COGNITIVE SCIENCE
A Multidisciplinary Journal

Cognitive Science 47 (2023) e13370

ISSN: 1551-6709 online
DOI: 10.1111/cogs.13370

Distinct Profiles for Beliefs About Religion Versus Science

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Received 30 September 2022; received in revised form 12 October 2023; accepted 16 October 2023

Abstract

A growing body of research suggests that scientific and religious beliefs are often held and justified in different ways. In three studies with 707 participants, we examine the distinctive profiles of beliefs in these domains. In Study 1, we find that participants report evidence and explanatory considerations (making sense of things) as dominant reasons for beliefs across domains. However, cuing the religious domain elevates endorsement of nonscientific justifications for belief, such as ethical considerations (e.g., believing it encourages people to be good), affiliation (what loved ones believe), and intuition (what feels true in one's heart). Study 2 replicates these differences with specific scientific and religious beliefs held with equal confidence, and documents further domain differences in beliefs' personal importance, openness to revision, and perceived objectivity. Study 3 replicates these differences, further finding that counter-consensus beliefs about contentious science topics (such as climate change and vaccination) often have properties resembling religious beliefs, while counter-religious beliefs about religion (e.g., "There is no God") have properties that more closely resemble beliefs about science. We suggest that beliefs are held and justified within coherent epistemic frameworks, with individuals using different frameworks in different contexts and domains.

Keywords: Scientific belief; Religious belief; Justification; Epistemic frameworks; Epistemology

1. Introduction

Disagreement about what is true—and how we figure it out—has become more and more heated over the last few years. Are the wildfires on the West Coast of the United States caused by climate change, or forest mismanagement? Is Covid-19 a life-threatening disease, or a politically motivated hoax? Is racism systemic in the American police force, or limited to a

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few bad apples? These and other questions are hotly debated in Congress, on the news, and at dinner tables across the United States and beyond. Recent discussions in the philosophy and psychology of belief offer a possible explanation for the incalcitrance of these disagreements: people do not just disagree about the contents of their beliefs, but about the basis for belief itself. A clearer understanding of the differences between canonical scientific beliefs (e.g., that climate change is anthropogenic), religious beliefs (e.g., that prayer works), and beliefs that incorporate elements of both (e.g., theistic evolution) may help us understand why these conversations so often go awry. With luck, it may even help the conversations go better.

The research presented in this paper investigates variation within and across individuals in how beliefs are justified and held. To elicit variation within individuals, we consider beliefs about noncontentious science, politically fraught science, and religion. Specifically, we replicate previous findings that different kinds of justifications are used for beliefs on different topics, and we look at other properties of beliefs that theorists have suggested may differ across domains, including openness to revision, personal importance, and perceived objectivity. This allows us to ask whether—and how—bases for belief differ across individuals and types of beliefs.

1.1. Distinctions between scientific and religious beliefs

Previous research has identified several differences in the beliefs held within different domains—for example, in how typical scientific and religious beliefs are justified, in whether they are regarded as "objective," in their relationship to inquiry, and in the language we use to describe them. Here, we briefly review the most relevant prior work, along with proposals about the epistemic frameworks that might explain the variation observed across domains.

In a sample of U.S.-based adults, Shtulman (2013) found that participants in a free-response protocol offered different justifications for different beliefs, more often using appeals to evidence or deference to authority to justify beliefs about scientific entities (such as electrons and black holes) but more often using subjective justifications ("it makes sense") or appeals to volition ("I'd like to believe my loved ones are going [to Heaven]") to justify beliefs about supernatural entities such as heaven and ghosts. Shtulman found that the same pattern mapped onto refutations: asked what would change their mind, people were more likely to cite evidence or authority in the scientific domain, but subjective refutations ("maybe I'll feel differently one day") in the supernatural domain. Moreover, people were more likely to deny that anything could change their minds about supernatural beliefs than about scientific beliefs.

Metz, Weisberg, and Weisberg (2018) similarly looked at justifications for belief, but without specifying the domain of belief involved. Instead, they asked participants (also adults within the United States) to consider whether a variety of considerations were good or bad reasons to hold a belief. The candidate justifications included scientific evidence (e.g., "There is good scientific evidence for it"), religious authority (e.g., "The Bible says it is true"), intuition (e.g., "I feel it is true in my heart"), and affiliation (e.g., "My parents told me it is true"), among others. They found considerable individual variation in which reasons for belief were

accepted as legitimate, and moreover that these individual differences in acceptable justifications predicted beliefs about human origins. Those who more strongly endorsed religious, affiliative, and intuitive justifications were much more likely to endorse creationist explanations for human origins, while those who emphasized scientific justifications were more likely to endorse evolution with no role for God.

Scientific and religious beliefs have also been found to differ in their perceived objectivity. For example, Heiphetz, Spelke, Harris, and Banaji (2013) presented adult participants within the United States with two individuals endorsing conflicting sets of religious or scientific beliefs (e.g., one person believes that God hears verbal prayer, and the other person believes that only other people hear it). Participants were asked whether both people could be "right"—a response pattern that characterizes beliefs regarded as subjective preferences or opinions. For scientific/factual claims, participants tended to reject the idea that both could be right; for religious claims, this subjectivity was more often endorsed.

Studies with U.S.-based adults also find that canonical scientific and religious beliefs differ with respect to the perceived roles for inquiry in each domain. Liquin, Metz, and Lombrozo (2020) tested whether scientific and religious beliefs differ in the extent to which they demand an explanation, and whether a demand for explanation can be answered by an appeal to mystery. To illustrate, contrast "Why does the moon cause tides?" with "Why did Jesus turn water into wine?" Scientific questions like the former were judged to demand an explanation more strongly than religious questions like the latter, while answering "it's a mystery" was judged more appropriate as an explanation for religion than for science. These differences held even for individuals who endorsed the relevant beliefs with equal levels of confidence, and thus were not a product of domain asymmetries in strength of belief. Instead, the differences between scientific and religious beliefs were partially explained by judgments about epistemic limits and norms: what humans *can* and *should* explain in each domain. Davoodi and Lombrozo (2022) conceptually replicated several of these results, and additionally found that ignorance (not knowing how or why something is the case) was seen as undermining scientific claims more than it did religious ones. Finally, Gill and Lombrozo (2023) found that seeking further evidence or explanation to support a scientific claim was seen as evidence for an individual's commitment to science, while *abdicating* from further evidence or explanation to support a religious claim was seen as evidence for an individual's commitment to religion.

Finally, turning to language use, Heiphetz, Landers, and Van Leeuwen's (2021) analysis of the Corpus of Contemporary American English found that "believe" occurs far more often than "think" when discussing religious topics (e.g., "*believe* that God exists") versus scientific topics (e.g., "*think* that aspirin is not a cure"). Importantly, experimental follow-ups found that this linguistic difference did not track domain per se, but rather the doxastic attitude typically involved: when the researchers held a belief's content constant but varied the context such that the belief was either endorsed for scientific reasons or for religious reasons, they were able to replicate the differential pattern of choosing when to use "think" versus "believe." This linguistic differentiation in doxastic attitudes toward canonical religious and scientific claims has been replicated in a number of languages and cultures, suggesting that it is not an idiosyncrasy of English (Van Leeuwen, Weisman, & Luhrmann, 2021).

1.2. Theoretical proposals

What is the source of the differentiation between scientific and religious beliefs documented above? While a variety of theoretical proposals invoke some distinction between types of beliefs (e.g., Buckwalter, Rose, & Turri, 2013; Heiphetz et al., 2013, 2014; Stanovich & Toplak, 2019), a growing body of work suggests that contrasting attitudes toward beliefs across domains might correspond to the different functional roles that these beliefs play in human cognition. That is, some beliefs might play a primarily factual or truth-tracking role (hence grounded in evidence, regarded as objective, and subject to ongoing inquiry), and other beliefs might play more social or emotional roles (hence more closely tied to identity, in-group authority, and personal background).

For example, Tetlock's (2002) model of *social functionalism* proposes that people reason in different mindsets with different aims or functions. He differentiates the mindset of an *intuitive scientist*, who seeks true justified beliefs like a scientist or philosopher, from an *intuitive theologian*, whose priority is the protection of sacred values and group coherence, and an *intuitive prosecutor*, whose priority is defending social norms. Each of these mindsets comes with its own set of cognitive-affective-behavioral strategies for dealing with different sorts of challenges.

Similarly, Chinn, Rinehart, and Buckland's (2014) AIR model of epistemic cognition suggests that approaches to belief can vary in Aims, Ideals, and what are considered Reliable processes (AIR). Chinn et al. differentiate epistemic aims, such as knowledge and understanding, from nonepistemic aims, such as happiness and affiliation. Some empirical work suggests that many people think scientific explanations achieve epistemic aims more successfully than do religious explanations, but that religious explanations better achieve nonepistemic aims than do scientific explanations (e.g., Davoodi & Lombrozo, 2021).

Van Leeuwen (2014) develops a more specific distinction, differentiating *factual beliefs* and *religious credences* as distinct cognitive attitudes that often map onto scientific versus religious contents, respectively. Factual beliefs, he posits, are evidentially vulnerable, offer an informational basis for other attitudes, and are independent of practical setting (i.e., guide reasoning and action across contexts). In contrast, religious credences are susceptible to free elaboration (like a fiction or mythology), vulnerable to special authority (e.g., institution-assigned authority rather than demonstrated expertise, as in a priest), and have a perceived normative orientation (i.e., action on its basis is perceived as virtuous, e.g., acting on faith). Similar to Tetlock's (2002) theory of social functionalism, Van Leeuwen's distinction thus suggests that the general term "belief" includes doxastic attitudes that serve different functions in our cognitive and social lives.

These proposals are consistent with the hypothesis that individuals have distinct epistemic frameworks supporting beliefs, each with different norms of formation, justification, and revision. A limitation of this work is that it has been done almost entirely in Western, primarily Christian samples, whereas adherents to other religions may hold religious beliefs with different attitudes. Nevertheless, if there are such distinct epistemic frameworks (whether or not they map on to science and religion universally), individuals seem to be able to switch adaptively between them in different contexts and for different purposes.

1.3. The present research

The research reviewed in the previous sections suggests that people may have multiple ways of reasoning about and justifying scientific and religious beliefs. In particular, beliefs about science tend to be viewed by laypeople as objective, sensitive to evidence, and in need of further explanation, while beliefs about religion tend to be perceived as less objective, sensitive to social and other subjective factors, and sometimes better left as mysteries. Despite this growing evidence that scientific and religious beliefs are typically treated differently by the individuals who hold them, questions remain about what drives differences within this epistemic landscape, and about the extent to which differences are driven by domain per se versus the typical functional roles that scientific versus religious beliefs tend to play in human cognition.

