinen ajattelutyyli, ydintiedon sekaannukset sekä uskonnon kokeminen yhteiskunnallisesti tärkeiksi vähensivät konfliktin näkemisen todennäköisyyttä. Sen sijaan yksinkertainen näkemys tiedosta ja tieteen kokeminen yhteiskunnalliseksi tärkeäksi lisäsivät konfliktinäkemysten todennäköisyyttä. Ristiriidattomissa näkemyksissä ydintiedon sekaannukset lisäsivät sekä dialogi- että integraationäkemyksen todennäköisyyttä, mutta vähensivät erillisyyšnäkemyksen todennäköisyyttä. Myös intuitiivinen ajattelutyyli lisäsi dialogi- ja integraationäkemyksen kannattamisen todennäköisyyttä. Lisäksi uskonnon yhteiskunnallinen tärkeys lisäsi dialogi- ja integraationäkemyksen todennäköisyyttä, kun taas tieteen yhteiskunnallinen tärkeys lisäsi erillisyyšnäkemyksen todennäköisyyttä.</p> <p><i>Johtopäätökset.</i> Ihmisten väliset erot episteemisessä kognitiossa, ydintiedon sekaannuksissa sekä uskonnon ja tieteen arvioidussa yhteiskunnallisessa tärkeydessä vaikuttivat neljän tiede-uskonto-näkemyksen kannatukseen. Näin ollen ajattelutyylien, tietokäsitysten, kategoriavirheiden ja asenteiden syvällisempi tutkiminen luultavasti lisäisi ymmärrystä siitä, miten ihmiset hahmottavat uskonnon ja tieteen välisen suhteen.</p>			
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Tiivistelmä – Referat – Abstract <p><i>Objective.</i> The way science and religion relate is a topic of lasting debate and discussion but little research. Thus, people's perceptions of the science-religion relationship remain poorly understood. Yet, the way people relate science and religion to each other seem to be connected to their opinions, attitudes, and choices. The aim of this study was to examine how epistemic cognition, ontological confusions of core knowledge, and the perceived social importance of science and religion predict agreement with four science-religion perspectives: conflict, independence, dialogue, and integration.</p> <p><i>Method.</i> Participants (N=2256) were adult Finns who had, in an online survey, given their view on whether science and religion are in conflict. The sample was largely nonreligious with 67.2% not belonging to any religious denomination. Three logistic regressions were used to predict the likelihood to hold the conflict, dialogue and integration views, and an ordinal logistic regression was used to examine agreement with the independence view. Age, gender and education were controlled in all analyses.</p> <p><i>Results.</i> Intuitive thinking style, core ontological confusions, and the perceived social importance of religion decreased the likelihood to hold the conflict view whereas a simple view of knowledge and importance of science increased it. Regarding the three non-conflict views, core ontological confusions increased the likelihood to hold the dialogue and integration views, but decreased the likelihood to hold the independence view. In addition, intuitive thinking style increased the odds to agree with the dialogue and integration views. Moreover, importance of religion increased the likelihood to hold the dialogue and integration views while importance of science increased the likelihood to agree with the independence view.</p> <p><i>Discussion.</i> Differences in epistemic cognition, core ontological confusions, and the perceived social importance of science and religion affected agreement with the four science-religion perspectives. Therefore, it is likely that the ways people perceive the relation between science and religion could be better understood through further examination of thinking styles, views of knowledge and knowing, category errors, and attitudes.</p>			
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Preface

The data used in this thesis is from the research project *Uncovering the hidden nature of unbelief* (later *Uncovering unbelief*). It is part of a larger cross-cultural and interdisciplinary research program *Understanding unbelief* that ran from the summer of 2017 to the summer of 2019. The larger program and its 11 research projects were funded by the John Templeton foundation and managed by the University of Kent. The *Uncovering unbelief* project was carried out in three European countries by three researches: the project leader Marjaana Lindeman in Finland (University of Helsinki), Uffe Schjødt in Denmark (Aarhus University), and Michiel van Elk in the Netherlands (University of Amsterdam). This thesis is based on the Finnish data.

I worked as a research assistant in Finland throughout the project. I contributed to the questions included in the survey, helped with collecting and analyzing the data, and participated in the writing of the first article (Lindeman, van Elk, Lipsanen, Marin, & Schjødt, 2019). This thesis potentially overlaps with the article on the method section.

My heartfelt thanks go to my supervisor Marjaana Lindeman for all her invaluable comments and advice regarding this paper, and for being open to examine the science-religion perspectives in the research project. Overall, thank you for always being so open and supportive yet skeptical enough towards my ideas.

Table of Contents

1. Introduction	1
1.1 Science-religion perspectives	3
1.2 Need for explanations	5
1.3 Epistemic cognition	7
1.3.1 Thinking styles.....	7
1.3.2 Views of the structure of knowledge.....	9
1.3.3 Experiential view of knowing in science and religion	10
1.4 Ontological confusions.....	11
1.5 Perceived importance of science and religion	13
1.6 Aims of the study	15
2. Method.....	16
2.1 Participants.....	16
2.2 Procedure	16
2.3 Materials	16
3. Results	19
3.1 Predicting the perceived conflict	21
3.2 Predicting agreement with the non-conflict views	24
3.3 Closer look at responses to the non-conflict views	29
4. Discussion.....	30
4.1 Core ontological confusions and the science-religion perspectives	30
4.2 Thinking styles and the science-religion perspectives	32
4.3 Simple view of knowledge and the science-religion perspectives.....	34
4.4 Personal justification in science and religion	36
4.5 Importance of science and religion.....	38
4.6 Agreement with the science-religion perspectives.....	41
4.7 Limitations and future directions.....	42
4.8 Conclusion	44
References.....	45
Appendix: Comparing importance judgments and views of knowing between science and religion	50

1. Introduction

Science is an integral part of the modern world with over \$1.9 trillion invested globally in research and development in 2015 (National Science Board, 2018). Understanding the assumptions underlying modern science is crucial for defining science from pseudoscience, for understanding scientific findings, and for evaluating arguments correctly. These in turn have vast implications for individuals, societies, and ultimately the whole planet (e.g., genetically modified organisms, global warming). In the modern society the increasing popularization of science and easier access to scientific findings is bringing scientific knowledge to nearly everyone's awareness.

Besides the increasing availability of science, religion remains highly influential in many societies: worldwide 84 % of the world's population belonged to some religion in 2015 (Pew Research Center, 2017a). Religions may satisfy basic psychological motives such as the need to comprehend oneself and the world, to have control, and to belong. Moreover, upholding religious beliefs have been shown to help people cope with stress and anxiety (Farias, Newheiser, Kahane, & de Toledo, 2013). Religions can also strongly affect one's opinions and sense of identity, thus leading to larger sociopolitical effects (e.g., extreme abortion bans).

These two significant enterprises, science and religion, have often been pitted against each other. The growing secularization – especially in certain European countries – has somewhat paradoxically even intensified the visibility of religion and led to heated discussions. For example, new anti-religious movements (e.g., New Atheism) and parody religions (e.g., Pastafarianism) have emerged in the 21st century. In addition, anti-science campaigns, mainly lead by religious fundamentalists, are attempting to make themselves known. Some scholars have in fact expressed a growing concern for polarization in people's attitudes towards science and religion in the Western world (Rutjens, Heine, Sutton, & van Harreveld, 2018). The increase of secularization in most advanced industrial countries has also led to a growing interest in the possibility of a completely nonreligious worldview (e.g., Rutjens et al., 2018). However, the way people relate science and religion is poorly understood.

Even though the (in)compatibility of religion and science has been debated for centuries, the topic remains important and is abundantly discussed among the public and scholars in the modern society today. Considering the influential roles of both science and religion, it is not surprising that the way people relate them is also significant. For example, students' *science-religion perspectives* (i.e., the ways students perceive the relationship between science and

religion) have been linked to emotional distress as well as learning approaches and outcomes. For instance, uncertainty about the science-religion relationship, both as a whole and regarding specific topics, appears to produce anxiety in some students (e.g., Billingsley, Taber, Riga, & Newdick, 2013; 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., Taber, Billingsley, Riga, & Newdick, 2011a and 2011b; Yasri & Mancy, 2014; Hokayem & Boujaoude, 2008). Consequently, the relations between science and religion have also been recommended to be included in school curriculum (e.g., Taber et al., 2011a). Moreover, debates on potentially controversial issues such as abortion, evolution, 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; Whitehead & Baker, 2012).

While lay people's science-religion perspectives seem to matter, most of the knowledge is based on interviews. In fact, only a handful of systematic studies have been conducted on people's science-religion perspectives, and quantitative studies with larger samples are especially scarce. Research on the relationship between science and religion has so far been mainly philosophical, and focused on the theoretical ways to understand and categorize the relationship between the two different approaches to the unknown. In both philosophical and empirical research some authors approach the science-religion relationship from strongly one viewpoint, failing to examine the other perspectives objectively (e.g., Bensted, 2018; Barbour, 1990). Further, Baker (2012) notes that scholars have quoted Albert Einstein to support whatever position they hold. The lack of empirical research has ultimately lead Evans & Evans (2008) to describe the field of religion and science as "one of the muddiest in all sociology".

Overall, perhaps more important than one's science-religion perspective is the way one comes to hold it. Why do people actually adopt different science-religion perspectives? This thesis hopefully begins to answer this understudied question by focusing on the extent that epistemic cognition (here consisting of thinking styles, the perceived (un)simplicity of knowledge, and views of knowing in science and religion), and ontological confusions (i.e., category errors) are related to different science-religion perspectives. In addition, the way the perceived social importance of science and religion relate to the different science-religion perspectives is explored.

1.1 Science-religion perspectives

The possible ways of relating science and religion have been discussed in various typologies (e.g., Gould, 2001; Alexander, 2007; for a summary of different categorizations see Yasri, Arthur, Smith, & Mancy, 2013). Perhaps the most commonly used categorization among scholars is that of Barbour's (1990) which consists of four different science-religion perspectives: *conflict*, *independence*, *dialogue* and *integration*. The following descriptions mainly follow Barbour's views of these distinct, but not necessarily exclusive, ways to relate science and religion.

According to the *conflict view* science and religion are so incompatible that they both cannot exist peacefully. In the philosophical literature people holding this view are seen to choose either science or religion. Hence, the conflict view can be theoretically further divided into two distinct groups: science trumps religion (pro-science) and religion trumps science (pro-religion) conflict views. For example, the pro-science conflict view can be endorsed because religion and science are seen to make contradictory claims about the origins of the world and its content, and religion is seen to undermine the viewpoint of the chosen side, science (e.g., Taber et al., 2011b).

The independence view holds that science and religion can be completely separated since they concern two mutually exclusive aspects of reality: science tells us about the physical realm objectively and religion focuses on the supernatural realm, providing meaning and moral values (e.g., Gould, 2001). For example, separating soul from matter and using religion to understand the first and science to understand the second falls under the independence view. The separation of science and religion has also been described to stem from seeing them as answering different questions (how and why, respectively), and to include the use of different methods to gain knowledge (Yasri et al., 2013).

The dialogue view 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 dialogue perspective is the most heterogeneously and abstractly defined view in the literature, ranging from science and religion being mutually beneficial to their contact made possible through the social and historical roles of science and religion (see Yasri et al., 2013). I propose that the dialogue view can also be found more directly in the ways people relate science and religion. For example, viewing both science and religion to be necessary for understanding

miracles expresses a dialogue perspective (see Van Biema, 2006). What appears to be distinct and essential to this view is openness and valuation of differing views regarding the same topic.

The integration view includes various ways to combine science and religion to form a single explanation on a specific topic. There are two vastly different ways to achieve the view that science and religion provide the same answers to the same questions. In the first, no differences between science and religion are seen because they are perceived to be part of the same knowledge. This view is thought to be common among Eastern religions where science and religion are used interchangeably to further understanding (Yasri et al., 2013). In the second, science and religion are used to support each other directly: scientific findings are used to confirm religious knowledge and/or scientific knowledge is used to better understand religious texts. For example, when the emergence of species is explained through both evolution and creationism, science and religion can be seen as integrated (i.e., God used evolution; order in the universe proves God's existence). While the level of fusion varies in this category, no clear distinctions between scientific and religious explanations are seen whenever science and religion are combined. Instead science and religion are believed to provide the same knowledge on the issues. The integration view can thus be seen to consist of more concrete ways of combining science and religion compared to the dialogue view.

