

# 9 Scientific and Religious Explanations, Together and Apart

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What happens after we die? *“After we die, I think that our body begins to rot and decompose. I also think that our soul leaves our body. I think our soul goes to either heaven, purgatory, or hell.”*

Why do we die? *“We die because our time on earth is up. We die because it is time to be reunited with loved ones in heaven. We die because our bodies and organs deteriorate over time.”*

Why do natural disasters happen? *“Natural disasters happen because of events that usually occurred millions of years ago. Those events cause other events over time until it culminates in a particular event now . . . What puts those events into action in the first place though is God.”*

How did the universe come to exist? *“God booted up the system. The fundamental forces loaded. The expansion initiated. All of the programs began to execute.”*

—answers provided by Amazon Mechanical Turk workers in response to existential questions.

As part of a study investigating people’s explanations for the existential, we asked over 350 adults living in the United States to answer questions about life, death, and existence (Davoodi & Lombrozo, 2022). They answered questions such as, “Why is there suffering in the world?” and “How did the universe come to exist?” A group of over 600 other adults also living in the United States then classified these explanations as religious (“religious, supernatural, or spiritual”), scientific (“scientific, natural, or physical”), both, or neither. Across a range of questions, about 10% of explanations were classified as “both,” indicating that the explanation appealed to both religious and scientific elements to explain the existential (see Table 9.1).

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*Table 9.1* Threehundredfifty-eight unique explanations (generated in response to one of five existential questions) were each classified by 20–30 participants for whether they belonged to the domain of religion, science, both, or neither. Columns indicate the percentage of classifications of each type for each question. The final row reports the percentages for the full sample (which is not the same as the average across questions, since different numbers of explanations were available for each question, with a range of 50–129). These data were extracted from the materials associated with Davoodi and Lombrozo (2022). For the complete set of explanations, see <https://osf.io/evms7/>

<i>Existential Questions</i>	<i>Religious/ Supernatural/ Spiritual</i>	<i>Scientific/ Natural/ Physical</i>	<i>Both</i>	<i>Neither</i>
<i>What happens after we die?</i>	39.9%	34.8%	13.4%	11.8%
<i>Why is there suffering in the world?</i>	24.4%	49.7%	8.9%	17%
<i>How did the universe come to exist?</i>	26%	53.6%	11.6%	8.6%
<i>Why do natural disasters happen?</i>	11.6%	74.6%	7.2%	6.6%
<i>Why do we die?</i>	18.3%	60.9%	12%	8.7%
<b>Full sample</b>	<b>24.7%</b>	<b>52.8%</b>	<b>10.4%</b>	<b>12.1%</b>

Our epigraph offers several examples of these “conjunctive” explanations, which we define as explanations that combine elements from more than one explanatory framework (in this case, science and religion).<sup>1</sup>

How should we understand these explanations with both scientific and religious components? For those who endorse the relevant scientific and religious commitments that these conjunctive explanations presuppose, is there a sense in which they are seen as explanatorily *better* than explanations that offer only one of the two components? And if so, is this because the scientific and religious components accomplish different explanatory goals? (If so, which ones?) Or do they jointly achieve the same explanatory goal, but in a better or more complete form? (If so, better or more complete in what way?)

These are the questions we take up in this chapter. Specifically, we propose an account of the psychology of conjunctive explanations that appeals to what we call “partial functional differentiation,” according to which explanations that appeal to both science and religion can achieve a form of (perceived) explanatory superiority by virtue of the fact that each component better satisfies a different explanatory goal. We elaborate this hypothesis further in what follows, but two caveats are worth emphasizing at the outset. First, this is an empirical claim about human psychology, and in particular about the conditions under which certain kinds of (conjunctive) explanations might be preferred. It is not a normative claim

about the explanatory goals one should aspire to, nor about how one ought to evaluate the fulfillment of those goals. As a result, our claims (on their own) do not identify the conditions under which conjunctive explanations *should* be preferred. Second, it is important to note that we do not presuppose that the scientific or religious elements that we consider in candidate explanations (generated by participants or used as stimuli) are in fact true. Instead, we consider explanations from the perspective of an individual generating or evaluating them, and so assumptions about truth or other merits should be understood from the perspective of that individual. Despite these caveats, we think this psychological hypothesis about scientific and religious explanations for the existential might have interesting implications for more general claims about conjunctive explanations and explanatory coexistence, and we discuss these implications in concluding the chapter.