In the present research, we aim to fill some of these lacunae by addressing the following questions. In Study 1, we ask how justifications for belief differ across domains, even within the same person. This study offers a conceptual replication of prior work (Metz et al., 2018; Shtulman, 2013), but with a within-subjects design in which participants are asked to report what would constitute a good reason for belief in science or religion in general (vs. for a specific belief). This allows us to compare justifications within individuals but across domains, and both to a neutral baseline context in which neither domain is specified. In Study 2, we replicate key findings from Study 1 for specific beliefs that are held with the same degree of confidence, and we additionally investigate the attributes of belief in relation to both their domain and justifications. The attributes that we consider are openness to belief revision, personal importance, and perceived objectivity. Finally, in Study 3, we aim to dissociate the role of a belief's domain from its functional role in driving justifications and attributes. To do so, we focus on politically contentious scientific beliefs (e.g., climate change), which have scientific content, but plausibly, for some people, occupy a psychological role more akin to that of religious belief.

To the extent that epistemic frameworks play a role in belief formation, justification, and revision, this research is not merely an academic issue. As this manuscript was being written, a worldwide pandemic threatened millions of lives, yet people across the planet remained skeptical of the epistemic force of scientific evidence and consensus supporting vaccination. At the same time, the evidence for climate change continues to mount, between unprecedented wildfires from the Amazon to Australia and record high temperatures in the Arctic. Yet, half of Americans remain unconvinced that the threat is critical (Jenkins, 2021). It behooves us to get a better grip on the distinctive profiles of different kinds of beliefs, so we can better understand what drives them and how they can change.

2. Study 1: Justifications for belief across domains

In Study 1, we ask whether individuals value different reasons for belief across the domains of science and religion. We use a scale developed in Metz et al. (2018), in which they asked participants to indicate the extent to which different considerations (such as

scientific evidence or "what one feels in one's heart") constitute good reasons for belief. But in an important methodological departure, we treat this not as an individual difference measure, but as a way to evaluate differences within individuals in how they think about beliefs when science versus religion is cued.

We expect to find, in a conceptual replication of Shtulman's (2013) findings, that cuing science (vs. religion) will lead to stronger endorsements of scientific justifications for belief and weaker endorsements of religious and intuitive justifications. Shtulman coded justifications as subjective versus objective and deferential versus evidential. Going beyond this work, we also included additional candidate justifications for belief: affiliative (e.g., "The people I love believe it is true"), ethical (e.g., "Accepting it is the moral thing to do"), and explanatory (e.g., "It explains a lot of things really well").

We cue the domain in two ways. In the *Domain* condition, we explicitly identify the domain of belief (e.g., "consider claims or statements in the domain of science [religion]"). In the *Context* condition, we ask participants to imagine themselves in either a laboratory in a school or in a place of worship, but without specifying the domain of belief. We included both manipulations to better test the hypothesis that people can be flexibly cued to draw on different epistemic frameworks, as we would expect a variety of cues to play a role in real-world contexts.

We, moreover, include two additional conditions for comparison. In the *Authority* condition, we ask participants to evaluate candidate justifications from the perspective of a scientist or a priest, which we expect to provide upper bounds on the differentiation between scientific versus religious epistemic frameworks that we might expect participants to demonstrate in their personal judgments. That is, we expect participants to judge that a priest would much more strongly endorse the nonscientific justifications, especially the religious ones, while a scientist would much more strongly endorse the scientific justifications. Finally, we include a *Control* condition, in which we ask participants to consider claims without any cues to domain or context beyond the online survey. This baseline condition is designed to reveal chronic or default evaluations of justifications for belief, which we can compare to evaluations in other conditions. We predict that the baseline will fall somewhere between the science and religion conditions, as people in general draw on both sets of justifications.

2.1. Methods

2.1.1. Participants

Participants were 424 adults residing in the United States, recruited and paid via Amazon Mechanical Turk in 2018. Because Mechanical Turk participants tend to be less religious than Americans at large (Lewis, Djupe, Mockabee, & Wu, 2015), and it was important for our research questions to capture a sample with a range of religiosity, we restricted participation to the 12 U.S. states with the highest proportion of evangelical Christians[1] (Pew Research Center, 2014). Of the 424 respondents, 371 passed the attention checks (see below). This yielded 203 men and 168 women, ranging from under 21 to over 70 with median and mode in their 30s. Twelve percent had not attended college, 37% had some college, 42% had a college degree, and 9% had a Masters degree or higher. Despite the restriction to relatively religious states, 36% were atheists or agnostics. The sample also included Catholics (14%),

Table 1
Candidate justifications for belief

Type of justification	Items
Scientific ($\alpha = .88$)	There is good scientific evidence for it. There is scientific consensus that it is true. I read it in a scientific article.
Religious ($\alpha = .89$)	It is an article of faith in my religion. It's in Scripture. My religious leader said it is true.
Affiliative ($\alpha = .91$)	The people I love believe it is true. My friend(s) said it's true. Most members of my political party take it to be true. It would upset my friends & family if I didn't accept it. Many members of my political party find it offensive to reject the claim.
Ethical ($\alpha = .85$)	Believing it encourages people to be good. Accepting it is the moral thing to do. Not believing it would be morally wrong.
Intuitive ($\alpha = .84$)	It feels true in my gut. My heart tells me it's true.
Explanatory ($\alpha = .77$)	It explains a lot of things really well. It's the best explanation for some things. It makes sense.

Note. In Study 1, participants rated each criterion for belief on a 4-point scale, from "Excellent reason for accepting it" to "Poor reason for accepting it." Cronbach's α shown for each composite from Study 3, which had the largest within-subjects sample ($N = 291$).

Mainline Protestants (16%), Evangelical Protestants (6%), and other Christians (8%), as well as a few representatives each from the Latter-Day Saints, Islam, Buddhism, and Judaism and 11% "nothing in particular."

2.1.2. Design

Using Qualtrics, all participants in Study 1 evaluated a set of 19 candidate justifications for belief, that is, possible reasons someone might take a statement as true on a scale from 1 (poor reason for accepting it as true) to 4 (excellent reason for accepting it as true; see Table 1). For instance, in the *Domains* condition, participants were asked: "Consider the following possible justifications someone might use for accepting a [scientific/religious] claim or statement as true. How good is each reason?" They evaluated these candidate justifications either just once (for the control condition) or twice each (for the three experimental conditions). Participants were randomly assigned to one of four conditions: (1) the *Control* condition, (2) a comparison across *Domains* ("In the domain of science" vs. "In the domain of religion"), (3) a comparison across *Contexts* ("In a laboratory" vs. "In a place of worship"), or (4) a comparison of how different *Authorities* would evaluate the justifications ("What would a scientist say" vs. "What

would a priest say"). In the control condition, participants were asked to evaluate the candidate justifications for belief without any context, domain, or other prompts, to obtain a baseline (see complete framing questions in Supplementary Materials). Each of the three experimental conditions included two contrasting within-subject conditions (science vs. religion, laboratory vs. place of worship, scientist vs. priest), with order counterbalanced.

The manipulation, repeated at the top of each page of six candidate justifications, consisted of a photograph and written instructions (see Supplementary Materials). Religion, Place of Worship, and Priest conditions were cued with a photograph of a priest in a church; Science, Laboratory, and Scientist were cued with a photograph of a scientist in a laboratory. Both figures had their backs to the camera, such that neither gender nor race could be distinguished; their roles were clear from their clothing (a robe vs. a lab coat) and context. In order to make the between-subject conditions comparable, the same two photos were used across conditions. Control condition participants saw no photos.

2.1.3. Justifications for belief

The 19 candidate justifications (see Table 1) were all stated generally enough to be potentially applicable to almost any belief, and accessible without expertise. They included scientific justifications (e.g., "there is good scientific evidence for it," "there is scientific consensus that it is true"), religious justifications (e.g., "my religious leader says it is true," "it is an article of faith in my religion"), affiliative justifications (e.g., "the people I love believe it is true"), intuitive justifications (e.g., "my heart tells me it is true"), explanatory power justifications (e.g., "it explains a lot of things really well"), and ethical justifications (e.g., "believing it true would encourage people to be good"). The 19 candidate justifications were shown with order randomized. Participants were asked to rate each criterion on a 4-point scale, from "Excellent reason for accepting it as true" to "Poor reason for accepting it as true."

2.1.4. Attention check

An attention check, administered at the end of each set of 19 justifications, consisted of a multiple choice question about the manipulation. Those who did not correctly identify the manipulation (e.g., someone who said they were supposed to imagine the context of home when they had been asked to answer the questions in the context of a laboratory) were excluded from all analyses, since it suggested they had not read the instructions carefully enough for the manipulation to work.

2.1.5. Demographics

After answering the other questions, all participants responded to a set of multiple-choice questions about demographics, including gender, age, education, religion, and political identity (for economic and social issues). They also completed the Short-Form Santa Clara Strength of Religious Faith Questionnaire, consisting of five rating scale questions that consistently exhibit Cronbach's alphas over .90 (Storch, Roberti, Bravata, & Storch, 2004). They were finally asked to rate their agreement on a 7-point scale with each of two statements about the origin of humans, one citing evolution ("Humans came to be through evolution by natural

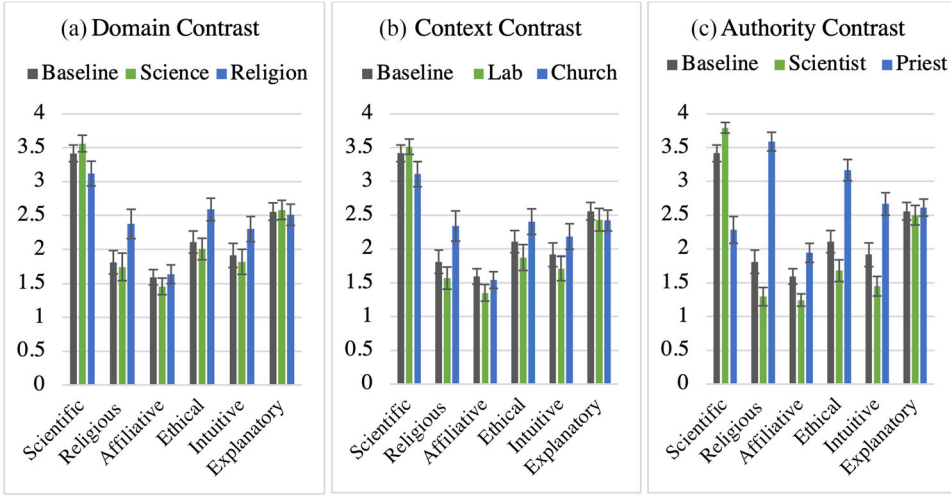

Fig 1. Condition contrasts for justifications for belief: Which justifications are accepted? (Study 1).
Note. Mean endorsement for each composite criterion for belief, as a function of religious and scientific cue type: (a) domain (science vs. religion), (b) context (lab vs. church), and (c) authority (scientist vs. priest). The control condition (in which neither science nor religion was cued) is included for reference, and is the same in all panels. Error bars show 95% CIs. The *Y*-axis shows an evaluation of candidate justifications for belief from 1 (poor reason to accept as true) to 4 (excellent reason to accept as true).

selection from earlier species") and one creation ("Humans came to be through special Creation by a divine Creator"). These were asked in two separate questions because interviews have indicated that some people hold both views simultaneously, possibly "believing" each in a different way or for different purposes (Metz, Weisberg, & Weisberg, 2020). Demographic questions were placed at the end of the survey to avoid identity-cuing effects that might create artifactual correlations between demographic variables and endorsed justifications for belief.