Overall, people's views seem to fit well into the four general science-religion perspectives proposed by Barbour (1990). Especially findings from interviews and open-ended surveys have consistently given support for the fourfold division (e.g., Billingsley, Taber, Riga, & Newdick, 2013; Taber et al., 2011b; Yasri & Mancy, 2014). In these studies, the four perspectives have also been found among vastly differing populations and contexts, for example among Christians, Muslims and Buddhists (e.g., Yasri et al., 2013; Vaidyanathan, Johnson, Prickett, & Ecklund, 2016; Ecklund, Park, & Sorrell, 2011). The conflict view and the three views of non-conflict seem to thus distinguish, at least roughly, between the different science-religion perspectives. The four views also appear largely sufficient, because when the science-religion relationships are divided more precisely the categories begin to overlap and separation becomes arbitrary (see Yasri et al., 2013). Still, expectedly, individuals' views are often not as distinct and defined as the ones described in taxonomies. Some people appear to be generally uncertain and undecided about how science and religion relate (e.g., Baker, 2012; Ecklund, Johnson, Scheitle, Matthews, & Lewis, 2016; Ecklund & Park, 2009; Taber et al., 2011a), and to agree with more than one view (Yasri et al., 2013; Bensted, 2018).

Considering the prevalence of the views, a large-scale survey has shown that in half of the 18 European countries surveyed, the majority (54–74 %) of the population agrees that science and religion are generally in conflict (Pew Research Center, 2017b). Similar agreement rates of 58–81 % have been obtained for the dialogue view and its equivalents (e.g., Bensted, 2018; Yasri et al., 2013; Stolberg, 2007). Support for the independence and integration views have generally been much lower (Stolberg, 2007; Yasri et al., 2013). Still, Bensted (2018) reported that slightly more than half of the students agreed with the independence view. Overall, agreement with the views varies largely between studies. For example, the conflict view has been supported by a third (Scheitle, 2011) or less (Baker, 2012) in the USA whereas higher rates (53 – 71 %) have been reported in Australia (Bensted, 2018), England (Stolberg, 2007), as well as in the USA (Longest & Smith, 2011). The country-level variation is quite understandable: countries differ in their religions and degree of religiosity, as well as in their level of scientific infrastructure and the relations between religion and state (Ecklund et al., 2016). This all likely leads to a different understanding of the science-religion relationship. Conclusions about agreement with the views are also difficult to make because studies have used varied questions and different categorizations to understand the science-religion perspectives. For example, the terms religion and faith have been used interchangeably (e.g., Ecklund et al., 2016; Bensted, 2018; Ecklund & Park, 2009; Longest & Smith, 2011), and the dialogue and integration views have not been clearly separated (e.g., Yasri et al., 2013; Ecklund et al., 2016; Bensted, 2018). Due to different operationalizations, variation between studies in the same country and with similar samples is expected. Still, the biggest shortcoming in the literature is the lack of knowledge about what explains (dis)agreement with the views.

1.2 Need for explanations

Despite the numerous prevalence studies, explanations for the origins of the four science–religion perspectives are unclear. In fact, barely any research has examined why people come to hold specific science-religion perspectives. It is unknown why some people agree with a specific perspective while others do not. It is unclear how people's views about knowledge or general thinking styles relate to the science-religion perspectives. In addition, the role of attitudes towards science and religion in explaining science-religion perspectives remains poorly understood. The few systematic studies attempting to understand why individuals adopt different views have mainly focused on demographics, such as religiosity and education (e.g., Scheitle, 2011; Ecklund & Park, 2009; Uecker & Longest, 2017). Although there are interview studies examining people's

science-religion perspectives (e.g., Yasri & Mancy, 2014), the qualitative nature of the research and lack of statistical analyses call for more quantitative studies. Still, due to the nature of the research and literature, philosophical and other theoretical reflections about the basis of the conflict view are common. While these often remain vague, they can offer a starting point for studying individual differences in holding the four science-religion perspectives.

Most of the theoretical arguments focus, either implicitly or explicitly, on epistemology (the characteristics of knowledge) or ontology (the characteristics of reality) of the science-religion perspectives (e.g., Yasri et al., 2013; Glennan, 2007). For example, the conflict view has been proposed to be due to the competing truth claims made by religion and science (Evans & Evans, 2008), and to be based on more fundamental ontological and epistemological differences between science and religion (Barbour, 1990). Hansson & Redfors (2007) refer to Görman (1992), and argue that one will end up with four distinct views of coexistence or conflict depending on how one answers two basic ontological and epistemological questions: 1) does one view reality as one or as made up of profoundly different parts, and 2) how one can reach knowledge about reality. Niiniluoto (1999) has emphasized epistemology by noting 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 addition, the contrasting ethical authority of science versus religion and differences in the discipline's moral values has been brought up as potential reasons for the conflict view (Evans & Evans, 2008). Relatedly, it has been proposed that people don't view conflict when both science and religion can be viewed positively and taken to be valid (e.g., Ecklund & Park, 2009; Ecklund et al., 2011).

Although the above considerations are broad and abstract, views on ontology and epistemology could be useful in understanding individuals' viewpoints on the relationship between science and religion. In order to study this, and to look beyond demographic variables, I draw on the psychological literature on epistemic cognition and ontological confusions. With this approach I hope to more thoroughly understand the mostly philosophical considerations relating to epistemology and ontology. In addition, I wish to start defining aspects of cognition that are relevant to people's science-religion perspectives. While a few broad mentions exist stating that 'cognitive mechanisms' could be relevant for one's science-religion perspectives (e.g., McPhetres & Nguyen, 2017), these mechanisms remain to be defined and studied. However, McPhetres & Nguyen (2017) strongly recommend looking into cognitive characteristics previously linked with

religious and supernatural beliefs, and this fits both epistemic cognition and ontological confusions. Lastly, the perceived social importance of science and religion are examined in relation to the four science-religion perspectives.

1.3 Epistemic cognition

Epistemic cognition consists of one's views of knowledge and beliefs. It includes views regarding the simplicity and certainty of knowledge, the possibility of learning, acceptable sources of knowledge, justifications for knowing, and habitual ways of thinking in everyday life, i.e. thinking styles (e.g., Evans & Stanovich, 2013; Hofer, 2000; Schraw, Bendixen, & Dunkle, 2002). Here the focus is on three aspects of this broad construct: analytic and intuitive thinking styles, views of the simplicity of knowledge, and views of knowing in science and religion.

1.3.1 Thinking styles

Thinking styles reflect the application of one's epistemic beliefs and goals in everyday life (Evans & Stanovich, 2013). They also cover the varied ways people collect and evaluate information, make conclusions, and the extent to which people think about problems before responding (Evans & Stanovich, 2013). Overall, thinking styles can be understood as one's usual way of thinking.

The present study examines how intuitive and analytic thinking style relate to the science-religion perspectives. The natures of the two styles can be understood through dual-process theories of cognition (reviews: Evans, 2008; Evans & Stanovich, 2013). In these theories, Type 1 processes are characterized as fast, automatic and unconscious, and they are separated from Type 2 processes which require working memory and are thus slower, more conscious and more effortful. Further, type 2 processes are divided into cognitive abilities (i.e., maximal performance), and thinking styles (i.e., typical thinking). People with an intuitive style tend to rely on feelings, heuristics and associations originating from Type 1 processes. Intuitions feel self-evidently true, but they are difficult to explain rationally since they are based on nonverbal Type 1 processes. Epstein (2010) has described intuition as "a sense of knowing without knowing how one knows". In contrast to preferring intuitions, people who have an analytic style crave more thought-out reasoning and need logical and more evidence-based reasons to accept and form ideas. Analytic style is based on more deliberate, abstract and systematic thought processes and is often manifested as "need for cognition", that is, willingness and enjoyment to think effortfully (Cacioppo, Petty, Feinstein, & Jarvis, 1996). Analytic and intuitive thinking styles are considered

largely unrelated (Epstein, 2010), and an individual can be high in both intuition and analytic thinking, generally and/or depending on the situation (e.g., Phillips, Fletcher, Marks, & Hine, 2016)

Although a few studies have shortly mentioned thinking styles as potential factors in understanding how people relate science and religion (McPhetres & Nguyen, 2017; Rutjens et al., 2018), the connections of intuitive and analytic thinking style to the different science-religion-perspectives have not been examined. They could still be relevant in understanding how people relate science and religion, and some hypotheses regarding the science-religion perspectives can be formed based on the literature on thinking styles.

Analytic thinking style correlates negatively (Fasce & Picó, 2019; Lindeman & Svedholm-Häkkinen, 2016; Pennycook, Ross, Koehler, & Fugelsang, 2016), and intuitive thinking correlates positively (Lindeman & Svedholm-Häkkinen, 2016; Shenhav, Rand, & Greene, 2012) with religious beliefs. Similar connections have also been found between the thinking styles and other measures of religiosity, such as viewing oneself as religious (Razmyar & Reeve, 2013). The findings imply that people high in intuitive thinking are more open to religious concepts compared to those high in analytic thinking. Further, conflict detection during base-rate reasoning tasks is negatively related to religiosity, and positively related to analytic thinking (e.g., Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2014). Based on the research, it is hypothesized that intuitive thinking style lowers the likelihood to view conflict between science and religion, and analytic thinking style raises it.

Besides helping us to understand whether one will perceive a conflict, analytic and intuitive thinking styles can help explain how one will approach a potential conflict: by attempting to explain it away, not being bothered by it or by forming a new, more rational view. Consequently, certain assumptions can be made regarding the non-conflict views. One starting point here is that the integration view always contains a level of incoherency – regardless of one's own view of the logicity of their arguments. Similarly, El-Hani & Sepulveda (2010) point out that the integration view, where scientific and religious ideas are combined, is often based on inconsistent ideas and arguments.

Since those high in intuitive thinking style often rely heavily on intuitions provided by Type 1 processes, they likely base their reasoning on a sense of holism where incoherence could be less noticeable and easier to tolerate. This holistic and associative nature of intuitive thinking (Epstein, 2010; Risen, 2016) should thus make intuitive thinkers likely to hold the integration view. The dialogue view might also be common among those with intuitive thinking style since it is a quite abstract view, leaving the precise mechanisms of integration unresolved and imprecise.

Analytic thinking style, in turn, should be negatively related to the integration and dialogue views. An increase in reflective thinking probably makes one more likely to view conflicts in integrative explanations, making one dissatisfied with them. Higher analytic thinking also makes it more likely that one is bothered by not clearly understanding how different views of the same issue could all be true. Consequently, the view taken here differs from the proposal made by Legare, Evans, Rosengren & Harris (2012) that integrating scientific and religious explanations to explain the same phenomenon is based on reflective thinking that is cognitively demanding and should be viewed as conceptual achievements instead of a sign of incoherent reasoning. Regarding the independence view, no reasonable predictions can be made since its relation to analytic and intuitive thinking styles could go either way.

1.3.2 Views of the structure of knowledge

Views concerning the structure of knowledge is another aspect of epistemic cognition, and it can be placed on a continuum, ranging from a simple to complex view of knowledge. A simplistic view of knowledge consists of avoiding ambiguity, seeking and preferring single answers and avoiding integration (Schommer, 1990). Information can be oversimplified by either focusing on only one aspect of information or by compartmentalizing different pieces of information (Schommer, 1990). In turn, a complex view of knowledge includes seeing knowledge as ambiguous, relative and contextual (Schraw, Bendixen & Dunkle, 2002; Hofer, 2000).

Some scholars have considered how one's view of knowledge could be related to specific science-religion perspectives. Barbour (1990) proposed that those holding the conflict perspective would seek out only one source of knowledge, i.e. science or religion, which they would regard as certain and reliable. In line with this suggestion, disagreement with the conflict view has been linked to dynamic and relativistic understandings of science and religion in qualitative studies (Roth, 1997; Ecklund et al., 2011). Barbour (1990) further proposed that scientific materialists and biblical literalists are two distinct groups that view science and religion as conflicting due to their similar, simple, view of knowledge. Perhaps consequently, most of the research has focused on exploring how the conflict view relates to these extremist views. A literal interpretation of religious texts (e.g., Bensted, 2018; Baker, 2012), and a rigid and positivistic understanding of science (e.g., Billingsley et al. 2013; Taber et al 2011a; Bensted, 2018; Hansson & Redfors, 2007) have indeed been positively related to the conflict view. In addition, Desimpelaere, Sulas, Duriez, & Hutsebaut (1999) found that fundamental religious believers, and another group that favored

science instead of religion, had a simple (stable, absolute) view of knowledge, and that a symbolical understanding of religion was related to a more complex, relativistic, and dynamic understanding of knowledge.