In what follows, we first review evidence for the psychological coexistence of natural and supernatural explanations, and we outline extant models of explanatory coexistence. Then, we ask *why* distinct explanatory frameworks (i.e., natural/scientific and supernatural/religious) coexist, and to answer this question, we discuss two models: functional differentiation and functional overlap. After reviewing relevant evidence, we ultimately endorse a form of partial functional differentiation with implications for accounts of conjunctive explanations.

### **Evidence for the Coexistence of Natural and Supernatural Explanations**

Prior work in psychology and anthropology has found that across a diverse range of cultures, both adults and children tend to explain matters of life and death and questions about the origins of life in terms of entities and processes that are scientific (e.g., physical causal processes) as well as religious (e.g., supernatural agents). For example, children and adults living in rural Madagascar and children in Madrid explained death by appeal to scientific processes (e.g., the cessation of physical processes) and supernatural or religious processes (e.g., the continuation of psychological processes even after death) (Astuti & Harris, 2008; Giménez & Harris, 2005). When asked why someone becomes sick, children and adults from both the US and India endorsed biological causes (e.g., being infected by someone else), psychological causes (e.g., being upset because vacation plans were canceled), and moral causes (e.g., not sharing things with friends) (Gelman & Raman, 2004). When asked to explain serious illnesses (e.g., AIDS), children and adults from peri-urban settlements outside of Johannesburg and from a rural region in South Africa offered both biological explanations and explanations related to witchcraft (Legare & Gelman, 2008). Importantly, these explanations were not always offered by different individuals, offering evidence for what we (and others) call

“explanatory coexistence”: endorsement of multiple (potentially inconsistent) explanatory frameworks by the same individual. Nor were they always offered in different explanations, providing evidence for “conjunctive explanations” as we define them: appealing to elements from more than one explanatory framework within a single explanation (see footnote 1).

Prior work similarly suggests that scientific and religious explanations for the origins of species can coexist and be conjoined, with creationist ideas informing young children’s understanding of evolution (Evans & Lane, 2011). Even with exposure to explicit education about evolution, children and adults incorporate intuitive beliefs about psychology (e.g., goal orientation) and biology (e.g., essentialism) or culturally available frameworks (e.g., creationism) with evolutionary terms or concepts (Evans, Legare, & Rosengren, 2011; Legare, Evans, Rosengren, & Harris, 2012; Evans, 2001). These “synthetic frameworks” (Vosniadou & Brewer, 1992) are found among 5–12-year old US children when reasoning about the origins of species and natural history, although the extent to which one kind of explanation dominates interacts with community beliefs (Evans, 2000). These hybrid models are so ubiquitous that even highly educated US adult museum visitors exhibit both creationist and evolutionary ideas in their open-ended explanations of biological change (Evans et al., 2010). Like explanations for death and disease, explanations for the origin of species similarly reflect natural, scientific, and physical beliefs, as well as supernatural, spiritual, and religious beliefs, either independently or in an integrated form.