The average religiosity for this sample was 2.64 on a 1–5 scale ($SD = 1.42$). The sample was also well balanced with respect to political identity, averaging 2.4 ($SD = 1.21$) on social policy and 2.9 ($SD = 1.18$) on economic policy (1 = very liberal, 5 = very conservative). They were more likely to agree with the statement of evolution than creationism, averaging 5.3 agreement with evolution ($SD = 1.92$) on a 7-point scale and 3.5 ($SD = 2.38$) agreement with creationism.

2.2. Results

2.2.1. Domain, context, and authority differences in justifications

To test the hypothesis that people accept different justifications for belief given different cues, we investigated within-subject differences in justifications between religious and scientific conditions (see Fig. 1). First, we created composite averages for each set of justifications, since they had fairly high internal reliability (see Table 1). Since there are three

sets of religious versus scientific conditions, we will call them religion versus science *cues*: this includes domain, context, and authority. For each set of justifications, we fit a multilevel model predicting participant acceptance of those justifications within a condition. Cue (science vs. religion) was included in the model as a fixed effect (dummy coded, with religion as the reference group), with random intercepts included for participant.

Within the domain condition (science vs. religion), there was a significant overall effect of cue for scientific justifications ($\chi^2(1) = 25.74$, $p < .0001$; $b = -.44$, 95% CI [−.60, −.28]), religious justifications ($\chi^2(1) = 35.71$, $p < .0001$; $b = 0.64$, 95% CI [.45, .82]), ethical justifications ($\chi^2(1) = 37.54$, $p < .0001$; $b = 0.58$, 95% CI [.41, .75]), affiliative justifications (($\chi^2(1) = 14.77$, $p = .0001$; $b = 0.18$, 95% CI [.09, .27]), and intuitive justifications ($\chi^2(1) = 28.71$, $p < .0001$; $b = 0.48$, 95% CI [.32, .65]). Scientific justifications were endorsed as better reasons for belief in the domain of science than in the domain of religion, while religious justifications, ethical justifications, affiliative justifications, and intuitive justifications were endorsed as better reasons for belief in the domain of religion than in the domain of science. The effect of domain was not significant for explanatory justifications ($b = -.07$, 95% CI [−.18, .04]).

As expected, the context condition (laboratory vs. place of worship) exhibited similar patterns to the domain condition, while the authority condition (priest vs. scientist) involved an exaggeration of the contrasts that emerged in the former two conditions (see Table 2).

2.2.2. *Departures from control*

The inclusion of a baseline control condition, in which participants evaluated justifications for belief without any particular cue, allows the comparison of both science and religion conditions to a relatively neutral condition, which theoretically should track "general" or chronic justifications for belief. Because the context and domain conditions were so similar, they were collapsed for greater power. We fit multilevel models predicting acceptance of each set of justifications, with two dummy variables as fixed effects and random intercepts for participants. The first dummy variable captured the difference between ratings at baseline and ratings for the religion cues (domain and context conditions), and the second dummy variable captured the difference between ratings at baseline and ratings for the science cues (domain and context conditions). To test whether each difference (baseline vs. religion, baseline vs. science) was significant, we fit a model excluding the relevant dummy variable, then compared it to the full model using likelihood ratio tests.

This analysis revealed that religion differed significantly from baseline with respect to scientific, religious, ethical, and intuitive justifications, but not affiliative or explanatory justifications (see Table 3). Only affiliative justifications were rated significantly differently in the baseline versus science conditions, suggesting that a mostly scientific epistemic mindset was a default for participants in our sample. The exception of affiliative justifications suggests that some people do use and approve affiliative justifications in their default epistemic frameworks, but consider it less appropriate in explicitly scientific contexts.

Table 2
Effects of condition and domain cues on endorsement of justifications (just.) for belief in Study 1

	b	*CI*	χ^2(df = 1)
Domain condition			
Scientific Just.	−0.44	[−.60, −.28]	25.74**
Religious Just.	0.64	[.45, .82]	35.71**
Affiliative Just.	0.18	[.09, .27]	14.77*
Ethical Just.	0.58	[.41, .75]	37.54**
Intuitive Just.	0.48	[.32, .65]	28.71**
Explanatory Just.	−0.07	[−.18, .04]	1.60
Context condition			
Scientific Just.	−0.26	[−.36, −.15]	20.21**
Religious Just.	0.76	[.58, .94]	51.03**
Affiliative Just.	0.19	[.11, .28]	18.76**
Ethical Just.	0.52	[.37, .68]	36.27**
Intuitive Just.	0.48	[.30, .65]	25.07**
Explanatory Just.	0.00	[−.14, .13]	0.00
Authority condition			
Scientific Just.	−1.50	[−1.72, −1.29]	130.39**
Religious Just.	2.29	[2.09, 2.49]	248.16**
Affiliative Just.	0.69	[.55, .83]	63.66**
Ethical Just.	1.49	[1.28, 1.71]	121.65**
Intuitive Just.	1.20	[.98, 1.42]	88.55**
Explanatory Just.	0.11	[−.07, .30]	1.40

Note. In each condition, the comparison is to religions (domain of religion, place of worship, religious authority), such that positive coefficients indicate greater endorsement in religion, negative coefficients greater endorsement in science.

*indicates $p<.001$; **indicates $p<.0001$.

Table 3
Multilevel model showing departures from control in Study 1

	b	*CI*	χ^2(df = 1)
Domain: Baseline versus **Science**			
Scientific Justifications	−.12	[−.27, .04]	2.18
Religious Justifications	.15	[−.07, .37]	1.86
Affiliative Justifications	.19	[.05, .33]	7.00**
Ethical Justifications	.17	[−.03, .36]	2.81
Intuitive Justifications	.14	[−.05, .36]	2.13
Explanatory Justifications	.05	[−.11, .22]	0.41
Domain: Baseline versus **Religion**			
Scientific Justifications	.23	[.07, .39]	8.20**
Religious Justifications	−.55	[−.76, −.33]	23.90**
Affiliative Justifications	.00	[−.14, .15]	0.00
Ethical Justifications	−.38	[−.58, −.19]	14.48**
Intuitive Justifications	−.33	[−.53, −.12]	9.37**
Explanatory Justifications	.09	[−.08, .26]	1.13

Note. The comparison is to baseline. *indicates $p < .01$, **indicates $p < .001$.

2.3. Discussion

On the whole, the evidence strongly supports the hypothesis that different justifications for belief are accepted in different domains and contexts, offering a conceptual replication of previous research (Heiphetz, Spelke, Harris, & Banaji, 2014; Metz et al., 2018; Shtulman, 2013). When religion was cued, relative to when science was cued, scientific justifications were considered less good reasons for belief, while ethical, intuitive, religious, and affiliative justifications were considered better reasons for belief. Explanatory justifications were not affected by such cuing. This study goes beyond previous research by documenting domain-specific justifications using a systematic scale rather than free response justifications as in Shtulman (2013), as well as adding control and authority conditions to show default justifications and outer bounds.

Context (place of worship vs. laboratory) seemed to cue domain (religious vs. scientific domains) completely, such that the two between-subjects conditions (domain comparison vs. context comparison) showed identical patterns of effects. The authority condition (what justifications would a priest vs. scientist accept) showed the strongest contrasts (see Fig. 1). This suggests that participants are not selecting justifications for their own judgments as strictly as they imagine authorities/partisans in those domains might.

One limitation of this design is that "scientist versus priest" may conflate perceived expertise with perceived partisanship. For example, it is not clear whether participants thought scientists would ignore religious, intuitive, ethical, and affiliative justifications because of their greater expertise in utilizing the scientific justifications (an epistemic explanation) or because of their partiality to scientific justifications (a socioemotional explanation). We can, however, infer that the contrast between authorities is not only because scientists and priests are evaluating claims in different domains, since the authority contrast is much stronger than the domain or context contrasts.

Another limitation is that we asked participants to evaluate candidate justifications, but did not observe the justifications they used in practice. It is technically possible that, given their perception that scientists versus religious leaders use different justifications, they endorse justifications accordingly in contexts dominated by those thought leaders, but would not necessarily enact this differential use themselves. This is made more plausible by the fact that many people accept scientific claims for social, not epistemic, reasons (e.g., deference to authority). Nevertheless, given the challenges of changing meaningful beliefs within the scope of a short-term study and the consistency with which justifications differ across domains, we think it is reasonable to infer that justifications are not only differentially endorsed but also differentially used.

To summarize, Study 1 tested the effects of domain, context, and authority on evaluations of justifications for belief, and found significant and meaningful differences. This result suggests two new questions: (a) Do these differences appear only when general domain is cued, or also for specific, personally held beliefs? and (b) Are these differences in the *justifications* for holding beliefs reflected in other aspects of the way the beliefs are held? In particular, are beliefs held on the basis of intuition and ethics seen as more personally important, less open

to revision, and less objective than beliefs held on the basis of scientific evidence? Study 2 seeks to address these questions.

3. Study 2

In Study 2, we investigate whether we find the same domain differences in justifications for belief when targeting specific beliefs in the domains of science and religion. Moreover, and going beyond prior work on justifications for belief, we attempt to match the target beliefs for the strength of endorsement within each participant. This is important to ensure that differences in endorsed justifications are not a function of the confidence with which beliefs in science versus religion are held, either within or across individuals. In particular, prior work has consistently found that scientific beliefs are held with higher confidence than religious beliefs, even in communities with high levels of religiosity (Harris et al., 2006; Davoodi et al., 2019; Cui et al., 2020). This leaves open the possibility that differences in patterns of justification (e.g., Shtulman, 2013) reflect differences in confidence, perhaps themselves reflecting the kinds of evidence available to support belief in each domain. It also remains possible that differences across domains largely reflect differences between the sorts of people who endorse scientific versus religious claims (e.g., Metz et al., 2018). Study 2 blocks such explanations for domain differences by focusing on differences in justifications for belief within the very same individuals who endorse a given scientific proposition and a given religious proposition with equal confidence.