Besides studies looking into one's understanding of scientific and religious knowledge, no study has yet, to my knowledge, explored how one's view of knowledge structure in general relates to the science-religion perspectives. Based on the above-mentioned studies indicating that a more complex and ambiguous understanding of science and religion lowers the likelihood to hold the conflict view, a simple view of knowledge is expected to be positively related to the conflict view. While this hypothesis includes Barbour's (1990) suggestion that those holding the conflict view prefer only one, certain, source of knowledge, the hypothesis does not imply that the conflict view is automatically less sophisticated than the non-conflict view. After all, some level of simplicity may be needed to be able to hold the conflict view while not yet having a naive understanding of knowledge. Even the literature on epistemic cognition underlines that the ability to evaluate claims is more mature than holding a completely complex and relative view of knowledge (Kuhn, Cheney, & Weinstock, 2000; Kuhn & Dean, 2004). Thus, the view taken here differs from the quite common assumption in the literature that the conflict view is *only* based on overly simple and naive understanding of science and/or religion, and believed to be overcome with more "epistemic insight" (e.g., Bensted 2018; Billingsley et al., 2013; Taber et al., 2011a; see also Barbour, 1990). In addition to the conflict view, the way simplicity of knowledge relates to the three non-conflict views is explored.

1.3.3 Experiential view of knowing in science and religion

Besides the more general epistemic views, i.e. thinking styles and views of the structure of knowledge, the way people justify and view scientific and religious knowledge in particular is studied. Hofer (2000) found that people use two distinct, negatively correlated, ways to justify knowledge in a subject: justification based on one's own and others' personal experiences, or based on authority figures and texts. Moreover, preferring personal justifications, i.e. first-hand experience, clustered together with tentativeness of knowledge, i.e. viewing knowledge more as opinions than facts and believing that one cannot actually prove specific views to be the correct ones (Hofer, 2000). Following Hofer, the term 'personal justification' is used below to refer to this factor. Namely, personal justification refers here to an experiential view of knowing where personal experiences are relied upon and preferred, answers are believed to be practically

impossible to prove correct, and their correctness is perceived mainly as a matter of opinion instead of fact. Thus, the factor appears to include viewing knowledge more openly and relativistically in a subject, and possibly to an extent doubting the existence and attainment of specific truths. Overall, the view that information can be gained through experiences is typical of intuitive thinking where experiences are taken as self-evidently valid and are automatically believed (e.g., Epstein, 2010).

Studies discussing one's understanding of, and trust in, scientific and religious knowledge could help us understand how higher personal justification in science and religion are related to the science-religion perspectives. Regarding religion, a literal interpretation of religious texts has been positively related to the conflict view (e.g., Bensted, 2018; Baker, 2012), whereas viewing religion as "spirituality", and being spiritual, has been positively associated with a non-conflict view (Ecklund et al., 2011; Ecklund & Park, 2009). These findings could indicate that trusting own experiences as valid sources of knowledge in religion, and viewing religious knowledge more openly, lowers the likelihood to hold the conflict view. Considering science, trusting the scientific method to provide the truth, and viewing the scientific method as a way to protect against biases originating from trusting one's own experiences, appears to be positively related to the conflict view among scientists (Ecklund et al., 2011). In addition, an absolute view of science has been associated with the conflict view in qualitative studies (e.g., Billingsley et al., 2013; Taber et al., 2011a; Bensted, 2018; Hansson & Redfors, 2007). Thus, higher personal justification in science should lower the likelihood to hold the conflict view.

In sum, it is hypothesized that higher personal justification in science and in religion are negatively related to the conflict view. These hypotheses are based on the previously described findings, and they also fit the earlier made proposals that intuitive thinking style lowers, and simple view of knowledge raises, the likelihood to hold the conflict view.

1.4 Ontological confusions

Besides epistemic cognition, ontological confusions can be relevant in understanding how people relate science and religion. Generally speaking, ontological confusions are category errors where the qualities of a distinct category (e.g., processes) are mistakenly attributed to members in another category (e.g., matter), for instance to say "thunderstorm is broken" is a category mistake (e.g., Chi & Slotta, 1993). Consistent with McPhetres & Nguyen's (2017) proposal to explore cognitive factors related to religious beliefs, a specific type of ontological confusions, i.e.

confusions of core knowledge, are studied here. These confusions are based on the idea that psychological, physical, and biological phenomena are distinct ontological categories that can be separated due to their unique core attributes which are learned during childhood mostly intuitively and without instruction everywhere in the world (e.g., Wellman & Gelman, 1992; Spelke & Kinzler, 2007). Specifically, core knowledge differentiates mental from physical, and within the physical domain, animate beings from inanimate objects, and living organisms from lifeless objects (Lindeman, Svedholm-Häkkinen, & Lipsanen, 2015). Whenever the distinct core properties of the categories are mixed, one entertains an ontological confusion of core knowledge (e.g., Lindeman, et al., 2015). For example, believing that a mind (mental phenomenon) can live without a biological body, or that thoughts can move physical objects (psychokinesis) are core ontological confusions, i.e., core knowledge confusions.

While core ontological confusions are common in children's thinking, they are also evident in the reasoning of some adults. Core ontological confusions are intuitive biases originating from Type 1 thinking (Svedholm & Lindeman, 2013; Lindeman, Svedholm-häkkinen, & Rieki, 2016). As such, they are closely related to thinking styles: intuitive thinkers are more likely and analytic thinkers less likely to endorse them (e.g., Lindeman et al., 2016; Lindeman & Svedholm-Häkkinen, 2016; Pennycook et al., 2015). Relatedly, core ontological confusions have been found to positively correlate with religious beliefs (Lindeman & Svedholm-Häkkinen, 2016; Pennycook et al., 2015; Lindeman et al., 2015). Positive associations have also been reported with other epistemically unwarranted beliefs, such as believing in paranormal phenomena (e.g., Lobato, Mendoza, Sims, & Chin, 2014). Moreover, core ontological confusions have been proposed to underlie an inadequate understanding of the nature of science (Lindeman, Svedholm, Takada, Lönnqvist, & Verkasalo, 2011), and to positively correlate with impaired physical cognition (Lindeman & Svedholm-Häkkinen, 2016). Thus, endorsement of core ontological confusions could make it easier to accept unscientific reasoning alongside modern scientific theories, leading to a lower agreement with the conflict view. The way core ontological confusions relate to the dialogue, integration and independence views is also studied.

Even though ontological confusions of any kind have not been mentioned in the science-religion literature, broadly considered ontological confusions can be found in the reasons some people give for their science-religion perspectives. For example, physicist Francis Collins explained his integration view with "If you're willing to answer yes to God outside of nature, then there's nothing inconsistent with God -- choosing to invade the natural world in a way that appears

miraculous" (Van Biema, 2006). Ontological confusions also seem to be present in other situations where scientific and religious knowledge are integrated, for example when supernatural is used as the distal reason for a phenomenon such as the creation of evolutionary principles (e.g., Legare et al., 2012). On the contrary, at least some people appear to hold the conflict perspective due to a refusal to accept ontological confusions into their strictly natural view of the world (e.g., Van Biema, 2006; Ecklund et al., 2011). These descriptions of general ontological confusions appear to be in line with the earlier stated hypothesis that core ontological confusions lower the likelihood to hold the conflict view.

1.5 Perceived importance of science and religion

Lastly, attitudes towards science and religion will be considered in relation to the science-religion perspectives. Attitudes are abstract evaluative judgments towards something or someone, and they vary in strength (reviews: Ajzen, 2001; Crano & Prislin, 2006). Strong attitudes have the most influence on cognition and action, and attitude importance is a central aspect of attitude strength (Howe & Krosnick, 2017). However, barely anything is known about how the perceived importance of science and religion relate to the science-religion perspectives. This is mainly due to the scarcity of studies but also due to the use of heterogeneous attitude measures; Studies have used general "attitudes towards science" and "attitudes towards religion" scales that consist of questions asking about distinct attitude dimensions, and even about specific topics, such as evolution (e.g., Bensted 2018; O'Brien & Noy, 2015). To more clearly know what is being examined, a specific aspect of attitude importance is studied here: the perceived importance of science and religion for society. These general and normative importance judgments of science and religion are distinct from how important they are in one's own life (Pew Research Center, 2018; Campbell, 2005).

Of the four science-religion perspectives, attitudes have mainly been examined in relation to the conflict view. Bensted (2018) reported that among students in an Australian Christian secondary school agreement with the conflict view appeared to be associated with less favorable views of Christianity and more favorable views of science. Further, compared to the independence and complementary views, the conflict view appeared to be associated with the most negative attitudes towards Christianity (Bensted, 2018). In the study, the complementary view was composed of questions relating to both the dialogue and integration views. The finding that a positive view of religion makes one less likely to hold the conflict view also gets some support from Ecklund & Park's (2009) study: among American scientists, perceiving peers to have a

positive view of religion decreased the likelihood to agree with the conflict view. In addition, Campbell (2005) found that agreeing that "a person could be both religious and scientific" was positively associated with viewing religion to be important in world affairs among Canadian university students. However, no significant correlations were found between a similar question about the importance of science in world affairs and the complementarity statement (Campbell, 2005). Similarly, Stolberg (2007) did not find significant relations between attitudes towards the importance of science in the world and the conflict perspective in a sample of English primary school teachers.

Based on the positive associations reported between favorable attitudes towards religion and disagreement with the conflict view, perceiving religion to be socially important is expected to lower the likelihood to hold the conflict view. While the correlations between the conflict view and the importance of science have not been significant, based on Bensted's (2018) observation social importance of science is expected to be positively associated with the conflict view. Of note, studies among different populations have similarly reported the conflict view to be related to attitudes towards science and religion. Yet, the hypotheses here are also formed in light of the mainly non-religious sample collected in this research project where the conflict view likely reflects a pro-science stance. This specification is important because it follows already from Barbour's (1990) categorization of pro-science and pro-religion conflict views that the bigger the difference in importance of science versus religion, to either direction, the more likely one should be to hold a conflict perspective. Moreover, studies often portray the conflict view to be due to people contrasting trust in scientific knowledge and scientific community with religions' authority and trust in religious views (e.g., Chan, 2018; O'Brien & Noy, 2018), likely leading those who hold the conflict view to only perceive science or religion to be important. Consistently, O'Brien & Noy (2015) used latent class analysis and found three science-religion perspectives based partially on attitudes towards science and religion: those favoring science over religion (pro-science view), those favoring religion over science (pro-religion view), and those viewing both favorably (non-conflict view). While Stolberg (2007) found a negative correlation between statements of inevitable conflict and "both science and religion are important for human well-being", the relation was not significant. In sum, the pro-science and pro-religion conflict views are likely oppositely related to attitudes towards science and religion, and here the focus is largely on agreement with the pro-science conflict.

Regarding the non-conflict views, Stolberg (2007) found that the integration and dialogue perspectives correlated moderately and positively with "both science and religion are important for human well-being". Similarly, Bensted (2018) noted that agreement with the complementary view, which combined the dialogue and integration views, appeared to be positively associated with positive attitudes towards both, science and Christianity. Moreover, compared to the conflict and independence views, the complementary view appeared to be most strongly associated with positive attitudes towards Christianity (Bensted, 2018). Of note, the complementary (Bensted, 2018), and dialogue views (Stolberg, 2007) were asked with questions concerning the usefulness or benefits of science and religion, and thus overlapped with attitudes. The independence view has been reported to be positively associated with positive attitudes towards science and Christianity (Bensted, 2018), but to also negatively correlate with the statement "both science and religion are important for human well-being" (Stolberg, 2007). Bensted (2018) further noted that of the studied three views, the independence view seemed to be most strongly related to positive attitudes towards science. Lastly, one's attitude towards the role of science in the world was not significantly related to agreement with any of the three non-conflict views (Stolberg, 2007).