Outside of tasks that prompt explicit explanations, there is a great deal of evidence that scientific and religious beliefs coexist and that it is more common to conceptualize them as independent or integrated, versus mutually exclusive. For example, among adults and children in Iran, the existence of both supernatural and scientific unobservable entities (e.g., angels and germs) is presumed at high levels by the same individuals (Davoodi et al., 2019). Moreover, religious values are seen as compatible with the value of science by Iranian adults regardless of level of religiosity (Payir et al., 2018, Payir et al., 2021, Davoodi et al., 2019). This is in contrast to patterns observed among religious adults in the US and in China, where level of religiosity is negatively correlated with the perceived value of science (Payir, 2021). Yet even among US adults, a highly polarized group when it comes to the relative roles of science and religion, a majority endorses the view that religion and science collaborate and support each other, versus being mutually exclusive (Ecklund & Scheitle, 2017). And even among scientists as well as religious individuals, the dominant view seems to be one of cooperation and coexistence between the two explanatory frameworks (Ecklund & Scheitle, 2017; Ecklund, 2010). Thus, there’s little doubt that scientific and religious beliefs coexist within the same individuals and that appeals to both supernatural/religious and

natural/scientific elements in a single explanation are widespread. In the next sections, we turn to models of how and why this conjunction occurs.

### Models of Explanatory Coexistence

Legare and Visala (2011) identify three ways in which natural and supernatural elements are incorporated in explanations: *target-dependent thinking*, *synthetic thinking*, and *integrated thinking*. As the term suggests, “target-dependent thinking” involves the use of natural and supernatural conceptions to explain different aspects of the same phenomenon. For example, as illustrated in the first explanation from the epigraph, explanations for what happens after death can invoke biological beliefs about the fate of the body as well as supernatural ideas about what happens to the soul: each set of beliefs is invoked to explain a distinct target. Evidence for target-dependent thinking also comes from studies with samples across different cultures. For example, adults and children adjust their explanations for life after death to specific narrative contexts that highlight either biological or spiritual aspects of death (Astuti & Harris, 2008; Harris & Giménez, 2005; also see Legare & Gelman, 2008 for context-dependent explanations about illnesses). If the target is biological death, the explanation is tailored to reflect biological ideas about decomposition. If the target is spiritual death, the explanation reflects supernatural themes involving some kind of continuation of life after death. Explanations about origins also exemplify target-dependent thinking. For example, a creationist could explain the origins of human beings by appeal to divine forces, but the origins of other species in evolutionary terms. Thus, although target-dependent thinking supports coexistence, it does not entail the integration of scientific and religious elements to explain the same target.

In contrast to target-dependent thinking, both synthetic and integrated thinking involve at least partial integration of natural and supernatural conceptions within the same explanation. In synthetic thinking, details about how the natural and the supernatural interact are not clearly understood or laid out, whereas in integrated thinking, these interactions are specified. For example, among the explanations from the epigraph, the second lists a number of both natural and supernatural reasons for why we die, but the connection between them is not clear. This is closer to Legare and Visala’s (2011) synthetic thinking. The final two explanations illustrate attempts to provide a story for how the natural and supernatural interact in giving rise to natural disasters or the existence of the universe. This form of integrated thinking has also been found across various cultures (see Evans 2008 and Scott, 2004). In a 2014 Gallup poll, 31% of US adults agreed with the statement “human beings have developed over millions of years from less advanced forms of life, but God guided this process” (Newport, 2014). Explanations like this, where God plays the role of a distant cause that sets more proximate causes into effect, or acts as an occasional corrective, generally

reflect integrated thinking. Other forms of more elaborate integrated explanations include incorporating scientific findings into one's understanding of, and reverence for, the divine. For example, John Van Sloten, a Christian priest, develops sermons in which he elaborately integrates science and belief in God (e.g., “what the nature of the human microbiome teaches us about the nature of God”), asserting (for example) that “creation is filled with revelation; with truths that reflect God’s thinking” (see Van Sloten, 2021).

### **Functional Differentiation vs. Functional Overlap**

The models of explanatory coexistence just reviewed offer a useful taxonomy for *how* science and religion jointly contribute to conjunctive explanations. But they leave us with a further question of *why* distinct explanatory frameworks are coordinated and coexist. In the case of target-dependent coexistence, what is it about particular targets or contexts that call out for scientific versus religious explanations? And in the case of synthetic and integrated thinking, what is it that religion and science each contribute, such that both are included to yield a conjunctive explanation?