In addition, Study 2 furthers our understanding of the landscape of epistemic frameworks by testing whether specific religious and scientific beliefs vary in several additional "belief attributes": objectivity, openness to revision, and personal importance. Evidence for domain differences in objectivity would conceptually replicate prior research (Heiphetz et al., 2013, 2014; Liquin, Metz, & Lombrozo, 2020), while evidence for domain differences in openness to revision and personal importance would provide new empirical evidence that scientific and religious beliefs differ along multiple dimensions (even after controlling for confidence). Moreover, asking participants about belief justifications and attributes in a single study can reveal associations between justifications and attributes, not only across domains but also within them. This is potentially important in shedding light on *why* beliefs with particular justifications or attributes may cluster in particular ways. For example, we might expect beliefs that are personally important to be less open to revision (because revision could be personally threatening; see Mandelbaum, 2019), and therefore, more likely to be justified on grounds that are less likely to change (e.g., religious, intuitive, ethical, and affiliative justifications, in comparison to scientific; see Friesen, Campbell, & Kay, 2014).

We hypothesized that religious beliefs would be rated more personally important than scientific beliefs, while scientific beliefs would be rated as more open to revision and more objective. Moreover, we predicted that these domain differences in the attributes of beliefs would correspond with previously established domain differences in justifications for belief, with endorsed justifications for the religious beliefs more often including affiliative, intuitive, ethical, and religious justifications, and endorsed justifications for scientific beliefs more often

including scientific justifications. Finally, we predicted that even within domains, the use of scientific justifications would be associated with more scientific-style attributes of belief such as objectivity and openness to revision, while the use of nonscientific justifications (religious, affiliative, intuitive, and ethical) would be associated with greater personal importance, less perceived objectivity, and lower openness to revision.

3.1. Methods

3.1.1. Participants

Participants were 193 adults recruited from Amazon Mechanical Turk, restricted to the same 12 states with high evangelical populations as in Study 1. Of these, those who did not agree with any of the candidate beliefs in either religion or science did not complete the survey and were excluded, since we could not question them about beliefs they did not hold (see Design for details). This yielded a usable sample of 118, of which 43% self-reported as male, 57% as female, none as other. Ages ranged from under 21 to over 70 with median and mode in their 30s. Nine percent had no college, 34% had some college, 44% had bachelors' degrees, and 13% had a post-bachelor degree. On five-point scales assessing political affiliation (5 = very conservative), they averaged 3.0 ($SD = 1.5$) for social issues and 3.2 ($SD = 1.4$) for economic issues. Seventy-five percent of participants were Christian, including 36% mainline Protestant, 16% Catholic, and 6% Evangelical. Although 19% of the original sample were Atheist or Agnostic, only 3% of the final sample were; this makes sense, since we had to exclude participants with no religious beliefs to which we could compare their beliefs about science. There were also a few participants who identified as Muslim, Jewish, Mormon, or spiritual. Participant religiosity averaged 2.16 ($SD = 1.08$) on the 5-point scale (1 = very religious).

3.1.2. Design

In order to investigate the specific attributes of beliefs for individuals, such as confidence and centrality to identity, it was necessary to ask about specific beliefs. Moreover, in order to keep beliefs from the two domains (religion and science) comparable, it was necessary to find pairs of beliefs accepted with the same degree of confidence. To find such beliefs, we asked all participants to rate their agreement on a 7-point scale with five common religious beliefs and five common scientific beliefs. These statements were chosen to be of roughly comparable complexity and length, and to have comparable rates of agreement among Americans according to representative national polls (see Table 4).

Each participant was then randomly assigned one claim from each domain with which they had "strongly agreed." If they did not strongly agree with any of the five claims from one domain, they were assigned one claim from each domain with which they "agreed." For those remaining who did "strongly agree" or "agree" with at least one belief from each domain, we randomly assigned a belief from each domain with which they provided *either* rating. If they did not strongly agree or agree with at least one claim from each domain, they were excluded from the study, since it was not possible to compare beliefs from each domain in these cases. Thus, the 118 participants who agreed with at least one claim in each domain (51

Table 4
Target religious and scientific beliefs used in Study 2

Domain	Belief	% Acceptance in poll	Source of poll
Religion	There is a God.	89%	Pew 2014
	Human beings have souls.	79%	Barna 2003
	There is a life after death.	72%	Pew 2014
	Miracles sometimes happen.	79%	Pew 2010
	Prayer works.	76%	Pew 2014
Science	The Earth goes around the Sun.	74%	NSF 2012
	The Moon causes tides.	76%	Pew 2014
	The center of the Earth is very hot.	84%	NSF 2012
	Continents move slowly, across millions of years.	83%	NSF 2012
	Burning fossil fuels creates CO2.	68%	Pew 2016

Note. Candidate beliefs used in Study 2 are listed, along with the percentage of the American population accepting each belief according to the indicated poll.

Table 5
Belief attribute statements presented in Study 2

Confidence[a]	I am confident that X.
Openness to	If I discovered strong evidence that not-X, I would change my belief.
Revision	I can imagine changing my belief that X.
($\alpha = .81$)	If the wisest person I know said that not-X, I would consider changing my belief.
	If experts on the subject all said that not-X, I would change my belief.
	*No matter what happens, I will always believe that X.
Personal	It would be painful to change my mind about whether or not X.
Importance	I feel like I would be a different person if I didn't believe that X.
($\alpha = .74$)	It matters to me to know the truth about whether or not X.
	It matters to me that it is true that X.
	I can imagine my belief that X affecting a decision.
	My belief that X informs other beliefs.
Objectivity	People who believe not-X are mistaken.
($\alpha = .46$)	*It's okay for people to believe whatever they want about whether or not X.

Note. Participants in Study 2 rated each item on a 7-point agreement scale, where the X was filled in with a religious or scientific claim with which they agreed or strongly agreed. Cronbach's alphas given from Study 3, which had the largest within-subject sample ($N = 291$).

[a]Initially, we included a second item to assess confidence ("I would stake my life on X"), but the internal reliability was poor (α=.56) and we realized it was confounded with other attributes, so we decided to use the single item asking directly about confidence in analyses. We retained the two objectivity items because they were drawn from previous work.

*Items indicated with an asterisk were reverse-coded.

of whom provided identical agreement ratings for the selected science and religion belief) were assigned one belief in each domain, where both beliefs selected for a given participant were endorsed with comparable strength.

Each participant then answered 15 questions about the attributes of each of those two beliefs (see Table 5). Half began with the religious belief, half with the scientific belief. These

15 questions included items on confidence, openness to revision, personal importance, and objectivity, each on a 7-point agreement scale. All belief attribute questions were given in randomized order. The belief was repeated in every question, to ensure participants continued to consider the selected belief.

After answering these questions for the first belief, participants were asked, "What are your reasons for believing that [X]? Select all that apply." They then checked off as many as they wanted of 24 candidate reasons for accepting something as true, including all 19 items used in Study 1 plus an additional five distractor items (e.g., "I saw it happen"), all presented in randomized order. We used a binary yes/no format as opposed to the 7-point ratings from Study 1 to streamline the task, which was longer than Study 1. Then, to create a single score for each category of justifications, we aggregated each set of related justifications into a single score ranging from 0 to 1 by dividing the number of checked items by the number of candidate justifications in that category, to yield a proportion of possible justifications within each category that participants, on average, endorsed.

Finally, participants answered the same set of demographic questions as in Study 1, including the Short-Form Santa Clara Strength of Religious Faith Questionnaire (Storch et al., 2004).

3.2. Results

As before, composite averages were created for attributes and justification types, as appropriate given high internal reliability (see Table 5). Participants' confidence in the statements from each domain were not significantly different, suggesting that our strategy for equalizing degree of belief across domains was successful, $t = -0.859$ (281), $p = .39$. This was crucial since we wanted to capture differences due to domain, not differences due to different levels of confidence.

3.2.1. Domain differences

To conceptually replicate the finding from Study 1 that participants accept different justifications for belief in different domains, this time considering specific beliefs matched for confidence, we investigated within-subject differences in endorsed justifications between religious and scientific domains. For each set of justifications, we fit a multilevel model predicting participant endorsement of those justifications. Domain (science vs. religion) was included in the model as a fixed effect (dummy coded, with science as the reference group), with random intercepts included for the participant. There was a significant overall effect of domain for scientific, religious, ethical, and intuitive justifications (see Table 6 and Fig. 2). These results support our findings from Study 1.

Analogous multilevel models predicting participant ratings of each belief attribute (averaged across 2–4 items for each attribute) indicated that participants put significantly greater personal importance on religious beliefs as opposed to scientific beliefs, and they viewed scientific beliefs as more open to revision and more objective than religious beliefs (see Table 6 and Fig. 3).

Table 6
Multilevel model showing differences between religious and scientific beliefs in Study 2

	b	*CI*	χ^2(df = 1)
Justifications			
Scientific Just.	.60	[.53, .67]	40.72***
Religious Just.	−.40	[−.50, −.30]	20.94***
Affiliative Just.	−.02	[−.07, .03]	0.96
Ethical Just.	−.17	[−.25, −.09]	11.47***
Intuitive Just.	−.47	[−.55, −.38]	29.34***
Explanatory Just.	−.08	[−.21, .04]	1.88
Attributes			
Confidence	.73	[−1.13, −.33]	9.22**
Openness to Revision	.56	[−.96, −.16]	6.46*
Personal Importance	−1.41	[.99, 1.85]	17.47***
Perceived Objectivity	.61	[.26, .96]	8.28**

Note. Comparison category is religion, that is, positive coefficients indicate greater use/endorsement in science than religion; negative coefficients indicate the opposite.
*$p<.05$; **$p<.01$; ***$p<.001$.