1.6 Aims of the study

The purpose of this study is to explain whether or not people adopt a conflict view between science and religion, and to predict agreement with the three non-conflict views of independence, dialogue, and integration. The following hypotheses and questions were set:

Hypotheses:

The conflict view is

1. negatively related to core ontological confusions and intuitive thinking style
2. positively related to analytic thinking style and simple view of knowledge
3. negatively related to personal justification in science and religion
4. positively related to importance of science and negatively to importance of religion

Research questions:

How the three non-conflict views are related to

1. core ontological confusions?
2. intuitive and analytic thinking style?
3. simple view of knowledge?
4. personal justification in science and religion?
5. importance of science and religion?

2. Method

2.1 Participants

The participants (N = 2256) were male (44.9 %), female (52.6 %), and other (1.8 %), and their ages varied between 18 and 84 (M= 40.9, SD= 13.2). Full-time occupations were 19.6 % studying, 56.6 % working, and 22.2 % other. The level of education was distributed as follows: some (3.2 %) or completed (5.6 %) postgraduate work, some (18.7 %) or completed (47.2 %) studies in university or college, some (4.2 %) or completed (18.8 %) high school, and highest studies in compulsory school (1.6 %). Due to missing values the percentages do not add up to exactly 100 %. Most of the participants (67.2 %) did not belong to any religious denomination, and the rest belonged mainly to Evangelical Lutheran Church (26.8 %) or chose the option "other" (3.6 %). Other religious denominations were chosen by less than one percent.

Originally, 2268 individuals submitted the survey in Finland, but only those who answered the question about conflict between science and religion were included in this study.

2.2 Procedure

Since the research project aimed to better understand unbelief, we focused on getting mainly nonreligious participants. The study was conducted as an online survey in Finland (and Denmark and the Netherlands) during the spring of 2018, and the respondents were given ca. 3 weeks to participate. The participants were told that the study investigates how people think about religious beliefs, unbelief, science and knowledge. In Finland, the participants were recruited to the online study via several Facebook group pages (e.g., the Finnish association of skeptics), two twitter accounts, several university and open university student mailing lists, and a pool of participants who had expressed interest in taking part in our studies related to everyday thinking. As compensation, Finnish participants were promised feedback about their worldview profile. This feedback was based on their responses on some of the scales included in the survey (e.g., thinking styles, views of knowledge, and importance of science and religion).

2.3 Materials

The relationships between science and religion

Participants' *views on the conflict between science and religion* were assessed by presenting the statement "Religion and science are not in conflict with each other" with three answer options (1 = *agree*, 2 = *moderately agree*, 3 = *disagree*). Disagreement with the statement was labeled as

holding the conflict view. If a participant agreed or moderately agreed with the item, an introduction text and three follow-up statements were shown regarding the perceived lack of conflict: "Religion and science are not in conflict with each other because: 1. They focus on different topics, 2. One can have many perspectives on the same issue, and 3. They give similar answers to questions." The first follow-up item was termed the independence view, the second the dialogue view, and the third the integration view. The three statements were answered on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*), and agreement was equated with holding the corresponding non-conflict view of independence, dialogue, or integration.

The sum variables described below were created by averaging the scale items and calculated only for participants with less than 25 % of missing items on each scale. Scale reliabilities are shown for the whole sample since the values were similar for the subsample (those answering the three non-conflict questions).

Epistemic cognition

Participants' *views of knowledge structure*, i.e., complexity vs. simplicity of knowledge, were assessed with seven items ($\alpha = .72$), such as "Things are simpler than most experts would have you believe". The scale was named Simple View of Knowledge, and its items were modified after the Epistemic Beliefs Inventory (Schraw, Bendixen, & Dunkle, 2002), and the Epistemological Questionnaire (Schommer, 1990). The participants were asked to rate their level of agreement with the statements on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*).

Analytic and intuitive thinking styles were assessed with a 6-item Need for Cognition Scale ($\alpha = .73$), and a 5-item Faith in Intuition Scale ($\alpha = .76$). The items were derived from the 10-item Faith in Intuition Scale (FI), and the 12-item Need for Cognition Scale in the Rational/Experiential Multimodal Inventory (Norris & Epstein, 2011). Example items are "I enjoy problems that require hard thinking", and "I like to rely on my intuitive impressions" (1 = *strongly disagree*, 4 = *strongly agree*). For details about selecting the items, see Lindeman, van Elk, Lipsanen, Marin & Schjødt (2019).

Participants' *views of knowing in the fields of science and religion* were both assessed with three items, derived from Hofer (2000). Participants were first asked to think about science and to rate their agreement (1 = *strongly disagree*, 5 = *strongly agree*) with the following statements: "First-hand experience, rather than scientific knowledge, is the best way of knowing something", "Correct answers to scientific questions are more a matter of opinion than fact", and "There is

really no way to determine whether scientific experts have the right answer to the questions in their field". These items formed the sum variable Personal Justification in Science ($\alpha = .67$). Next, the participants were asked to think about religion, and to rate their agreement with three similar statements: "First-hand experience, rather than religious knowledge, is the best way of getting answers to religious questions", "Correct answers to religious questions are more a matter of opinion than fact", "There is really no way to determine whether someone has the right answer to a specific religious question". The first item lowered the reliability of the scale by .08, and thus only the last two items were used to form the sum variable Personal Justification in Religion ($\alpha = .65$).

Core ontological confusions

Two scales were used to examine *core ontological confusions*.

A scale created by Lindeman & Svedholm-Häkkinen (2016) that asked participants to evaluate 24 words as mental or non-mental (1 = *not at all mental*, 4 = *mental*) was used to assess over-mentalizing ($\alpha = .92$). The instruction also specified that "By mental we mean anything that has some kind of psyche or spirit, or something which has mental properties. For example, thoughts are mental and human beings are mental beings. Many people also consider God to be a mental being. A pen or a car, by contrast, is generally considered non-mental". The Over-mentalizing 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 that were abstractions, animates or mental phenomena (e.g., justice, fish, goal). The fillers were included to obscure the meaning of the scale.

Core ontological confusions were measured more broadly with 14 statements ($\alpha = .81$) from the Core Knowledge Confusions scale (Lindeman et al., 2015). The participants were presented with statements, such as "Force lives in the universe" and "House knows its history", and they were asked to rate on a 5-point scale whether the statements were *fully metaphorical* (1) or *fully literal* (5). Before rating the statements, the participants were given an example of a literally true statement ("Mozart was a composer"), and of an only metaphorically true statement ("Friends are the salt of life"). The full scale included 20 statements of which six were fillers (three metaphorical and three literal filler items, e.g., "Howling wind is a flute", "Flowing water is liquid").

Importance of religion and science

The perceived importance of religion and science for society were assessed with a modified version

of the Importance of Science subscale which is originally developed to measure attitudes towards the importance of science and technology (Kind, Jones, & Barmby, 2007). The five statements were modified so that both importance of science ($\alpha = .75$), and importance of religion ($\alpha = .88$) could be assessed with similar statements, i.e., "Science is important for society", "Science makes our lives easier and more comfortable", "The benefits of science are greater than its harmful effects", "Science helps poor people", and "There are many exciting things happening in science". For the questions concerning religion, the word 'science' was replaced with 'religion'. Participants indicated their level of agreement with the items on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*).

3. Results

The different views were affirmed as follows: 37 % agreed or moderately agreed that science and religion are not in conflict, and of these 72 % agreed with the independence view, 65 % with the dialogue view, and 17 % with the integration view. The answer distributions remained similar after deleting cases with missing values on the independent variables. Due to this, and the small percentage of missing values, participants with missing values were excluded from the subsequent analyses. Answer distributions in a data without missing values on the independent or dependent variables are shown in Table 1.

Table 1.
Response distributions (%) of the dependent variables after deleting cases with missing values.

	Answer option					valid N
	1	2	3	4	5	
Conflict	8.4	28.8	62.8	–	–	2172
Independence	4.3	8.6	14.0	46.5	26.6	799
Dialogue	6.8	10.3	16.5	38.1	28.3	795
Integration	31.8	31.8	18.8	14.7	2.9	789

To examine potential outliers two relative scales were formed, potentially ranging from -4 to 4 (Appendix). First, the importance of religion was subtracted from the importance of science for each participant. This relative importance scale had a mean of 2.06 and a standard deviation of 1.22 in the whole sample. Three individuals who rated religion to be more than 1.60 points (more than 3 standard deviations from the mean) more important than science were excluded from the analyzed data. Second, another relative scale was formed by subtracting the value of personal justification in science from personal justification in religion. This scale had a mean of 2.43 and a

standard deviation of 1.25. Five individuals who viewed science to be more than 1.60 points higher in personal justification compared to religion were excluded from the analyses.

Correlations between the independent variables (including the control variables) are shown in Table 2. Spearman correlations were used due to the skewness of some of the scales. The largest correlations were moderate in the whole analyzed sample with the largest correlation being between importance of science and personal justification in science ($r_s = -.40$). Among those answering the three non-conflict questions, the strongest correlation was between importance of religion and personal justification in religion ($r_s = -.44$, $p < .001$). No multicollinearity between the independent variables was detected in either the whole sample or subsample ($VIF < 1.75$ and tolerance > 0.55 for variables in Tables 3–6).

Table 2
Spearman correlations between independent variables in the whole analyzed sample; the means and (standard deviations) are shown on the diagonal

	1	2	3	4	5	6	7	8	9	10	11
1. Need for cognition	3.02 (0.46)										
2. Simple knowledge	-.26***	2.35 (0.67)									
3. Faith in intuition	-.37***	.14***	2.45 (0.52)								
4. Core confusions	-.22***	.23***	.30***	1.96 (0.50)							
5. Over-mentalizing	-.20***	.03	.31***	.37***	1.54 (0.54)						
6. Personal science	-.27***	.20***	.30***	.32***	.31***	1.73 (0.71)					
7. Personal religion	.08***	.02	-.05*	-.11***	-.09***	-.11***	4.16 (0.98)				
8. Importance of religion	-.12***	-.13***	.20***	.19***	.27***	.29***	-.31***	2.59 (1.03)			
9. Importance of science	.23***	-.09***	-.20***	-.19***	-.28***	-.40***	.15***	-.25***	4.65 (0.45)		
10. Age	-.01	.05*	.01	.07***	-.05*	-.02	.09***	-.20***	.08***	–	
11. Education	.17***	-.28***	-.09***	-.14***	-.11***	-.18***	.03	.03	.11***	.19***	–
12. Gender	-.19***	-.05*	.21***	.13***	.22***	.18***	-.04	.15***	-.18***	-.09***	.06**

*** $p \leq .001$. ** $p < .01$. * $p < .05$.

N=2164 for correlations between variables 1–11. For correlations with gender N=2123.

Gender coded dichotomously: men=0 and women=1.

Four analyses were performed to independently investigate how epistemic cognition, core ontological confusions, and importance of science and religion are related to the different science-religion perspectives. Stepwise models were used to better understand both the independent effects of and relations between the variables. Due to high theoretical overlap, and thus potentially high shared variance, the scales of Core Knowledge Confusions and Over-mentalizing were first added to the models independently. The effects of gender, age, and education are controlled in all analyses. Because of the explorative nature of the analyses, p-values were not Bonferroni corrected, and thus the original significance levels are shown.

3.1 Predicting the perceived conflict

A binary logistic regression model was used to study how the independent variables, mentioned in the four hypotheses, explain whether people adopt a conflict or non-conflict view. The binary model with two dependent variable categories was chosen instead of a multinomial one due to the small percentage of participants strongly agreeing with the conflict view and for clearer interpretation of the results. Visual examination of the means and medians of the independent variables between those agreeing, moderately agreeing and disagreeing to the conflict question further provided some support for the combination of the agree and moderately agree answer-categories: the values changed in order, and the moderately agree category appeared to mainly be closer to the agree than to the disagree group. Results of the logistic regression are shown in Table 3.