Shtulman and Lombrozo (2016) propose a “differential utility” account of explanatory coexistence, according to which multiple, potentially mutually inconsistent explanatory frameworks exist in parallel because they are best suited to achieving different goals and therefore continue to derive cognitive value. By analogy to scientific theories (e.g., Newtonian mechanics versus relativistic mechanics), one framework might yield predictions very quickly that are good enough for many purposes, while another might offer greater accuracy or precision but at greater cognitive cost. Which framework is more appropriate will depend on the particulars of a given situation. Shtulman and Lombrozo consider examples that involve balancing different epistemic goals (e.g., making different kinds of inferences), but the idea of differential utility applies much more broadly. For example, if some explanations are better suited to play social, moral, or emotional roles, they might coexist with explanations that achieve epistemic goals (e.g., accuracy), but not social, moral, or emotional ones.

The idea of differential utility motivates a hypothesis about why people might generate or favor conjunctive explanations involving elements from both science and religion. This hypothesis, which we call “the functional differentiation hypothesis,” posits that science and religion play distinct functional roles. On this view, the explanatory domain selected for a target-dependent explanation will be a matter of which role the target calls out for, and conjunctive explanations will benefit from satisfying a broader range of roles. Functional differentiation thus offers a natural account of the presence and persistence of explanatory coexistence in

all three forms reviewed previously. If this is correct, what might be the respective explanatory roles of science and religion?

The biologist Stephen Jay Gould popularized the idea that science and religion govern “non-overlapping magisteria” (see Gould, 2002), with science confined to factual matters and religion to matters of value and meaning. Differentiation along these lines is also common on models of secularization, some of which suggest that with the expansion of science’s ability to explain the natural world, religion has withdrawn from this role and instead plays non-epistemic roles, such as conveying a sense of meaning and purpose (see Larmore, 1996; Bruce, 2002; Chaves, 1994; Yamane, 1997), providing emotional comfort, and helping us cope with existential fears (e.g., Stark & Brainbridge, 1987; Durkheim, 1912).

Even advocates for a more collaborative relationship between science and religion seem to endorse forms of functional differentiation. For example, the religious scientist Francis Collins asks, “When does life begin? When does the soul enter? That’s a religious question. Science is not going to be able to help with that” (Paulson, 2010). It isn’t only that the perceived domain of a question can determine the anticipated domain of a response (akin to target-dependent thinking), but that responses from the different domains play different roles: Collins appeals to religion when it comes to offering meaning and morals (Collins, 2007). As we’ll see in what follows, psychological evidence also bears on the question of whether (and by whom) science and religion tend to be differentiated along these lines.

An alternative to complete functional differentiation in the form mentioned previously is complete functional overlap, according to which science and religion have the potential to play the *same* explanatory roles. Some advocates for this view see overlap as a reason to reject science or to reject religion (especially insofar as they make inconsistent empirical claims). For example, Richard Dawkins characterizes religion not as ancillary to science but as “bad science,” and therefore a reason to reject it in favor of good science (Krauss & Dawkins, 2007). But for those who accept both science and religion, functional overlap need not challenge either domain: someone could take science and religion to jointly inform factual questions about the origins of the universe, of the human species, and of suffering. For instance, someone might believe that humans were created by God in a single day but also believe that we should understand the unit of time communicated by “day” in a way that’s consistent with scientific evidence concerning the time course of human evolution. In a case like this, it’s not obvious that these influences of religion versus science are playing meaningfully different functional roles (i.e., epistemic versus non-epistemic).