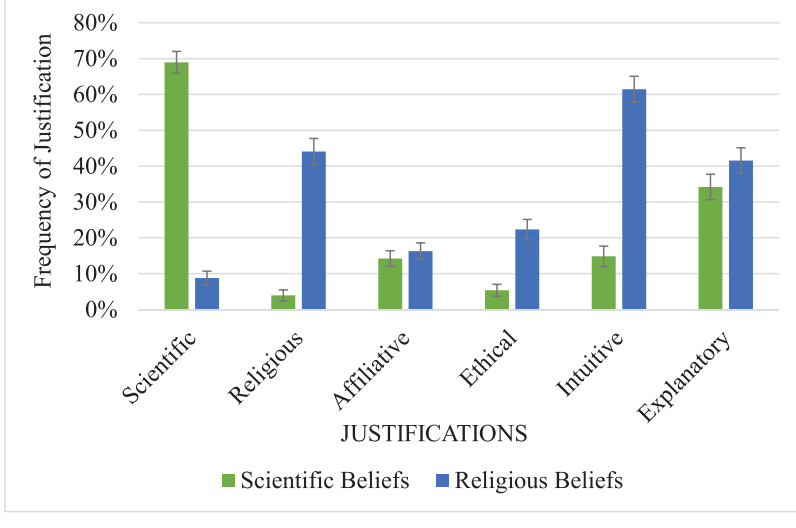

Fig 2. Justifications used to support each belief in Study 2.
Note. Error bars show standard errors.

3.2.2. Correlations

We next investigated the relationships between justifications for belief and belief attributes within the domains of science and religion, separating by domain (see Fig. 4). The two domains showed some similarities, but also differences. Beliefs of greater personal importance tended to be seen as more justified by religious, ethical, intuitive, and explanatory jus-

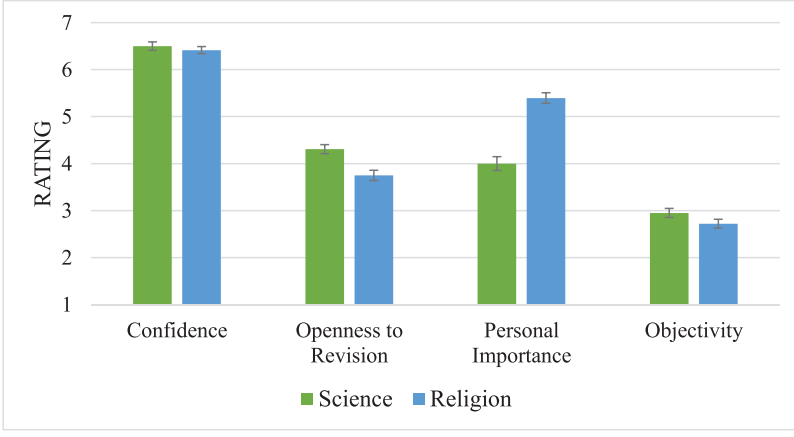

Fig 3. Attributes of beliefs across domains in Study 2.
Note. Error bars show standard errors. Agreement shows the average across items within each scale.

tifications (but not scientific ones) in both domains. Perceived objectivity of religious beliefs (but not scientific ones) correlated positively with the use of religious and ethical justifications. Meanwhile, in the science domain, objectivity correlated only with scientific and explanatory justifications.

The use of nonscientific justifications (religious, affiliative, ethical, and intuitive) correlated strongly in both domains, with correlations ranging as high as $r = .57$ for affiliative, ethical, and intuitive justifications in the science domain, indicating that participants who endorsed some nonscientific justifications were much more likely to endorse other nonscientific justifications. Explanatory justifications tended to correlate with the endorsement of other justifications, with the exceptions of religious and ethical justifications for science and scientific justifications for religion. Confidence increased with religious and intuitive justifications in religion. Personal importance correlated positively with perceived objectivity in both domains, but more strongly for religious beliefs.

3.3. Discussion

Offering a conceptual replication of the findings of Study 1, Study 2 found clear domain differences in how scientific and religious beliefs were justified, even for specific beliefs held by an individual with equal confidence. Beliefs about religion were more often justified by religious and ethical criteria, while beliefs about science were more often justified by scientific criteria. The use of explanatory and affiliative justifications was not significantly different across domains.

Study 2 goes beyond Study 1 in showing that beliefs in science were also rated as less personally important, more open to revision, and more objective than beliefs in religion, as predicted. Moreover, the use of different justifications was related to these other attributes of particular beliefs, including confidence, personal importance, openness to revision, and per-

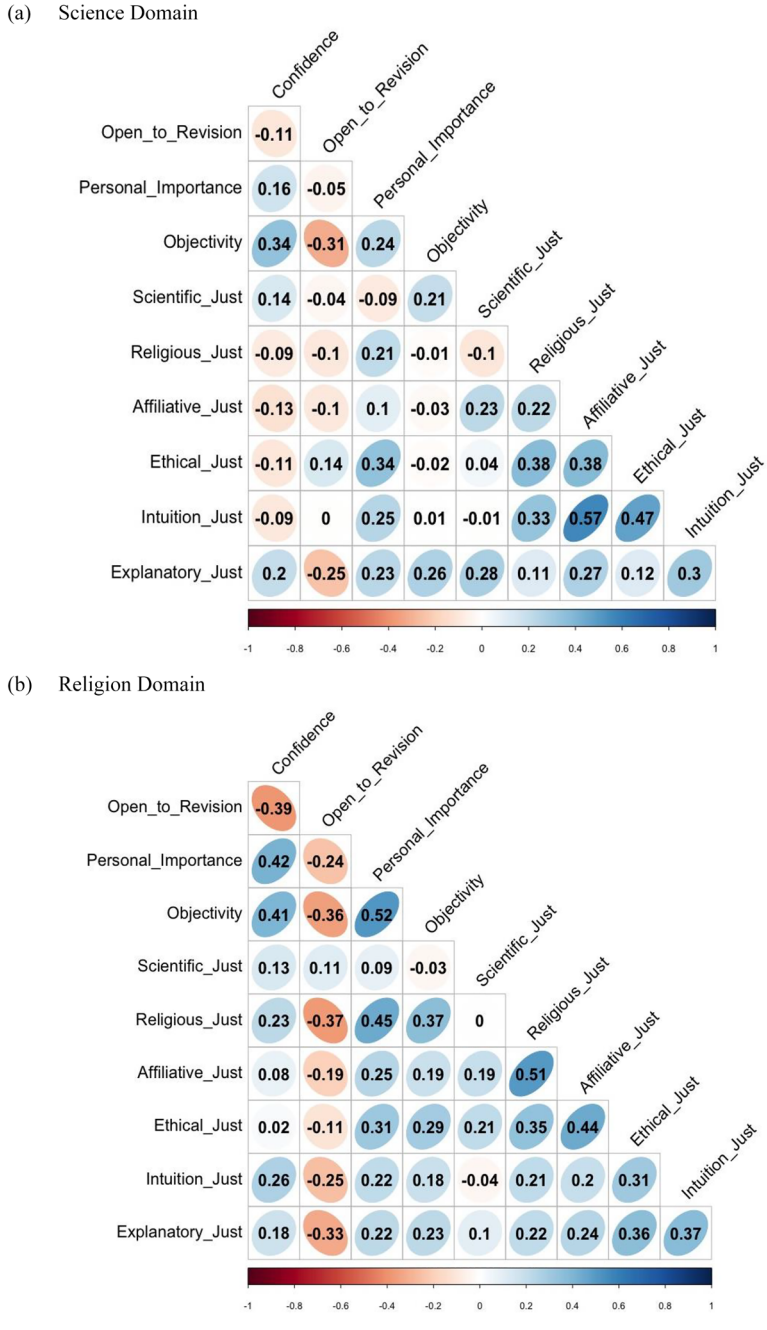

Fig 4. Pearson's correlations between attributes for belief and justifications within domains in Study 2. *Note*. All correlations above .2 are significant at $p<.05$, above .25 significant at $p<.01$.

ceived objectivity, even within domains. These findings are broadly consistent with theoretical proposals that different kinds of beliefs are held and treated differently. For instance, consistent with Tetlock (2002)'s "intuitive theologian," whose goal is social cohesion, religious beliefs, but also those higher in personal importance, tended to cluster with lower openness to revision and with nonscientific justifications. And consistent with Tetlock's "intuitive scientist," whose goal is accurate understanding, scientific beliefs were associated with higher openness to revision. For the most part, we see these patterns not only between but also within domains, bolstering the evidence from Metz et al. (2018) of significant individual differences in the use of different epistemic frameworks.

4. Study 3

Having established features of the epistemic landscape that vary between canonical beliefs in religion and science, we turn in Study 3 to testing where politically contentious scientific beliefs (such as evolution and climate change) fall in comparison. While such beliefs are scientific in content, they may occupy a functional role more akin to that of religion, insofar as they are driven more by social and ideological factors rather than exposure to scientific evidence (e.g., Lewandowsky, Gignac, & Oberauer, 2013, 2019). For example, Kahan (2014, 2016; Kahan et al., 2012) argues that if the "intuitive scientist" is the normal way of approaching beliefs about scientific entities, then greater scientific knowledge ought to predict greater acceptance of scientific consensus, regardless of political or religious affiliations. Contrary to this prediction, higher performance on Kahan's Ordinary Science Intelligence (OSI) test, which includes items on general science knowledge and scientific methodology, predicted greater polarization on politically fraught scientific issues like evolution and climate change. That is, higher understanding among liberals predicted greater acceptance, but among conservatives, higher understanding predicted *lower* acceptance. This suggests that these beliefs may reflect the operation of social or emotional motivations to rationalize beliefs that are ultimately held for nonscientific reasons, even though they contain scientific content.

Beliefs about contentious scientific topics (e.g., vaccination, evolution, and cannabis) thus offer an opportunity to pull apart the domain of a belief from its functional role. If domain per se is what determines how beliefs are justified and the attributes of those beliefs (openness to belief revision, personal importance, objectivity), then beliefs about contentious science should pattern similarly to beliefs about noncontentious science. By contrast, if the functional role of a belief is more important than its domain (which merely tends to correlate with functional role), then we should expect beliefs about contentious science to differ from beliefs about noncontentious science, and for the differences to be such that beliefs about contentious science are closer to the profile for religious beliefs. We expect these patterns to be most pronounced for those who hold beliefs against the scientific consensus; such beliefs are likely to have more religious or ideological attributes (i.e., more nonscientific justifications, higher personal importance, and lower perceived objectivity), versus those who hold beliefs consistent with the scientific consensus, which are likely to have more scientific attributes (i.e., fewer nonscientific justifications, lower personal importance, and higher perceived objectivity and

openness to revision). However, it is also possible that even those who agree with the scientific consensus do so in part for ideological rather than purely scientific reasons. For example, many of those who accept evolution may do so primarily because their friends and family accept evolution and because they identify with a scientific worldview, rather than because they appreciate the force of the evidence.