H1 and H2 are answered in the first two columns: higher levels of core ontological confusions (measured with both scales), and faith in intuition decreased the likelihood to hold the conflict view, whereas increases in viewing knowledge to be simple raised the likelihood to perceive conflict between science and religion. Need for cognition was not significantly associated with the conflict view in Step 1. Results for H3 and H4 are shown in steps 2 and 3. Perceiving knowledge to be more personally justifiable in religion, and viewing science to be more socially important increased the likelihood to hold the conflict view. The more personally justifiable knowledge was viewed to be in science, and the more socially important religion was perceived to be, the less likely one was to hold the conflict view. In addition, the item asking about *preferring first-hand experience in religion* (excluded from the Personal Justification in Religion sum variable) was separately added to the model in step 2; The item weakly decreased the likelihood to view conflict (OR= 0.77, 95% CI= 0.71–0.84, $p < .001$). The effects of Personal Justification in Religion,

and Personal Justification in Science remained largely similar to those shown in step 2 of Table 3 (OR= 1.68, 95% CI= 1.52–1.85, $p < .001$; and OR= 0.54, 95% CI= 0.47–0.62, $p < .001$, respectively).

The results regarding the effects of importance of science and religion, and personal justification in science and religion were further studied through the two relative scales originally formed to examine potential outliers (Appendix). For both scales, only participants with values above zero were chosen to maximize the linearity of the associations (i.e., only those who viewed science to be more important than religion, and those who viewed religious knowledge to be more personally justifiable than scientific knowledge, were included). The two redefined relative scales were then separately added to the logistic regression model with only the control variables. First, when the relative importance scale was added to the model with the controls it increased the likelihood to hold the conflict view (OR= 3.59, 95% CI= 3.15–4.09, $p < .001$, N= 1984). Meaning that the more important one viewed science to be vs. religion, the more conflict one saw. Second, when the relative personal justification scale was added to the model with the controls it also increased the likelihood to hold the conflict view (OR= 1.75, 95% CI= 1.59–1.92, $p < .001$, N= 2041). Indicating that the more personally justifiable one viewed knowledge to be in religion vs. in science, the more conflict one saw. Among the whole analyzed sample, less than 2 % of those that saw conflict (N=1356) viewed knowledge in science to be more personally justifiable than in religion, or perceived religion to be more important for society than science.

Looking at the first three columns in Table 3, core ontological confusions and epistemic cognition, except for analytic thinking, had quite equally strong effects on the probability to view conflict. Of all the variables, a change in the perceived importance of science and religion had the largest effects on the probability to view conflict. Further, when all the variables were included in the same model, analytic thinking became a significant predictor with higher analytic thinking decreasing the likelihood to view conflict. When an extra step was done where all other variables but importance of science and religion were added to the model, analytic thinking style was not a significant predictor of agreement (OR= 0.86, $p = .19$)

Table 3. *Logistic regression: predicting agreement that conflict exists between science and religion*

Variable	Entered Independently		Step 1		Step 2		Step 3		Step 4	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Need for cognition			1.01						0.68**	0.52–0.89
Simple knowledge			1.60	1.37–1.86					1.42	1.18–1.71
Faith in intuition			0.46	0.38–0.56					0.71**	0.55–0.90
Core confusions	0.54	0.44–0.65							0.99	
Over-mentalizing	0.45	0.38–0.54							0.75*	0.59–0.94
Personal science					0.52	0.45–0.59			0.86	
Personal religion					1.53	1.39–1.68			1.18**	1.05–1.33
Importance of religion							0.26	0.23–0.30	0.29	0.25–0.33
Importance of science							1.82	1.43–2.32	1.58	1.20–2.08

Note. Dependent variable coded dichotomously (0= answer options 1 and 2, and 1= answer option 3). Confidence intervals shown only for significant ($p < .05$) variables. $p \leq .001$. ** $p \leq .01$. * $p < .05$. N = 2164.

3.2 Predicting agreement with the non-conflict views

Research questions 1–5 were examined with three separate analyses. First, an ordinal logistic regression model was run to investigate the independence view. The first two response categories were combined into one disagreement category due to the small number of people strongly disagreeing with the view (N=33), and a significant test of parallel lines indicating that some independent variable values did not change equally between all five adjacent response categories. Next, two binary logistic regression models were used to predict agreement with the dialogue and integration views since the assumption of proportional odds was not upheld for certain variables, even after combining the response category with the fewest answers into the adjacent one. The following scales would have broken the test of parallel lines in ordinal analyses with five response categories: need for cognition (in the independence view), importance of science and religion (in the dialogue view), and personal justification in science and in religion (in all three views). A look at the means and medians of these variables in the different response categories showed that the independent variable values overall changed in one direction, providing support for the broader categorizations of dependent variable values used in the analyses.

Results for the independence view are shown in Table 4, the dialogue view in Table 5, and the integration view in Table 6. The first columns of the tables provide the answer to Q1: core ontological confusions (measured with both scales) were negatively related to the independence view, and positively related to the dialogue and integration views. Comparing the effect sizes of the variables between the perspectives, especially over-mentalizing appeared to be more strongly related to agreement with the dialogue than the integration view. Regarding Q2, need for cognition was not significantly related to any of the non-conflict perspectives, whereas an increase in intuitive thinking style raised the probability to hold the dialogue and integration views. Simple view of knowledge was positively related to the likelihood to agree with the integration view but was unrelated to the independence and dialogue views (Q3).

Next, Q4 was examined. Personal justification in science was negatively related to agreement with the independence view, and positively related to agreement with the dialogue and integration views. Personal justification in religion had the opposite effect on the likelihood to agree with the three views: Viewing religious knowledge to be more personally justifiable decreased the likelihood to agree with the dialogue and integration views, and very slightly increased the level of agreement with the independence view. Regarding Q5, viewing religion to

be socially important was positively related to the dialogue and integration views. Viewing science to be socially important was positively related to the independence view, and negatively related to the dialogue view.

When all independent variables were included in the models at the same time, the models differed in the variable(s) that remained significant predictors of agreement. Importance of science increased, and personal justification in science very slightly decreased the level of agreement with the independence view, when all predictors were in the model. Over-mentalizing, personal justification in science, and importance of religion increased the likelihood to agree with the dialogue view, above the effects of the other variables. The integration view had the highest amount of predictor variables in the last step: importance of religion, faith in intuition, and simple view of knowledge increased, and personal justification in religion decreased the likelihood to agree with the view.

Table 4. Ordinal regression: predicting agreement with the independence view

Variable	Entered Independently		Step 1		Step 2		Step 3		Step 4	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Need for cognition			1.26						1.11	
Simple knowledge			0.82						0.92	
Faith in intuition			0.97						1.25	
Core confusions	0.64	0.49–0.84							0.85	
Over-mentalizing	0.67	0.53–0.83							0.82	
Personal science					0.64	0.54–0.77			0.78*	0.63–0.97
Personal religion					1.16*	1.02–1.32			1.09	
Importance of religion							0.88		0.94	
Importance of science							1.95	1.47–2.57	1.47*	1.07–2.02

Note. Dependent variable coded into four categories (0= strongly or moderately disagree, 1 = in between, 2 = moderately agree, 3 = strongly agree). Confidence intervals shown only for significant ($p < .05$) variables. $p \leq .001$. * $p < .05$. N = 798.

Table 5. *Logistic regression: predicting agreement with the dialogue view*

Variable	Entered Independently		Step 1		Step 2		Step 3		Step 4	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Need for cognition			0.79						0.89	
Simple knowledge			1.23						1.23	
Faith in intuition			2.27	1.45 – 3.56					1.17	
Core confusions	2.72	1.71 – 4.34							1.34	
Over-mentalizing	3.32	2.06 – 5.35							1.86*	1.06 – 3.24
Personal science					2.83	1.94–4.12			1.67*	1.08–2.59
Personal religion					0.63	0.50–0.80			0.91	
Importance of religion							2.83	2.19–3.65	2.52	1.89 – 3.37
Importance of science							0.35	0.20–0.62	0.66	

Note. Dependent variable coded dichotomously (0= strongly or moderately disagree, and 1= strongly or moderately agree). Confidence intervals shown only for significant ($p < .05$) variables. **p < .001.** * $p < .05$. N = 663.

Table 6. *Logistic regression: predicting agreement with the integration view*

Variable	Entered Independently		Step 1		Step 2		Step 3		Step 4	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Need for cognition			1.07						1.17	
Simple knowledge			1.51**	1.10 – 2.07					1.52*	1.06 – 2.18
Faith in intuition			2.16	1.45 – 3.22					1.84**	1.17 – 2.91
Core confusions	2.09	1.43 – 3.06							0.99	
Over-mentalizing	1.64	1.21 – 2.22							1.24	
Personal science					1.75	1.34–2.29			1.32	
Personal religion					0.57	0.47–0.70			0.67	0.53 – 0.84
Importance of religion							2.23	1.76–2.83	1.78	1.36 – 2.33
Importance of science							0.70		1.18	

Note. Dependent variable coded dichotomously (0= strongly or moderately disagree, and 1= strongly or moderately agree). Confidence intervals shown only for significant ($p < .05$) variables. $p \leq .001$. ** $p \leq .01$. * $p < .05$. N = 640.

Lastly, the results regarding Q4 and Q5 were examined more closely. The relative importance and relative personal justification scales were added to the three models individually, with only the control variables (Appendix). For a clearer interpretation of the results, only those having positive values on the two relative scales were analyzed (i.e., individuals rating knowledge in religion to be more personally justifiable than in science, and viewing science to be socially more important than religion). The odds ratios of these redefined relative scales in predicting agreement with the independence, dialogue and integration views are set out in Table 7. Overall, the results are in line with the independent effects of the variables described previously. A raise in viewing science to be more important than religion led to a somewhat higher likelihood to agree with the independence view, and to a lower probability to hold the dialogue and integration views. In other words, in a sample where science was viewed to be more important than religion, the smaller the difference between the importance of science versus religion was, the more likely one was to hold the dialogue and integration views. Turning to the difference in personal justification, the more personally justifiable religious knowledge was viewed compared to scientific knowledge, the more likely one was to more strongly agree with the independence view, and to disagree with the dialogue and integration views.

Table 7. *The redefined relative scales' effects on the probability to agree with the non-conflict views*

Variable	Independence			Dialogue			Integration		
	OR	95% CI	N	OR	95% CI	N	OR	95% CI	N
Science more important	1.21*	1.03–1.43	652	0.38	0.29–0.49	536	0.51	0.38–0.70	536
Religion more personal	1.31	1.14–1.49	726	0.50	0.40–0.62	605	0.53	0.43–0.66	595

Note. Dependent variables coded similarly to Tables 4–6: the independence view is analyzed using ordinal regression (categorized into four response categories), and the dialogue and integration views using logistic regression (two response categories). The used relative importance and relative personal justification scales ranged between 0.2–4. **p < .001.** *p < .05.

3.3 Closer look at responses to the non-conflict views

Looking at the relations between the non-conflict views, the dialogue and integration views correlated positively with each other, and negatively with the independence view (Table 8). More precisely, 37.0 % of those not viewing conflict agreed with both the independence and dialogue views but not with integration, 6.1 % agreed with the dialogue and integration views but not with

independence, and 1.2 % agreed with independence and integration but not with dialogue. In addition, 5.7 % of the participants did not agree with any of the non-conflict reasons, whereas 7.6 % agreed with all of them. When participants only agreed with one of the non-conflict statements, the independence view was the most popular explanation (chosen by 34 % of those agreeing with the view), followed by the dialogue perspective (chosen by 20 % of those agreeing with the view), and lastly by the integration view (chosen by 10% of those agreeing with the view).

Table 8
Correlations (r_s) between the non-conflict questions

	Independence	Dialogue	Integration
Independence	1		
Dialogue	-.12	1	
Integration	-.29	.32	1

N= 810. $p \leq .001$.

4. Discussion

The purpose of this study was to examine and predict how people view the relationship between science and religion. This was done through exploring agreement with four science-religion perspectives, i.e., four ways to relate science and religion. Specifically, that science and religion are in conflict (the conflict view), or that they are not in conflict because science and religion focus on different topics (independence), because one can have many perspectives on the same issue (dialogue), and/or because religion and science give similar answers to questions (integration). Core ontological confusions, epistemic cognition, and the perceived importance of science and religion for society predicted agreement with the four views. The results provide new insights into a topic that has been widely debated for decades but has received only little research attention so far.