Functional overlap is attractive insofar as it accounts for cases in which science and religion seem to occupy the same explanatory space. It’s less clear, however, how functional overlap, as opposed to functional

differentiation, explains (vs. merely describes) explanatory coexistence. Specifically, could there in fact be advantages to scientific and religious coexistence, even when the two domains play overlapping explanatory roles? Speculatively, there might be advantages to offering multiple, independently sufficient explanations, or to greater flexibility in selecting elements to fulfil common functional roles. For example, people prefer explanations for complex phenomena (such as why cancer rates are increasing, or why China's population is not decreasing) that appeal to multiple, independently sufficient causes (Zemla et al., 2017). This is plausibly because these independently sufficient causes jointly make the explanandum more probable, or because these more complex explanations are taken to be more informative—a property of explanations that has been shown to increase explanation ratings in prior research (Liquin & Lombrozo, 2020; see also Glass & Schupbach, this volume, for relevant discussion). Similarly, it could be that at least for some people, explanations with scientific and religious elements are favored not because each element fulfills an independent explanatory role but because the elements jointly satisfy a common role more forcefully or more readily.

So far, we have been discussing the more extreme versions of these views, namely, “complete functional differentiation” and “complete functional overlap.” Between these two extremes, however, is a rich middle ground. In fact, we will ultimately endorse a form of *partial* functional differentiation, according to which science is perceived to better satisfy epistemic goals, and religion non-epistemic goals, but with flexibility in both domains. In the next section we review evidence concerning the (perceived) epistemic roles of science and religion, followed by their (perceived) non-epistemic roles. We then describe a recent study (Davoodi & Lombrozo, 2022) that offers the most direct support for partial functional differentiation in the case of scientific and religious explanations, in particular.

## Epistemic Roles for Science and Religion

Prior work suggests that scientific and religious beliefs play different epistemic roles, as reflected in their relationship to evidence, in attitudes to inquiry, and in their perceived objectivity. Regarding the role of evidence, Shulman (2013) found that while both scientific and religious beliefs are often justified by appeal to some authority (experts or texts), scientific beliefs are justified by appeal to evidence more often than religious beliefs are. Differences in patterns of justification for scientific and religious beliefs have also been documented among children from different cultures (Davoodi et al., 2020). Metz, Weisberg, and Weisberg (2018) report that those who endorse an evolutionary explanation for human origins (vs. creationism) are more likely to invoke scientific evidence and less likely to invoke criteria such as what they feel in their heart. These domain-dependent criteria for belief are also found within individuals:



someone who endorses a scientific and a religious belief equally strongly is nonetheless more likely to invoke evidence to justify the former than the latter (Metz, Liquin, & Lombrozo, in prep). Perhaps reflecting these different bases for belief, several studies have found that scientific beliefs tend to be held with greater confidence than religious beliefs, among both adults and children in different parts of the world (Harris, 2012; Harris et al., 2006; Davoodi et al., 2019; Cui et al., 2020).

Some studies additionally suggest that religious beliefs are removed from evidential considerations or held to different evidential standards. Friesen, Campbell, and Kay (2015) found that religious believers reported greater religious conviction after reading a passage that claimed that the existence of God could never be proven or disproven, versus one that claimed that the existence of God would eventually be proven or disproven. In another study, religious participants who read a passage that threatened their religious belief more strongly endorsed unfalsifiable reasons for that belief than did participants who read a passage that was less threatening. These findings suggest that religious beliefs may benefit from unfalsifiability: they are resilient by virtue of their invulnerability to evidence. Suggesting different evidential standards for religious belief among religious believers, McPhetres and Zuckerman (2017) found that religious participants required less additional evidence to conclude that an effect was attributable to prayer versus a natural process, whereas this asymmetry in standards of evidence was not observed among participants who were not religious.

The role of inquiry itself may also be judged differently across scientific and religious domains. Liquin, Metz, and Lombrozo (2020) found that American, predominantly Christian adults judge science questions to be in greater need of explanation than religious questions. Within the same sample, individuals were more willing to accept “it’s a mystery” as an answer to religious questions compared to scientific questions. Gill and Lombrozo (2019) report that in a similar sample, demanding further evidence or explanation for a scientific claim is regarded as a sign of commitment to science, whereas abdicating from further evidence or explanation regarding a religious claim is seen as a sign of commitment to religion. These findings are consistent with the idea that the norms governing scientific belief (but perhaps not religious belief) aim at verifiable truth, such that explanations and evidence should be pursued, and that declaring something a mystery is inappropriate or a sign of failure.