In order to investigate beliefs that both align and misalign with scientific consensus concerning contentious issues, we include a "pro" and a "con" version of each belief, where "pro" refers to the consensus position. For example, the pro belief for climate change is "The climate is being affected by human activities, past and present"; the corresponding "con" belief is, "The climate is NOT being affected by human activities, past or present." For a complete design, we also include pro and con versions of noncontentious science (e.g., pro: "The center of the Earth is very hot"; con: "The center of the Earth is very cold") and for religion (e.g., pro: "There is a God"; con: "There is no God"), where "pro" in this case refers to the religious consensus. Including both pro and con beliefs in the domain of religion offers an additional opportunity to dissociate the effects of domain from those of functional role. If religious content per se shifts the justifications for or attitudes toward beliefs, then pro and con religious beliefs might look very similar. After all, it is difficult to acquire scientific evidence either way about most claims about religion, be they faith-based or skeptical. On the other hand, if the functional role is crucial, we might expect con religious beliefs to pattern more similarly to science, given that they are less likely to constitute a community or identity.

4.1. Methods

4.1.1. Participants

We recruited 291 adult participants via MTurk, again restricting to 12 states with relatively religious populations. Of these, 218 agreed or strongly agreed with at least one belief from each of the three domains (see below for details). Since only these participants can be analyzed fully, the remaining demographic statistics are given for this subset. This yielded a sample that was 54% female, 45% male, 0.4% other, ranging from under 21 to over 70 with median and mode in their 30s. Education ranged from nonhigh school graduate to doctorate degrees, with median and modal participants holding a bachelor's degree. Participants represented the entire range of the political spectrum, with a slight conservative bias (averaging 3.2 for social issues, 3.0 for political issues on a 5-point scale on which 5 is "very conservative"). The modal religion was Catholicism, with 24.3% of participants; other Christians included Mainline Protestant (17.4%), Evangelical (4.6%), and Other Christian (8.7%). There were a few participants (0.5–3%) from Islam, Judaism, Buddhism, Latter-Day Saints, and Orthodox, while 6.9% described themselves as Spiritual. About 27% said they were not religious, with 9.2% marking Atheism, 8.7% Agnosticism, and 8.7% "nothing in particular."

4.1.2. Design

Participants were first asked to choose the claim for which they held the strongest belief from each of the three lists (order of lists randomized). The *Religious Beliefs* list thus contained five items about religion, including both "pro-religion" and "con-religion" versions

of each belief for a total of 10 options (e.g., "There is a God" *and* "There is no God"). The *Scientific Beliefs* list contained five items about noncontentious science, again with each in a positive form ("pro-science") and its reverse ("con-science") for a total of 10 options (e.g., "The Earth goes around the Sun" and its nonscientific consensus opposite, "The Sun goes around the Earth"). The *Contentious Scientific Beliefs* list contained a science-consistent belief ("pro-science") and a science-inconsistent belief ("con-science") on five science topics for which there is a scientific consensus but remaining public contention: GMOs, vaccines, climate change, evolution, and marijuana. See Table 7 for a complete list of beliefs. We included items for which liberals sometimes hold the counter-scientific belief (GMOs, vaccines) as well as items for which conservatives are more likely to hold the counter-scientific belief (climate change, evolution) in order to find beliefs for which participants across the political spectrum would feel strongly (Hamilton, 2015; Hornsey, Harris, Bain, & Fielding, 2016; Lewandowsky et al., 2013; Scott, Inbar, & Rozin, 2016).

This process yielded each participant's strongest-held beliefs in each of the three categories (Religion, Non-Contentious Science, and Contentious Science). Participants then rated how strongly they agreed with each of the three statements they had chosen on a 7-point scale. This process allowed us to control for remaining differences in how strongly beliefs were held across categories.

Once agreement with the three chosen beliefs was confirmed, participants rated each of the three on the same belief attribute rating scales used in Study 2, including items on confidence, openness to revision, personal importance, and objectivity. The sequence of beliefs and questions was randomized, but the set of questions about each belief was asked as a block, so that participants could think carefully about their attitudes toward one belief at a time.

Next, participants were asked to consider 23 possible reasons for each of their three beliefs on a 4-point scale (1 = "Not a reason" to 5 = "A very strong reason"), dropping a distractor item from Study 2. Again, the sequence of beliefs and candidate reasons was randomized.

Finally, participants responded to the same set of demographic questions as in Studies 1 and 2. The demographic questions were finished, as in earlier studies, with the Brief Santa Clara Religiosity Scale (Storch et al., 2004).

4.2. Results

4.2.1. Distribution of beliefs

In the domains of religion and noncontentious science, a majority of participants chose the same statements: "There is a God" for religion (55%), and "The Earth goes around the Sun" for noncontentious science (66%). The remaining participants were spread across the remaining statements (see Table 7). Only 18% (41 participants) chose one of the counter-scientific consensus statements for contentious science.

An aim of the design was to identify, for each participant, equally strongly held beliefs in each of the three domains. Of the 291 participants, 218 "agreed" or "strongly agreed" with their chosen claims in all three domains. Of these, 129 participants "strongly agreed" with all three. Rates of agreement differed slightly across domains: for the religious beliefs, 67% "strongly agreed" with their chosen claim, and another 22% "agreed"; only 2% did not

Table 7
Candidate beliefs about religion, noncontentious science, and contentious science in Study 3

Beliefs about religion	Noncontentious science beliefs	Contentious science beliefs
1a. There is a God. (55%)	1a. The Earth goes around the Sun. (66%)	1a. GMOs (Genetically Modified Organisms) are safe to eat. (7%)
1b. There is NO God. (8%)	1b. The Sun goes around the Earth. (4%)	1b. GMOs (Genetically Modified Organisms) are NOT safe to eat. (6%)
2a. Human beings have souls. (16%)	2a. The Moon causes tides. (5%)	2a. Vaccines are beneficial for children's health. (24%)
2b. Human beings do NOT have souls. (0.5%)	2b. The Moon does NOT cause tides. (0)	2b. Vaccines can cause autism. (3%)
3a. There is a life after death. (4%)	3a. The center of the Earth is very hot. (4%)	3a. The climate is being affected by human activities, past and present. (22%)
3b. There is NO life after death. (6%)	3b. The center of the Earth is very cold. (0)	3b. The climate is NOT affected by human activities, past or present. (3%)
4a. Miracles really happen. (3%)	4a. Continents move very slowly. (3%)	4a. Humans evolved by natural selection from earlier species. (12%)
4b. Miracles never happen. (.5%)	4b. Continents do not move at all. (1%)	4b. Humans did NOT evolve by natural selection from earlier species. (6%)
5a. Prayer works. (3%)	5a. Infections can be caused by bacteria or viruses. (18%)	5a. Marijuana can benefit people with certain medical conditions. (17%)
5b. Prayer does not work. (6%)	5b. Infections are never caused by either bacteria or viruses. (0)	5b. Marijuana CANNOT benefit anyone, no matter what their medical condition. (.5%)

Note. All participants saw all 30 statements, choosing the one from each list that they believed most strongly. All items include an approximate inverse (a's & b's), to avoid leading questions and to maximize the chances that every participant would find a belief that they held strongly in each domain. Statements marked (a) are either the pro-religious claim (for Religion domain) or the scientific consensus claim (for noncontentious science and contentious science claims), while (b) items are those counter to religion or scientific consensus. Parenthetical percentages show % of participants choosing each statement.

agree. For noncontentious scientific beliefs, 79% "strongly agreed," with 13% "agreeing." For contentious scientific beliefs, 70% "strongly agreed" and 21% "agreed." Similar to our approach in Study 2, we conducted analyses on the 218 participants who "agreed" or "strongly agreed" with all three statements they had chosen.

Because internal reliabilities of sets of justifications and attribute questions were high, we calculated average scores for each type of justification and attribute.

4.2.2. Replication of Study 2 with extension to contentious science

First, we considered only the beliefs identified as "pro," which had the largest sample sizes. This also offers a replication of Study 2, with the addition of contentious science as an additional category of belief. We used domain as a predictor in linear mixed regression ANOVAs, with random intercepts for belief, and with noncontentious science as a reference category.

We looked first for differences in confidence, to check that our method for equating confidence worked. As expected, there were no significant differences in confidence in pro beliefs across domains ($\chi^2 = 1.42$ (df = 2), $p = .49$). This suggests that any subsequently identified differences are due to domain, and not confidence.

The differences between science and religion observed in Study 2 in personal importance (with religion higher) and objectivity and openness to revision (with religion lower) replicated (see Fig. 5 and Table 8). Meanwhile, contentious science emerged as significantly different from noncontentious science in both personal importance (higher for contentious beliefs, as predicted) and openness to revision (also higher for contentious beliefs, counter to our prediction).

We repeated this analysis comparing endorsement of justifications across domains, within pro-consensus subset of beliefs (see Table 9). Differences in the use of scientific, religious, and intuition-based justifications between science and religion replicated. Plausibly no significant differences appeared between contentious and non-contentious science because these analyses include only pro-scientific consensus beliefs.

4.2.3. Pro/con belief attribute comparisons

We ran likelihood ratio tests on the effect of pro/con belief within each domain (again with a random intercept for belief subject). Among beliefs about religion, pro-religious beliefs were rated as significantly more personally important than con-religious beliefs ($\beta = .79$, $\chi^2(1) = 21.78$, $p < .001$). However, there was no evidence for a significant difference in the personal importance of pro versus con beliefs in the science domain or the contentious science domain. For confidence, there was a significant difference between pro-science beliefs and con-science beliefs for noncontentious science, ($\beta = .92$, $\chi^2(1) = 7.27$, $p = .007$), with participants reporting greater confidence in pro-science beliefs than con-science beliefs (unsurprising since the latter are due mainly to ignorance). However, there was no evidence for a significant difference in participants' confidence about pro versus con beliefs in the contentious science domain or the religion domain (see Table 10 and Fig. 6).

Table 8
Multilevel models predicting attributes of belief in Study 3

	Openness to revision		Personal importance		Objectivity	
	b [CI]	χ^2 *(df = 2)*	*b [CI]*	χ^2 *(df = 2)*	*b [CI]*	χ^2 *(df = 2)*
Domain: Religion	−1.03 [−1.61, −0.44]	14.03***	0.36 [−0.17, 0.88]	10.92**	−0.93 [−1.69, −0.19]	8.23*
Domain: Contentious science	−1.24 [−1.81, –0.67]		−0.64 [−1.16, –0.13]		−.19 [−0.55, 0.92]	

Note. All CIs are 95%. These models are based on ANOVAs using contentious science as a reference category, analyzing only pro-consensus beliefs (both pro science and pro religion). The models included a random intercept for belief.

*$p<.05$; **$p<.01$; ***$p<.001$.