4.1 Core ontological confusions and the science-religion perspectives

The conflict view was less likely among those endorsing core ontological confusions, thus supporting Hypothesis 1. Regarding the non-conflict views, core ontological confusions made one less likely to agree with the independence view, and more likely to agree with the dialogue and integration views (Q1). When the dialogue and integration views are seen to contain a level of incoherency, the results fit Pennycook et al.'s (2015) proposal that core ontological confusions are negatively associated with conflict detection. The findings are also consistent with core ontological confusions' positive relations to religious beliefs (e.g., Lindeman et al., 2015) and to an insufficient

understanding of the nature of science (e.g., Lindeman et al., 2011; Lindeman & Svedholm-Häkkinen, 2016). Moreover, the findings appear to be in line with the arguments people use to describe and explain their science-religion perspectives. While some note that the concept of supernatural conflicts with their view of logic and science (e.g., Pew Research Center, 2018; Van Biema, 2006; Ecklund et al., 2011), others use the unknown and the unlimited possibilities of the supernatural to create various ways to combine the natural and supernatural (e.g., Legare et al., 2012; Van Biema, 2006).

Even though occasional mentions of ontology exist in the science-religion literature (e.g., Görman 1992, cited in Hansson & Redfors, 2007), the way ontological confusions relate to the science-religion perspectives has not been studied or even clearly suggested. The virtual absence of theoretical considerations that relate science-religion perspectives to ontological confusions could partly explain why discussions around science-religion perspectives and views on ontology often remain broad and ambiguous (e.g., Glennan, 2007). I propose that in the future it would be useful to study people's perceptions of ontology as described in philosophy (e.g., which categories could exist, such as material and immaterial entities), and to separately examine the psychological construct of core ontological confusions. After all, one can be open to non-discovered truths, even the possibility of non-material entities, without accepting the supernatural explanations and ideas proposed by people so far (see Van Biema, 2006). Future research could also benefit from studying how core ontological confusions, ontological views, and views of knowledge relate to each other and the science-religion perspectives.

To sum up, the relations found here between science-religion perspectives and core ontological confusions, together with the way people describe their views in the literature, give reason to study core ontological confusions more vigorously in the future. The results showed that core ontological confusions made one more likely to agree with the dialogue and integration views, and less likely to agree with the conflict and independence views. Thus, the findings point to a possibility that endorsing category errors of core knowledge could predispose people to hold views where divergent explanations are combined to varying degrees, and to make people less likely to hold views where science and religion (and their explanations) are kept distinct from each other. Due to the nature of the sample, the negative association found between core ontological confusions and the conflict view likely applies to a pro-science conflict view. After all, endorsing core ontological confusions could make some more open to both scientific and unscientific reasoning (leading people away from a pro-science conflict view), while increasing others'

preference for religious explanations over modern scientific theories (leading people towards a pro-religion conflict view). How core ontological confusions relate to viewing conflicts in reasoning overall or to being bothered by noticed inconsistencies in explanations remains to be explored.

4.2 Thinking styles and the science-religion perspectives

Intuitive thinking style decreased the likelihood to hold the conflict view, in line with the second prediction of Hypothesis 1. Among those disagreeing with the conflict view, intuitive thinking style increased the likelihood to hold the dialogue and integration views but was unrelated to agreement with the independence view (Q2). The found relations suggest that preferring a fast and associative way of processing information (e.g., Epstein, 2010) makes people less sensitive to notice conflicts, more tolerant of the existence of various, even contradicting, viewpoints, and more inclined to combine various explanations. Relatedly, the findings go together with the proposed negative association between intuitive thinking and conflict detection (e.g., Pennycook et al., 2014). The results are also consistent with earlier reported positive connections between intuitive thinking style and religious beliefs (e.g., Lindeman & Svedholm-Häkkinen, 2016), when being open to religious concepts is expected to increase the acceptance of co-existence of science and religion. Importantly, the conflict view should again be interpreted through the low religiosity of the sample and high regard for the importance of science. In fact, the level of intuitive thinking among those holding a pro-religion conflict view remains to be studied but is expectedly high. Similar to core ontological confusions, intuitive thinking style could predispose some people to prefer religion over science, and to thus view conflict.

Intuitive thinking style and core ontological confusions affected agreement with most of the science-religion perspectives similarly, which is to be expected from the nature of the variables: Core ontological confusions originate from Type 1 processing, and intuitive thinking style describes a general tendency and preference to rely on Type 1 processing. They differed, however, on the independence view which was not related to intuitive thinking style but was slightly negatively related to core ontological confusions. Thus, the view that science and religion focus on different topics appears to be equally endorsed among individuals with various levels of intuitive thinking, but core ontological confusions specifically make one less likely to hold the view. New studies are needed to better understand the relations between these variables in explaining the different perspectives.

Contrary to the largely anticipated effects of intuitive thinking style, the lack of effects analytic thinking style had on the science-religion perspectives was unexpected. Analytic thinking style did not affect the likelihood to hold the conflict view, failing to support Hypothesis 2. Moreover, analytic thinking style was not related to any of the non-conflict views (Q2). The findings appear to go against the positive associations found between analytic thinking and conflict sensitivity and the broader proposition that analytical people are more sensitive to perceive conflicts between scientific and religious explanations compared to more intuitive individuals (Pennycook et al., 2014). However, analytic thinking consists of various largely independent aspects, and can thus be measured with multiple scales (e.g., Evans & Stanovich, 2013; Pennycook et al. 2014). Of note, the Need for Cognition Scale, used here, is a measure of extensive thinking (see Svedholm & Lindeman, 2013). As such, it cannot differentiate between rational thinking that is reflective, objective, and evidence-based from more biased thinking that consists of extensive reasoning for one's intuitions or other prior views. The current results thus show that enjoying and habitually engaging in effortful thinking does not explain whether one agrees or disagrees with a particular science-religion perspective.

Yet, the Need for Cognition Scale had complex associations with some of the views: it was not linearly associated with the independence view, and actually weakly lowered the likelihood to agree with the conflict view when the importance of science and religion were added to the model. Due to the weak effect size and emergence of significance only after the addition of the importance of science and religion, no conclusions can yet be made about the potential effect of analytic thinking style on the conflict view. To better understand whether and how analytic thinking explains science-religion perspectives, more distinct aspects of it need to be studied, such as the tendency and ability to be rational. After all, uncritical reflections could make it easy to find evidence for any view one wants to hold as well as affect what this preferred view is, while rational thinking might operate oppositely in regards to how the relationship between science and religion is viewed. Exploring how analytic thinking interacts with other variables in explaining science-religion perspectives would also clarify its effects.

From a theoretical perspective, some researches have broadly mentioned the importance of thinking styles in understanding which science-religion perspectives one holds (e.g., McPhetres & Nguyen, 2017). However, clear hypotheses about how analytic and intuitive thinking style relate to the science-religion perspectives are practically nonexistent in the literature. In the future, more objective research into thinking styles and their relation to epistemic cognition is needed to

clarify the even contradictory descriptions of different science-religion perspectives. For instance, the integration view has been viewed to be based on both inconsistent reasoning (El-Hani & Sepulveda, 2010) and coherent reflective thinking (Legare et al., 2012). To study these descriptions, special care should be taken to clearly define how analytic thinking and terms related to it, such as "conceptual achievements" (Legare et al., 2012) and "epistemic insight" (e.g., Billingsley et al., 2013), are understood. Different aspects of analytic thinking should also be examined separately. After all, integrating scientific and religious explanations can be cognitively demanding and effortful while also being prone to incoherencies. In conclusion, the results of this study demonstrate a need to more closely examine how analytic thinking style relates to the science-religion perspectives. The results also show the usefulness of intuitive thinking style in understanding how people view science and religion to relate.

4.3 Simple view of knowledge and the science-religion perspectives

Having a simple view of knowledge increased the likelihood to hold the conflict view, as expected in Hypothesis 2. Since having a simple view of knowledge includes preferring unambiguous and exact facts (Schommer, 1990), the finding fits the dynamic and relativistic narratives people use to describe their non-conflicting science-religion perspectives (e.g., Roth, 1997; Ecklund et al., 2011). The result is also consistent with Barbour's (1990) proposal that the conflict view is held by those having an absolute view of knowledge. However, the result only tells us that those agreeing with the conflict view perceive knowledge to be simpler compared to those disagreeing with the conflict view. Thus, Barbour's (1990) proposal of the two types of people that view conflict, biblical literalists and scientific materialists, could be too restricting. It remains possible that some view conflict due to an overly naive understanding of knowledge as Barbour suggests, while others view conflict due to developed evaluative thinking. The latter notion is based on literature stating that a completely complex and relative view of knowledge reflects a lower level of epistemological understanding than evaluating judgments despite the uncertainty of knowledge (e.g., Kuhn et al., 2000). Therefore, some level of simplicity of knowledge might be necessary to view conflict without indicating an overly naive knowledge view.

To better understand how views of knowledge relate to the conflict view, knowledge views should be measured more broadly in upcoming studies. For example, certainty of knowledge (e.g., Schommer, 1990), and levels of epistemological understanding (Kuhn et al., 2000) could be assessed. Comparison of the pro-science and pro-religion conflict views would also be useful. Both

conflict groups might have a simpler view of knowledge than those not seeing conflict, but one conflict group might have a simpler view of knowledge than the other. As mentioned previously, the conflict view studied here mainly reflects a pro-science view.

Of the non-conflict views, a simple view of knowledge increased the likelihood to agree with the integration view but was unrelated to the independence and dialogue perspectives (Q3). At first glance, the results do not fit the nature of simplistic view of knowledge as avoidance of ambiguity and integration, and a preference for single answer and compartmentalizing information (Schommer, 1990). However, perhaps viewing science and religion to provide similar knowledge is a way of avoiding ambiguity and having single answers to questions among those disagreeing with the conflict view. The results call for more thorough exploration of how a simple view of knowledge, as well as other knowledge views, are related to the non-conflict perspectives. It is possible that with additional measures, or in other samples, a simple view of knowledge would have more clearly differentiated between different non-conflict views.

In addition to the preliminary nature of this study's results, the literature on science-religion perspectives makes the need for more vigorous studies evident. First, general knowledge views, including the simplicity of knowledge, have essentially gone unexamined. Consequently, the relations between one's view of knowledge structure in general and one's understanding of religious and scientific knowledge in particular remain to be studied, and are likely complex. The bottom line is that the way one understands scientific and religious knowledge could or could not be related to one's general view of knowledge structure. Namely, a relativistic and changing view of knowledge in science and religion could be related to a more complex view of knowledge in general, and a literalistic and rigid interpretation of science and religion could be associated with a simpler view of knowledge. However, more research is needed. Second, different terms (e.g., simplicity, certainty, rigidity and narrowness) have been used nearly interchangeably to describe one's view of scientific and religious knowledge, and knowledge in general (e.g., Billingsley et al., 2013; Taber et al., 2011a). Third, the few constructs meant to measure knowledge views in the science-religion literature have been operationalized quite broadly. For example, scientism scales appear to combine a misconception of science as too simple, faith in science, and ontological questions (e.g., Bensted, 2018; Stolberg, 2007). Thus, upcoming studies need to look into more clearly defined aspects of knowledge views when explaining the science-religion perspectives. This applies to studying general knowledge views as well as views of scientific and religious knowledge.

4.4 Personal justification in science and religion

Hypothesis 3 was supported for science but not for religion: personal justification in science lowered the likelihood to hold the conflict view, whereas personal justification in religion increased the likelihood to hold the conflict view. Regarding science, the finding is in line with the positive relationship reported between the conflict view and trusting the scientific method over experiences (Ecklund et al., 2011). The finding is also consistent with the conflict view's positive association with a more positivistic view of science (e.g., Hansson & Redfors, 2007), and negative association with a more open and dynamic understanding of scientific knowledge (e.g., Roth, 1997; Ecklund et al., 2011). For science, the original personal justification factor from Hofer (2000) worked: the sum variable included preferring first-hand experience, viewing answers to be practically impossible to prove correct, and correctness to be more a matter of opinion than fact. Thus, the result showed that having an experiential view of knowing in science was negatively related to the conflict view. In other words, relying more on experiences in science and viewing scientific knowledge more openly decreased the odds to hold a (pro-science) conflict view in a sample where personal justification in science had mainly very low values.