Finally, scientific and religious claims tend to differ in perceived objectivity. Heiphetz and her colleagues (2013) found that 5–10-year-old children and adults differed in the extent to which they thought that two characters making contradictory religious versus factual/scientific claims were both “right.” Specifically, participants judged two characters disagreeing on religious and ideological beliefs (e.g., one believed God hears verbal prayer, and the other believed only other people hear

verbal prayer) as both “right” at higher rates than when two characters disagreed on factual beliefs (e.g., one thinks that germs are very small, and the other thinks that germs are very big). Moreover, children (8- and 10-year-olds) and adults judged correct factual claims, compared to religious claims, as revealing more information about the world and less information about the person making the claim (Heiphetz et al., 2014), suggesting a divergence in perceived level of objectivity in factual versus religious claims. Consistent with this, Gottlieb (2007) found that within a sample of fifth, eighth, and twelfth graders from secular and religious schools in Israel, many children argued that disagreements about the existence of God cannot be resolved by appealing to objective empirical investigation or logical proof and did so at a younger age than deciding that disagreements about punishing children cannot be resolved empirically or logically. Moreover, there is evidence from diverse cultures showing different attitudes towards religious belief and matter-of-fact belief, with “belief” more often associated with religious claims and “think” more often associated with scientific or factual claims (Van Leeuwen et al., 2021; Heiphetz et al., 2021).

Jointly, this body of work suggests that science and religion are treated differently when it comes to epistemic considerations and that science is more strongly associated with evidence, inquiry, and objectivity (at least in the largely Christian and Western samples tested). This is consistent with the functional differentiation hypothesis. At the same time, there are reasons to expect this differentiation to break down when religious belief is especially strong. Many religious believers plausibly *do* take themselves to have strong evidence for their beliefs and consider their supernatural commitments to be a matter of objective fact.

Some evidence supports the idea that for the more religious, religion is perceived to achieve epistemic goals very effectively. Not surprisingly, religious individuals hold religious beliefs with greater confidence than nonreligious individuals do (Davoodi et al., 2019; Cui et al., 2020). Moreover, Liquin, Metz, and Lombrozo (2020) found that while domain differences in need for explanation and mystery acceptability persisted among the most religious participants, differences between science and religion were moderated by religiosity: the most religious participants (vs. the least religious) reported a greater need for explanation regarding questions about religion and, in one study, a greater tolerance for mysteries regarding science. In Gottlieb (2007), children from secular schools were less likely than children from religious schools to think that one should appeal to rationality in resolving conflicts about the existence of God, a difference that was not observed in their views about punishing children.

There is also indirect evidence that individuals who identify as more religious operate with a broader conception of evidence. For example, what one feels in one’s heart, or what one’s loved ones believe, might

itself be construed as a source of evidence on a par with scientific evidence (Metz et al., 2018; Metz et al., in prep). Religious miracles themselves might be regarded by members of religious communities as evidence for belief in religious narratives or the power of the divine (see Payir et al., 2021; Davoodi et al., 2022). Religious believers are also more likely to report having had an experience that convinced them of God's existence (Shenhav et al., 2012), which they might plausibly classify as a source of evidence. Moreover, it has been argued that children from religious communities have a more flexible and broader conception of causality (Davoodi et al., 2016; Corriveau et al., 2015; but see Payir et al., 2021; Davoodi et al., 2022), which may impact how cause-and-effect mechanisms or violations of causal regularities are evaluated in gauging epistemic qualities.