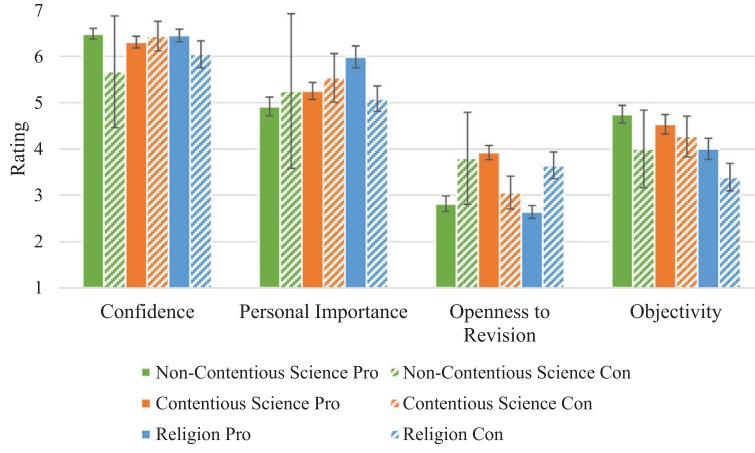

Fig 5. Belief attributes by domain in Study 3.
Note. Error bars show 95% CIs.

Table 9
Multilevel model showing domain differences for pro-consensus beliefs in Study 3

	Domain: Religion			*Domain: Noncontentious science*	
	b	*95% CI*	$\chi^2(\text{df} = 2)$	*b*	*95% CI*
Justifications					
Scientific Just.	−1.40	[−1.73, −1.05]	33.14***	0.28	[−0.05, 0.62]
Religious Just.	0.82	[0.19, 1.45]	10.04**	−0.30	[−0.93, 0.32]
Affiliative Just.	0.31	[−0.21, 0.82]	2.64	−0.11	[−0.62, 0.39]
Ethical Just.	0.16	[−0.30, 0.62]	5.24	−0.39	[−0.83, 0.06]
Intuitive Just.	0.97	[0.74, 1.23]	25.05***	−0.08	[−0.30, 0.14]
Explanatory Just.	0.22	[−0.19, 0.63]	1.18	0.09	[−0.32, 0.49]

Note. These models are based on ANOVAs using contentious science as a reference category, analyzing only pro-consensus beliefs and including a random intercept for belief.
***indicates $p < .001$; **$p < .01$.

4.2.4. Pro/con justification differences

We subsequently ran likelihood ratio tests on the effect of pro/con within each domain on justifications (again with a random intercept for belief; see Table 11). The pro/con distinction was greatest for beliefs in the domain of religion: pro-religious beliefs were more likely to be justified by appeal to religious, intuitive, affiliative, and explanatory criteria. For contentious science, only religious and scientific justifications were significantly different across pro and con, with religious justifications used more frequently for beliefs against scientific consensus and scientific justifications being used more frequently for beliefs that aligned with scientific consensus. For noncontentious science, scientific justifications were more frequent for pro beliefs, while religious and ethical justifications were more common for con beliefs.

Table 10
Pro/con comparisons of belief properties in Study 3

Properties	*b*	*[95% CI]*	χ^2 *(df = 1)*
Science Domain			
Confidence	0.922	[0.25, 1.59]	7.269**
Open to Revis.	−1.173	[−2.27, −0.08]	4.375*
Personal Import	−0.379	[−1.29, 0.51]	.720
Objectivity	0.672	[−0.39, 1.73]	1.561
Contentious Science Domain			
Confidence	−0.131	[−0.45, 0.19]	.664
Open to Revis.	1.103	[0.60, 1.58]	18.52***
Personal Import	−0.218	[−0.65, 0.16]	1.401
Objectivity	0.265	[−0.25, 0.78]	1.034
Religion Domain			
Confidence	−0.353	[−0.017, −0.614]	3.44
Open to Revis.	−0.804	[−1.31, −0.31]	9.854**
Personal Import	0.794	[0.47, 1.12]	21.78***
Objectivity	0.419	[−0.06, 0.90]	2.90

Note. CI indicates 95% confidence intervals, calculated using likelihood ratio tests, with belief topic as a random intercept and Pro as baseline (such that positive coefficients indicate greater agreement for pro than con beliefs, and negative coefficients indicate greater agreement for con than pro beliefs).

*indicates $p<.05$; **$p<.01$; ***$p<.0001$.

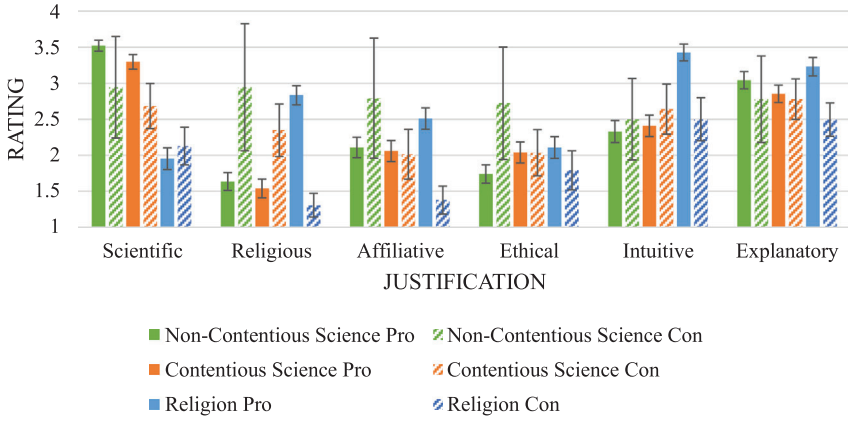

Fig 6. Use of justifications across domains in Study 3.
Note. Error bars show 95% CIs.

4.2.5. Correlations

The correlations from Study 2 generally replicated, across both pro- and con-consensus beliefs (see Fig. 7). We predicted that belief attributes and justifications would form similar clusters within as well as between domains. Indeed, patterns of correlation appeared similar across the domains in most respects, with a few notable differences. Strong correlations

Table 11
Pro/con comparisons of justifications in Study 3

Justifications	*b [95% CI]*	χ^2 *(df = 1)*
Religion		
Scientific	−0.17 [−0.52, 0.17]	1.05
Religious	1.47 [1.19, 1.75]	87.73***
Affiliative	1.16 [0.84, 1.48]	46.56***
Ethical	0.33 [0.02, 0.64]	4.30*
Intuitive	0.91 [0.65, 1.20]	36.42***
Explanatory	0.71 [0.42, 1.00]	22.28***
Noncontentious science		
Scientific	0.52 [0.10, 0.95]	5.72*
Religious	−1.39 [−2.06, −0.73]	15.23***
Affiliative	−0.79 [−1.56, −0.03]	3.77†
Ethical	−1.04 [−1.71, −0.36]	7.83**
Intuitive	−0.11 [−0.94, 0.72]	.05
Explanatory	0.18 [−0.49, 0.85]	0.29
Contentious science		
Scientific	0.67 [0.39, 0.94]	22.02***
Religious	−0.75 [−1.13, −0.42]	18.34***
Affiliative	0.06 [−0.32, 0.41]	0.06
Ethical	0.04 [−0.40, 0.31]	0.092
Intuitive	−0.24 [−0.62, 0.12]	1.50
Explanatory	0.21 [−0.10, 0.51]	1.67

Note. Results from mixed likelihood tests of pro/con comparisons within each domain, with con as baseline such that positive coefficients indicate greater use in pro than con beliefs, negative coefficients indicate greater use in con than pro.

†indicates $p<.055$; *$p<.05$; **$p<.01$; ***$p<.001$.

emerged across all three domains of belief between the personal importance of the belief and the use of nonscientific justifications (i.e., religious, affiliative, intuitive, ethical, and even explanatory power). Nonscientific justifications correlated with confidence in religion, but not in science.

The most marked contrast (as usual) was between the noncontentious science and religion domains. In religion but not in science, the greater the use of religious or intuitive justifications for a belief, the lower the belief's openness to revision. As in Study 2, personal importance predicted higher objectivity in religion and moderately in contentious science, but not in noncontentious science.

4.3. Discussion

Study 3 found meaningfully different profiles for beliefs about noncontentious science, contentious science, and religion in a within-subjects design, indicating significant differentiation regarding how people hold and justify beliefs not only across domains but also within them. Contentious science was higher than noncontentious science in both personal importance (as expected) and openness to revision (which was not expected). A candidate

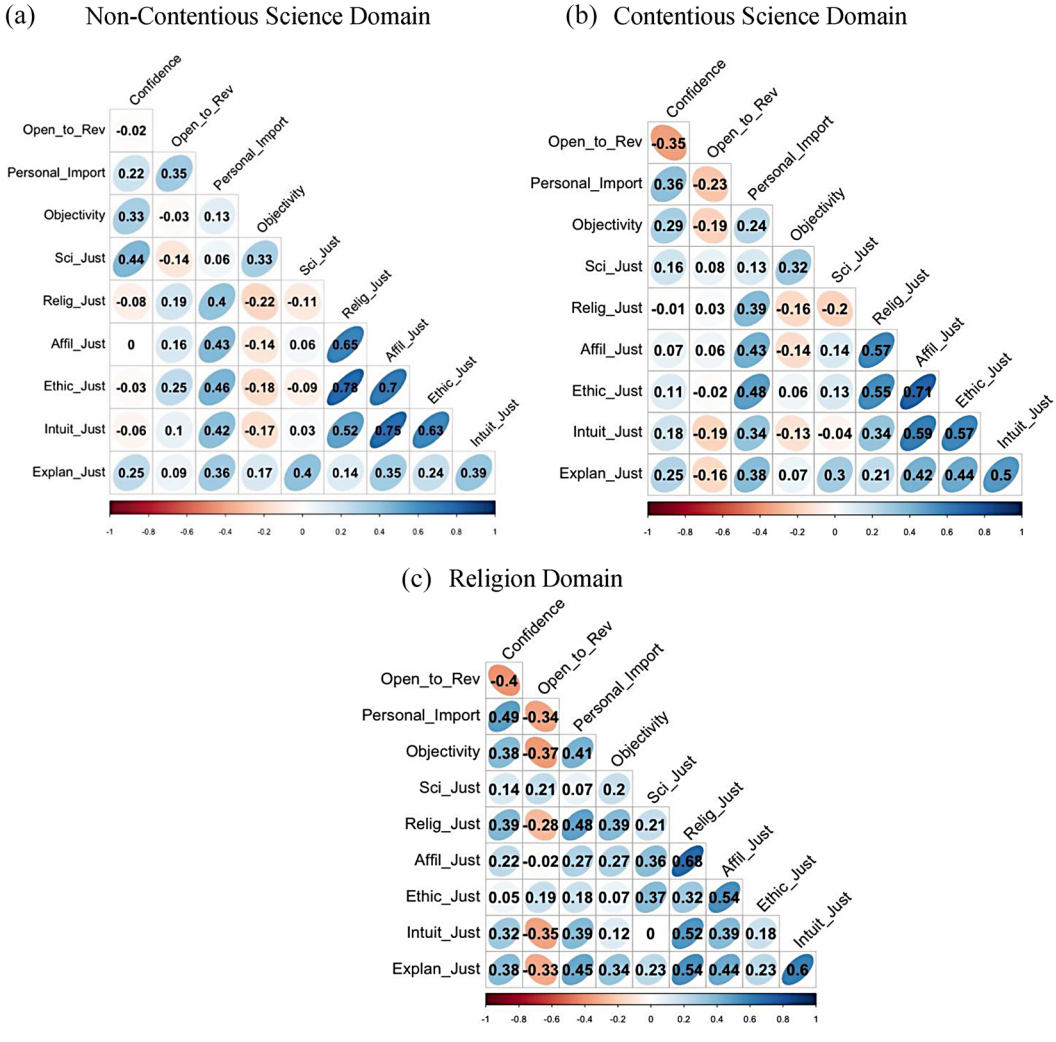

Fig 7. Pearson's correlations within domains.
Notes. Correlations above $r = .18$ are statistically significant at $p<.01$. Labels: Open_to_Rev = Openness to Revision, Personal_Import = Personal Importance, Sci_Just = Scientific Justifications, Relig_Just = Religious Justifications, Affil_Just = Affiliative Justifications, Ethic_Just = Ethical Justifications, Intuit_Just = Intuitive Justifications, Explan_Just = Explanatory Justifications.