The unexpected result regarding religion could be understood through both the nature of the sample and the used personal justification variable. Regarding the sum variable, viewing first-hand experience to be the best way to gain knowledge in religion could not be comfortably combined with viewing correct answers as opinions or as something that cannot be proven to be correct. Consequently, the personal justification sum variable was formed from the last two items. The result thus showed that viewing knowledge in religion to be opinions and correctness in the field to be impossible to prove increased the likelihood to view conflict between science and religion. This could imply that a lack of faith in the existence and attainment of religious truths increased the likelihood to view conflict, specifically pro-science conflict. The nature of the sample fits this suggestion: personal justification in religion had high values in the sample and it correlated negatively with the importance of religion. Thus, the scale could describe a lack of appreciation and belief in religion in this largely nonreligious sample. Of note, the item asking about preferring first-hand experience in religion (not included in the sum variable) slightly lowered the likelihood to hold the conflict view, in line with hypothesis 3.

Consequently, it might be that an experiential view of knowing in science and religion decreases the likelihood to view conflict as long as one values religious and scientific knowledge to

some extent. This somewhat fits Ecklund et al.'s (2011) notion that in order to not view conflict both science and religion need to be viewed as valid knowledge areas, and Ecklund & Park's (2009) proposal that scientists need to be able to view the norms and doctrines of religion as plausible to not view conflict. Namely, in this sample, an increase in preferring personal justification in science likely did not threaten the perceived validity of science whereas an increase in preferring personal justification in religion perhaps indicated a lack of plausibility regarding religion. In line with this, among those viewing religion to be more personally justifiable than science, the more personally justifiable religion was viewed compared to science, i.e. the bigger the difference, the more likely one was to agree with the conflict view. In the future, more religious and less scientific samples are needed to study how the level of difference in personal justification in science vs. religion –to either direction–relates to the conflict view. Also the separation of pro-science and pro-religion conflict views would be important. The current sample consisted mainly of people viewing knowing in religion to be more personally justifiable than in science, and five individuals rating knowing in science to be noticeably more personal than in religion were excluded from the analysis.

Regarding the non-conflict views, personal justification in science decreased the likelihood to hold the independence view and increased the likelihood to hold the dialogue and integration views. Bensted (2018) and Stolberg (2007) similarly reported that a more materialistic view of science increased the likelihood to agree with the independence view. The findings also fit the vague and open reasoning people use to describe their dialogue and integration views (e.g., Van Biema, 2006; see also Legare et al., 2012). Compared to personal justification in science, personal justification in religion affected agreement with each of the views oppositely: it decreased the likelihood to hold the dialogue and integration views, and very slightly increased the likelihood to agree with the independence view. Thus, the more one viewed religious knowledge as facts and viewed it possible to prove answers correct, the more likely one was to consider science and religion to go together. This fits research showing that religiosity increases the likelihood to integrate science and religion (e.g., Uecker & Longest, 2017). Overall, the independence view was oppositely related to personal justification in science and in religion compared to the dialogue and integration views. This was also evident among those viewing religion to be more personally justifiable than science: the more personally justifiable religion was viewed compared to science, i.e. the bigger the difference, the more likely one agreed with the independence view and the less

likely with the dialogue and integration views. This could be expected as the independence view states that science and religion can be separated.

Overall, the results highlight the need for further studies. Here personal justification was assessed with only a few items, reliabilities of the personal justification variables were quite low ($\alpha < .70$), and trusting experiences to provide knowledge in the field of religion did not work as expected with the other factor items from Hofer's (2000) study. The results thus imply that the factor structures of epistemic beliefs differ in the fields of science and religion. In the future, views of knowing in science and in religion should be studied more broadly and precisely, using better assessment methods and exploring the factor structures. This could clarify how, in the field of religion, relying on experiences to provide knowledge relates to viewing knowledge as difficult or unnecessary to prove correct, and to trusting authority as a knowledge source. Clustering individuals could be useful to enlighten whether the relations between knowledge views in science and in religion is what matters for people's science-religion perspectives. Additional analysis methods are also needed to closer study the quite rough odds ratio estimates provided here. After all, there was some evidence that the personal justification variables were not linearly associated with the science-religion perspectives. In sum, the results showed that personal justification in religion and in science explained agreement with the science-religion perspectives but more research is needed to better interpret the results. Additional studies are also necessary to advance the literature. For instance, the broad discussions around plausibility views of science and religion (e.g., Ecklund & Park, 2009) remain to be specified and examined.

4.5 Importance of science and religion

Perceiving science to be socially important increased and perceiving religion to be socially important decreased the likelihood to hold the conflict view, as proposed in Hypothesis 4. The negative effect importance of religion had on the conflict view is similar to the negative associations reported between positive views of religiosity and the conflict view (e.g., Bensted, 2018; Ecklund & Park, 2009; Campbell, 2005). The positive effect importance of science had on the likelihood to hold the conflict view fits Bensted's (2018) finding that the conflict view is associated with favorable views of science. However, the finding differs from Campbell's (2005) and Stolberg's (2007) studies which did not find relations between the conflict view and the perceived importance of science in the world. The difference could be due to this study controlling importance of religion when examining importance of science, its larger sample, and the

noticeably high view of importance of science; Science was valued to be maximally important for society by nearly half of the participants while religion was viewed as not at all important for society by nearly 15 % of the participants. Thus, the results are estimates for a largely non-religious and scientific sample. To sum up, when the importance of the other was controlled, valuing religion lead to seeing less conflict and valuing science lead to seeing more conflict between science and religion, as a whole.

Still, the possible relative nature of importance of science versus importance of religion cannot be ignored when considering the results. In this study, the conflict view can quite confidently be interpreted as favoring science over religion, i.e. as the pro-science conflict view; Only a minority saw religion to be more important than science to any extent, and the couple of individuals rating religion to be noticeably more important than science were excluded from the analyses. Further, among those viewing science to be more important than religion, an increase in the difference of importance judgments strongly raised the likelihood to hold the conflict view. Thus, the finding provides some evidence for the underlying assumption in much of the literature that people favor either science or religion when they agree with the conflict view (e.g., Barbour, 1990; O'brien & Noy, 2018). It also fits the few studies implying that the conflict view could be related to viewing the importance of science and religion oppositely (e.g., O'brien & Noy, 2015; Stolberg, 2007). Notably, the difference in valuing science vs. religion might not be linearly associated with the conflict view and should be further examined. Overall, samples viewing the importance of religion and the importance of science more variedly are needed. This would make it possible to study how the extent one favors science over religion and religion over science relates to agreement with the conflict view, and specifically the conflict views of pro-science and pro-religion. Lastly, there was only a weak negative correlation between importance of science and importance of religion in the whole data. Thus, clustering individuals based on their attitudes towards both science and religion could be useful to show whether its the relations between attitudes that matter for the conflict view.

Regarding the last research question, considering science to be important increased the likelihood to hold the independence view, decreased the likelihood to hold the dialogue view and was unrelated to agreement with the integration view. Considering religion to be important increased the likelihood to hold the dialogue and integration views, and was unrelated to agreement with the independence view. In sum, viewing science to be socially important made one more likely to not view conflict due to the independence view, whereas viewing religion to be

important made one more likely to not view conflict due to the dialogue and/or integration views. The positive effect importance of science had on agreement with the independence view is in accordance with Bensted's (2018) finding that the independence view is related to positive attitudes towards science. The non-significant relation between the independence view and the importance of religion could be due to the mild separation question used that proposed separation of science and religion to be possible due to their different topics instead of asking about the possibility to keep them completely separate. The integration views' positive relation to the importance of religion is consistent with the literature (e.g., Stolberg, 2007; Bensted, 2018; Uecker & Longest, 2017). The dialogue view has been found to positively relate to valuing science and religion. However, in these studies the view itself has been assessed with questions on the usefulness (e.g., Yasri et al., 2013) or the benefit (e.g., Stolberg, 2007) of both, science and religion. Here, valuing religion to be socially important increased, and valuing science to be socially important decreased the likelihood to agree that one can have many views on the same topic.

The relative nature of the perceived importance of science versus religion might also matter for agreement with the non-conflict questions. Among those viewing science to be more important than religion the results were quite similar to the independent effects reported earlier: the more one valued science over religion for society, the less likely one was to hold the dialogue and the integration view, and slightly more likely to hold the independence view. Thus, clustering individuals based on the perceived importance of science and religion might prove informative in understanding agreement with the non-conflict views as well. It could also be useful to directly ask whether one views both, science and religion, positively. For instance, Stolberg (2007) used this kind of a question and found that the independence view was negatively related to and the dialogue and integration views were positively related to agreeing that "both science and religion are important for human well-being".

For each of the four views, importance of science and/or religion were either the strongest or among the strongest predictors of agreement. While people's attitudes towards science and religion are often mentioned in relation to the science-religion perspectives, quantitative studies are still few. Moreover, the existing quantitative research is often lacking theoretical basis. Questions about the relations between science and religion should be more clearly differentiated from questions about attitudes towards science and religion than previously (e.g., Stolberg, 2007; Bensted, 2018). Through studying these relations, the nature of the perspectives could become clearer. Overall, it is likely that attitudes and science-religion perspectives go hand in hand and

affect each other. Different aspects of attitudes (e.g., importance of science and religion in one's own life versus in society), and different attitude dimensions (e.g., ambivalence, and intensity) should also be studied separately in future studies. Lastly, the way the conflict view relates to attitudes depends on whether one holds a pro-science or pro-religion conflict view, a point that has only rarely been considered when quantifying relations (but see O'Brien & Noy, 2015).

4.6 Agreement with the science-religion perspectives

While more representative and varied samples of Finns are needed to understand agreement with the science-religion perspectives in Finland, the agreement rates among this particularly non-religious sample of Finns can add to the literature. More than half (63 %) of the participants viewed science and religion to conflict, and this level of agreement is similar to what has been reported in some European countries (e.g., Pew Research Center, 2017b). Of the non-conflict views, the independence view was the most popular one (held by 72 % of those disagreeing with the conflict view), followed closely by the dialogue view (65 %), and far behind by the integration view (17 %). Consistent with this, other studies have reported agreement rates with the integration view to be low (Yasri et al., 2013; Stolberg, 2007) and with the independence view to be high (e.g., Ecklund et al., 2016; Bensted, 2018; but see Yasri et al., 2013). So far, the questions concerning the dialogue view have differed noticeably between studies as has the agreement with them (e.g., Stolberg, 2007; Yasri et al., 2013). Further, the dialogue view has not been formed similarly as here. Nevertheless, in this study the view that one can have many perspectives on the same issue was popular among those not viewing conflict. Overall, the three options for the non-conflict were largely sufficient here, in line with earlier findings (e.g., Yasri et al., 2013). Thus, the four perspectives proposed by Barbour (1990) appear to be the ones that should be further studied, using clear questions.

Further, most of the participants agreed with more than one explanation for the non-conflict. This finding is consistent with studies showing that some people agree with multiple reasons for the non-conflict (Yasri, et al., 2013; Bensted, 2018), and with Barbour's (1990) proposal that the science-religion perspectives are distinct but not necessarily exclusive views. In this study the integration and dialogue views correlated positively with each other and negatively with the independence view. The relations fit the scarce literature reporting positive relations between the integration and dialogue views (Stolberg, 2007; Yasri et al., 2013), and indications of negative relations between these views and the independence view (Stolberg, 2007). These

correlations are also in line with the similar predictors found for the dialogue and integration views here. Still, the correlations were not strong. Of those not viewing conflict, 37 % agreed with both the independence and dialogue views but not with the integration view. Thus, there are distinct groups of participants that the general correlation trends fail to capture.

4.7 Limitations and future directions

An important source of uncertainty in this study was the general nature of the independent variables. Consequently, more precise assessment methods are needed to verify and to better understand the findings. Especially epistemic cognition, both in general and specific to science and religion, should be studied more in depth. Also characteristics not considered here, such as religiosity and attitude dimensions, should be explored in the future.