Thus, in contrast to the evidence for functional differentiation reviewed previously, it may be that for the more religious, epistemic functional differentiation is more modest, nonexistent, or potentially even reversed, with religion taken to satisfy epistemic criteria more successfully than science. An important limitation in relating this work to explanatory coexistence, however, comes from the fact that most of this research has concerned scientific and religious beliefs more generally, not explanations per se. We consider partial functional differentiation in the context of explanations after we review prior work on the *non*-epistemic roles of science and religion, in the next section.

## **Non-Epistemic Roles for Science and Religion**

Scientists, including Gould and Collins, have emphasized the putative preeminence of religion over science when it comes to supplying morals and meaning. But both religion and science have the potential to play a variety of additional (though perhaps related) non-epistemic roles. As we review later in this section, research suggests that compared to scientific beliefs, religious beliefs are more strongly associated with morality, social identity, and a sense of self. There is also evidence that religious beliefs can offer a sense of control, buffer existential anxiety, and offer a sense of meaning. But as we'll see, there's some evidence suggesting that scientific beliefs can serve these latter roles, too.

Beginning with morality, religious beliefs seem to play a special role in many people's intuitive theories of what promotes moral behavior. Evidence across several countries suggests that people associate atheism with immoral behavior and indeed that this association persists (in attenuated form) among atheists themselves (Gervais et al., 2017; Wright & Nichols, 2014; see also Gervais, 2014; Gervais et al., 2011). Surveys find widespread belief in 22 countries (of 39 surveyed) for the claim that it's necessary to believe in God to be a moral person (Pew Research Center, 2014), with decreasing (but nonetheless high) rates of endorsement in the

US (42% in 2017, Pew Research Center, 2017). Many psychological and evolutionary accounts of religious belief also converge on the proposal that belief in supernatural agents promotes cooperation and prosocial behavior, especially when the agents are perceived to be punitive (see Norenzayan, 2013, for a theory of how belief in Big Gods supported the evolution of cooperation; see Johnson & Krüger, 2004; Johnson & Bering, 2006; Johnson, 2015 on Supernatural Punishment Theory; see also Bloom, 2012; Bourrat et al., 2011; Cushman & Macindoe, 2009; McKay & Whitehouse, 2015; Preston & Ritter, 2013; Saroglou, 2006; Purzycki et al., 2016). As one piece of evidence, an analysis of survey data across 87 countries found an association between belief in supernatural monitoring and punishment and the perceived impermissibility of various moral transgressions (Atkinson & Bourrat, 2011).<sup>2</sup>

Turning from the moral to the social, there is evidence that religious involvement can play an important role in social integration (see for example, Cadge & Ecklund, 2006, showing patterns of religious service attendance among immigrants), and that religious belief may itself serve as a catalyst for belonging to a community and signaling social commitments. In recent work, for example, Cui and colleagues (2019) found that within a religious minority group in China, children's beliefs about the ontological status of religious entities resembled those of their parents, whereas there was no relationship between children's and parents' ontological beliefs about religious entities among the mainstream secular group. This context-dependent pattern provides evidence for the role of religious belief as a marker or even "glue" for community ties and social identity, especially when observed among minority groups, such as religious communities within Mainland China. On the other hand, the role of scientific belief as a social catalyst is more debatable (for relevant discussion see Kahan, 2012; Kahan et al., 2017; Kahan et al., 2011; Van Leeuwen, 2017; Wilkins, 2018).

Religious beliefs and affiliation can also play a major role in individuals' self-conceptions (Freeman, 2003; Kinnvall, 2004; Verkuyten & Yildiz, 2007). Religious identity, along with national and racial identity, has been found to form a robust component of self-concept among adults in Singapore (Freeman, 2003; see also Kinnvall, 2004 for the theoretical significance of religious identity to individuals' self-concept). Moreover, religious beliefs typically serve a more critical role in personal identity compared to beliefs about scientific facts. For instance, Metz and colleagues (in prep) found that religious beliefs that were matched to scientific beliefs in terms of the strength with which they were held were nonetheless judged more personally important.