explanation for the latter result is that for most people, who are not at the frontlines of the science communication battles, an awareness that there is disagreement about an issue may be enough to make them more open to revision. However, this only seems to be true for beliefs supporting the scientific consensus, and not for beliefs against the scientific consensus (see Section 4.3.3 and Fig. 5). Most importantly, Study 3 found support for the prediction that politically contentious scientific beliefs that go counter to scientific consensus (e.g., denying

anthropogenic climate change) pattern differently from noncontentious scientific beliefs or from politically contentious scientific beliefs that are in line with scientific consensus (e.g., accepting anthropogenic climate change), where the former beliefs differ from the latter in being more similar to the profile typically seen for religious beliefs. This is consistent with the idea that a belief's functional role in human cognition—rather than its domain per se—partly determines its epistemic profile.

There were also differences within domain between pro and con beliefs, supporting the evidence from Metz et al. (2018) that individuals' epistemic tendencies predict their beliefs. Those beliefs justified by scientific criteria tended to be perceived as more open to revision and less personally important, while beliefs justified by nonscientific criteria (such as affiliation, intuition, ethics, and religion) tended to be perceived as less objective, less open to revision, and more personally important. However, these patterns showed some variability across domains. For example, personal importance predicted higher openness to revision in non-contentious science, but lower openness to revision in the other two domains. These data suggest that when examining correlations between different properties of beliefs, it may be important to consider the domain. Beliefs on different subjects can be treated in importantly different ways.

5. General discussion

Taken together, this research suggests that beliefs differ across domains in openness to revision, personal importance, and perceived objectivity, as well as being justified and evaluated on the basis of different criteria (conceptually replicating Metz et al., 2018 and Shtulman, 2013). Scientific beliefs are judged to be more open to revision, more objective, and less personally important, while being justified on the basis of scientific rather than religious, intuitive, affiliative, or ethical criteria. In contrast, religious beliefs are judged to be more personally important, less objective, and less open to revision, while being justified primarily on the basis of religious, intuitive, affiliative, and ethical criteria. Finally, politically contentious scientific beliefs fall in between these two, bearing some resemblance to non-contentious science but with higher personal importance and, when corresponding with the scientific consensus, greater openness to revision. This makes sense, since a scientific issue is unlikely to become a subject of public controversy unless nonscientists consider it personally important, while openness to revision is likely to lead to adjustment toward the scientific consensus.

Why do these domain differences in justifications for belief and belief attributes arise? Because our studies are observational, we cannot speak directly to the causal connections that are likely to hold between belief justifications and attributes. It could be that beliefs grounded in affiliative, ethical, and intuitive justifications tend to be regarded as personally important because community, ethics, and authenticity are themselves regarded as personally important. Or, conversely, perhaps personally important beliefs come to be justified on the basis of more unfalsifiable and therefore stable considerations (for evidence, see Friesen et al., 2014). Future

work can aim to disentangle the causal connections between the associations we document here.

We do think our findings offer some evidence for the importance of a belief's functional role, as distinct from the domain of its content. For instance, the claims that climate change is or is not caused by human activity are both scientific in content, though only one corresponds to the current scientific consensus. And the claims that God does or does not exist both contain religious content, though only the former is regarded as canonically religious. Study 3 finds that these pairs of beliefs differ systematically from each other in their justifications and attributes, and these differences make sense on the view that the characteristics of belief derive from their functional role.

Appealing to beliefs' functional roles is somewhat analogous to Tetlock's (2002) intuitive scientist versus theologian, but with a broader conception of each role and a focus on the practices and norms for belief justification and revision within each mode of cognition (see Cusimano & Lombrozo, 2021a, for relevant discussion). Our approach also bears similarities to Van Leeuwen's (2014, 2023) distinction between different cognitive attitudes (see also Davoodi & Lombrozo, 2022a, 2023).

One way to think about these contrasts is in terms of epistemic frameworks cued by different contexts, domains, and individual habits, each consisting of a cohesive set of norms, justifications, attitudes, and functions. The correlations among belief properties and justifications described above may suggest such coherent structures. It makes sense that beliefs held on the basis of affiliation, intuition, religion, and ethics may be held with greater personal importance and lower openness to revision, since these justifications are highly personal and do not often change. Meanwhile, scientific beliefs, insofar as they aim to track shared objective reality accurately, ought to be subject to revision in light of novel evidence, even or perhaps especially when they are personally important.

How might our findings shed light on reasoning and action on the basis of politically contentious beliefs? Because few people are explicitly aware of their epistemic frameworks (though see Cusimano & Lombrozo, 2021b, 2023, for cases in which participants show some metacognitive awareness), they may make mistakes in applying, for example, a religious epistemic framework to a scientific issue such as whether vaccines are safe. Such conflicts may lead to problematic reasoning, such as basing a belief that vaccines cause autism on the beliefs of one's friends and family. This poor reasoning in turn could lead to maladaptive beliefs and behaviors (here, not vaccinating one's children).

Though the evidence is consistent with this account, the present observational studies cannot demonstrate causality. While it is plausible that the use of particular justifications leads to accepting particular beliefs in particular ways, it is also plausible that the whole complex—endorsed justifications, beliefs, and attributes of beliefs—are acquired together from social influences. Beliefs that people bring to the lab are typically difficult to change, making causal claims about belief formation and revision difficult to study experimentally. We did not take on the challenge of changing people's meaningful beliefs in the context of a study (for both ethical and practical reasons), but it would be of great interest to observe people actually changing their beliefs in light of new evidence or authority. Given ethical constraints, an interview design might be a good initial step in this direction.

The importance of social influences makes it particularly important to acknowledge the limitations of this WEIRD (Western, Educated, Industrialized, Rich, Democratic; Henrich, Heine, & Norenzayan, 2010) sample. As in most Western studies, the religious sample is limited primarily to Christians, with too few representatives from other major religions to compare. It is more than plausible that followers of other religions might exhibit different epistemic profiles. For example, Christianity's emphasis on faith may be a cause of the strong negative associations with openness to revision, which might not replicate with Hindu or Buddhist populations. Moreover, this sample was drawn entirely from residents of the United States, and it is plausible that nations differ in epistemic norms just as they do in social norms. Indeed, the individual variation found within this American sample suggests that cross-cultural variation is likely.

Further research will also require recruiting a larger number of participants who believe strongly in a nonscientific consensus position. The fact that a plurality of participants who chose a nonscientific consensus position chose antievolution (12% of the sample) is also a significant limitation of this research, since creationism has much stronger religious aspects than most contentious scientific issues and this may have inflated differences. Nevertheless, these studies offer strong evidence that not only are beliefs in different domains based in different justifications, but they also have different properties. Moreover, even beliefs within the same domain can be based on different justifications, often corresponding with their levels of personal importance, openness to revision, and perceived objectivity.

Another direction for future research concerns the role of explanatory justifications across domains and epistemic frameworks. We found minimal differences across domains and types of beliefs in the extent to which the following were regarded as good bases for belief: "It explains a lot of things really well" and "It's the best explanation for some things." However, it remains possible that the nature of the explanation itself differed across domains or types of beliefs. For example, participants may have held explanations in different domains to different evidential standards (Davoodi & Lombrozo, 2022a), or expected them to play different explanatory roles (e.g., as mechanical vs. functional explanations, Brewer, Chinn, & Samarapungavan, 1998).

We hope that a better understanding of the different epistemic frameworks used for beliefs can aid science communicators and educators when discussing publicly contentious but scientifically settled issues, such as climate change, GMOs, and vaccination. It may be necessary to persuade listeners that these particular issues are better examined and held according to a scientific epistemic framework than a religious one. If this perspective shift is achieved, the evidence and scientific consensus might have a greater impact on beliefs. The finding that context (place of worship vs. laboratory) entirely cues domain (religion vs. science) suggests that the choice of epistemic frameworks may be guided largely by habit and association, rather than deliberate reflection. It may be the case that simply becoming more conscious and deliberate about our epistemic frameworks, in part through learning about the nature of science and why it is an effective way of knowing about particular entities, may help us become more adept at applying our epistemic frameworks appropriately.

In any case, it seems clear that not all beliefs are held in the same way, and that the type of belief is partly determined by (or determines) the justifications used to ground it. This

fits with previous conceptual and empirical work on epistemic similarities and differences across domains. Further research is needed to investigate the social and cognitive factors that influence people's choice of justifications. It is our hope that a better understanding of how people hold and justify their beliefs will enable teachers of critical thinking to empower their students to form and maintain more accurate beliefs that support good decisions.

Note

1 Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, North Dakota, Oklahoma, South Carolina, South Dakota, Tennessee, Utah, and West Virginia. Texas and North Carolina are also among the most Christian states, but in the previous research, many of the participants from these states were secular liberals from the big cities, so we excluded them. See Pew Research Center (2014) for details.

Acknowledgments

This project was made possible through the support of a grant from the John Templeton Foundation (61100). The opinions expressed in this publication are those of the authors and do not necessarily reflect the views of the John Templeton Foundation. A subset of this work was presented at the 2019 meeting of the Society for Philosophy and Psychology.

Conflict of interest statement

The authors have no known conflict of interest to disclose.

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table S1 Instructions for each condition of Study 1