Besides improving the predictors, the wording of the perspectives could be refined in the future. The general wording was intended to tap into participants' understanding of the way science and religion relate overall, in their opinion. To better interpret the answers, and to make it easier for people to answer, "for me/in my opinion" should be added to the questions in the future. The conflict view should also be further separated into pro-science, pro-religion, and undecided views – through direct statements. The dialogue view could be assessed with additional questions such as whether the interaction between science and religion is useful (e.g., Stolberg, 2007). Further, noticeably many agreed with the particular independence question used, and perhaps it would have been better predicted if it had more clearly separated science and religion (see Stolberg, 2007; Yasri et al., 2013). Going forward, the use of clear frameworks and questions, and acknowledging how the science-religion perspectives are asked about is crucial for making the field less complicated.

The chosen analytic methods also have limitations, even though they were deemed to best suit the goal of the study, i.e., to predict agreement with four science-religion perspectives based on epistemic cognition, core ontological confusions and the perceived social importance of science and religion. First, the independence view was the only non-conflict view that could be predicted with ordinal regression. Thus, its odds ratios are not directly comparable with those in the other analyses. Second, the response categories of the science-religion perspectives were combined, and those answering 'in-between' on the dialogue and integration views were left out of the analysis. This inevitably simplified the data. Third, some variables appeared to be non-linearly associated with the science-religion perspectives but the associations were not examined here.

However, the odds ratios were believed to provide reliable estimates since the assumptions of the used analysis were met, and the relations between the independent and dependent variables changed into one direction. Fourth, there were signs of interactions and overlap between some of the independent variables but these were mainly left unexamined here. Overall, the statistical models provided quite rough odds ratio estimates and upcoming studies could detail and expand these findings.

The large confidence intervals and weak effects of some of the predictors can also be due to the lack of control for identifiable non-conflict view patterns among the participants, i.e., groups of participants that agreed with a single non-conflict view or a specific combination of them. The results indicated some differences in the predictors of the non-conflict views. The predictors of the independence view were clearly distinct from the other non-conflict views, but the dialogue and integration views also appeared to differ in some of their predictors. However, most people agreed with multiple non-conflict views. Thus, in the future it might be more relevant to form and examine groups of people with specific view(s) of non-conflict rather than explain (dis)agreement with a particular non-conflict view among all participants. For instance, one would expect the characteristics of those agreeing with both the independence and dialogue views to lay in between those agreeing with only either one explanation. After all, through characterizing and comparing distinct groups of people with a specific view and combination of views, people's science-religion perspectives could be more thoroughly understood and better predicted.

Lastly, the characteristics of the sample restrict generalizations of the results. The found associations can be seen to apply among quite scientific and nonreligious individuals, who mainly value science over religion and view knowing in religion to be more personally justifiable than in science. Thus, the conflict view in this study likely reflects a pro-science stance. New data is needed to explore the characteristics of the pro-religion conflict group. After all, it is likely that the pro-science and pro-religion conflict groups differ from each other on many demographics as well as the variables studied here. It might also be important in upcoming studies to more clearly separate individuals based on how they view knowledge in science versus religion, and how they value science versus religion.

4.8 Conclusion

The way people relate science and religion is a complex and nuanced topic, and scholars are sometimes passionate about their views. However, exactly for these reasons more explicit research is needed, forming and testing as clear explanations as possible. This study found that among a largely nonreligious sample of Finns, differences in core ontological confusions, epistemic cognition, and the perceived social importance of science and religion predicted agreement with the four science-religion perspectives of conflict, independence, dialogue and integration.

The conflict view was more likely among those viewing science to be socially important, having a simple view of knowledge, and perceiving knowing in religion as experiential. Moreover, those holding the conflict view were less likely to view religion to be socially important, to perceive knowing in science as personally justifiable, to endorse core ontological confusions, or to have an intuitive thinking style. Among those not viewing conflict, the likelihood to agree with the independence view increased with viewing science to be socially important, not perceiving knowing in science as personally justifiable, and being low in core ontological confusions. On the contrary, the likelihood to agree with the dialogue and integration views increased with viewing religion to be socially important, perceiving knowing in science to be personally justifiable, not perceiving knowing in religion as experiential, endorsing core ontological confusions, and having an intuitive thinking style. Further, viewing science to be socially important decreased the likelihood to agree with the dialogue view, and having a simple view of knowledge increased the likelihood to hold the integration view.

The findings indicate that to start cleaning up the noted muddiness of the field, one can turn to people's views on knowledge and what is possible, category errors they endorse, and attitudes towards science and religion. In order to better understand the nature of different science-religion perspectives, more thorough and detailed examination of especially epistemic cognition and attitudes is necessary, as well as the use of other analytic methods (e.g., clustering and comparing groups). In conclusion, through focusing on the why and how of individuals' science-religion perspectives, the field can hopefully start moving towards increasingly valid arguments and debate.

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APPENDIX

Comparing importance judgments and views of knowing between science and religion

The distributions of the relative scales are shown below for the whole sample (N = 2172), and for the subsample (i.e., those disagreeing with the conflict view, N = 809).

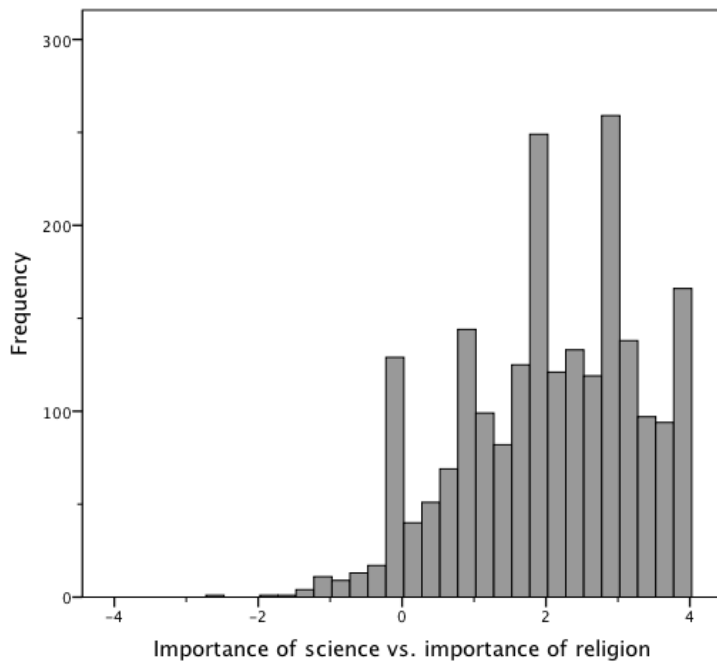


Figure 1. The distribution of the relative importance scale in the whole sample ($M=2.06$, $SD=1.22$). Positive values show how much more important science was rated compared to religion.

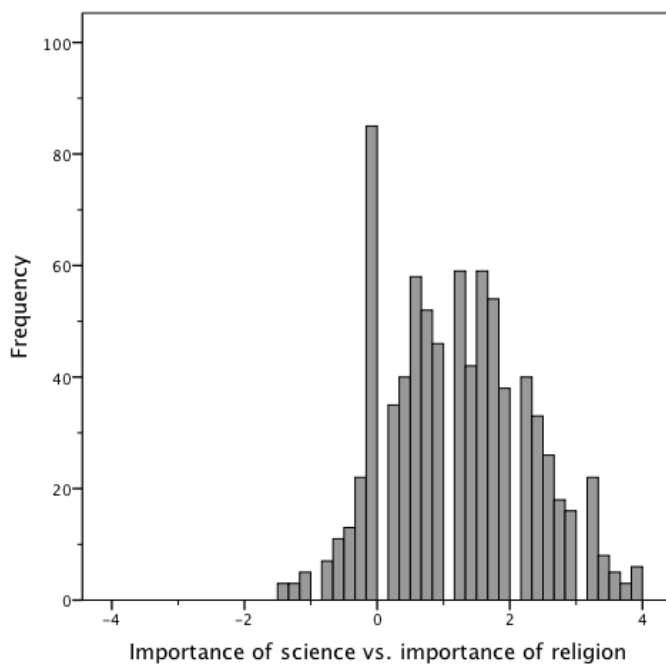


Figure 2. The distribution of the relative importance scale in the subsample ($M= 1.23$, $SD= 1.07$).

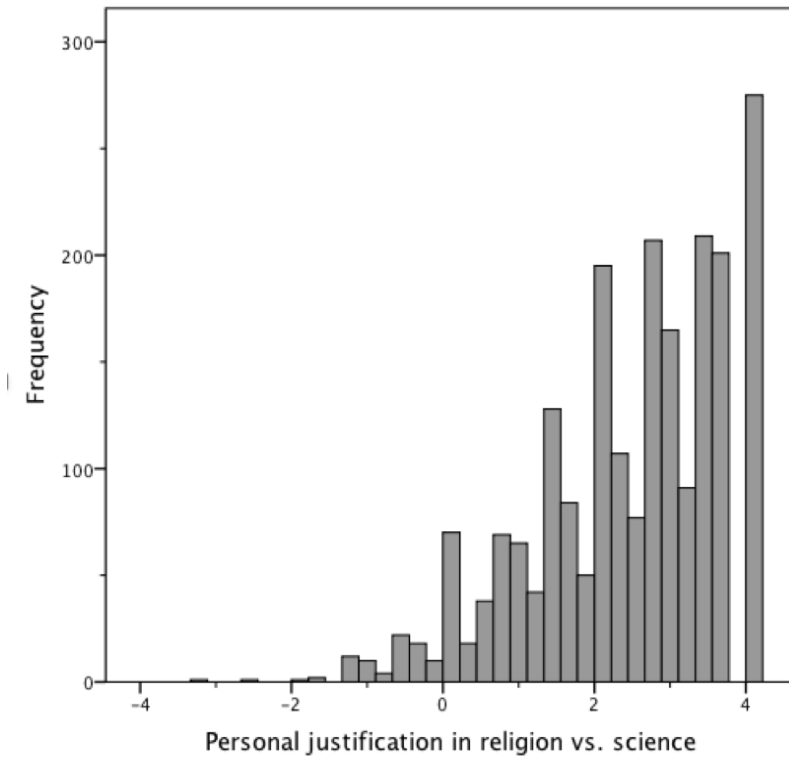


Figure 3. The distribution of the relative personal justification scale in the whole sample ($M= 2.43$, $SD= 1.25$). Positive values show how much more personally justifiable knowing in the field of religion was viewed compared to knowing in the field of science.

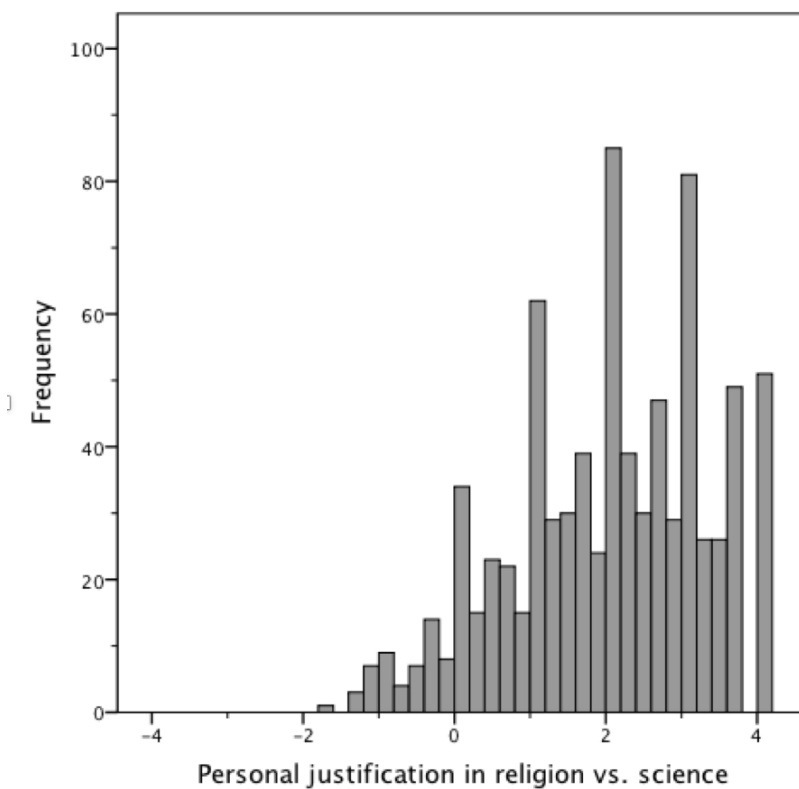


Figure 4. The distribution of the relative personal justification scale in the subsample ($M= 2.01$, $SD= 1.29$).