Religious beliefs may also have a perceived advantage over science when it comes to explaining subjective experiences. Gottlieb and Lombrozo (2018) found that US adults think it is less plausible that science could one day fully explain psychological phenomena that are perceived

as uniquely human and rich in introspective experience, such as moral behavior or belief in God, relative to phenomena that are shared with other species and more observable, such as motor movements or depth perception. While Gottlieb and Lombrozo (2018) did not investigate the perceived scope of religious explanations, it is plausible that for religious respondents, religious explanations are perceived to succeed precisely where science is thought to fall short.

The findings just reviewed suggest that religion is often perceived to have an edge over science when it comes to satisfying moral, social, and personal psychological roles. However, other non-epistemic roles have been linked to science as well as religion, especially regarding the need for order and control, anxiety about immortality, and search for meaning in life. For example, perceived threat to control seems to motivate adults to seek orderliness both in scientific theory and in religious belief. Kay and colleagues (2008) found that, among a group of university students in Canada, inducing a low sense of personal control increased belief in God when God was presented as intervening and controlling, but not when God was presented as non-intervening and working in “mysterious ways” (see also Kay et al., 2009; Kay et al., 2010; Laurin et al., 2008). Rutjens and colleagues (2010) found that after a threat to control (a prompt to think about an unpleasant situation in which they lacked control, coupled with reminders that the future is uncontrollable), their fairly secular sample more often preferred the theory of intelligent design to evolution when the evolutionary account emphasized chaotic and unpredictable processes, but not when it emphasized order and predictable processes. Similarly, Rutjens and colleagues (2013) showed that perceived threat to control increased the appeal of scientific theories that emphasize fixed stages (e.g., theories of grief, moral development, and stage theory of Alzheimer’s disease). These findings suggest that scientific beliefs and theories can offer the sense of control and predictability that is often ascribed to religious belief.

Drawing attention to mortality can also promote both religious and scientific belief, presumably as a way to mitigate associated discomfort or anxiety. Norenzayan and Hansen (2006), for example, found that increasing attention to mortality (by having participants write about death) led to higher levels of reported belief in God, as compared with a control condition in which participants were not invited to think about mortality (see also Vail et al., 2010; Jong et al., 2012). Farias and colleagues (2013) found that in a relatively secular sample, participants who were invited to reflect on their own mortality reported higher levels of “faith in science” compared to a control condition in which participants reflected on dental pain. Tracy, Hart, and Martens (2011) found that reminding participants of their own mortality increased the rejection of evolution or acceptance of Intelligence Design Theory, but that this effect was blocked

when participants read a passage (by Carl Sagan) that endorsed naturalism as a source of existential meaning.

Relatedly, research on the sense of meaning in life also suggests that although religion and religious beliefs may be especially well-suited to promoting a sense of meaning (Newton & McIntosh, 2013), science can sometimes take on associated roles (Rutjens & Van Elk, in prep). For instance, threats to meaning increased belief in miracles among US, predominantly Christian undergraduate students (Routledge et al., 2017), and threats to meaning increased belief in magical evil forces among religious US undergraduates (Routledge et al., 2016). Moreover, stronger need for meaning (as an individual difference variable) predicted greater religious commitment, stronger religious beliefs, and more frequent religious experience (Abeyta & Routledge, 2018). In the domain of science, while scientific *belief* was not related to meaning, specific non-epistemic *functions* of these beliefs were: for nonreligious participants, attributing importance to science as central to their identities was associated with higher perceptions of meaning (Rutjens & Van Elk, in prep, as reported in Rutjens & Preston, 2020). Finally, while distinct from a sense of meaning, there is also evidence that like religion, science can be associated with the experience of awe (Gottlieb et al., 2018; Johnson et al., 2019), especially for the nontheistic (Valdesolo et al., 2016).

Summarizing this research on non-epistemic functional roles, we see evidence that religious belief is associated with a host of non-epistemic goals, including moral behavior, social and personal identity, a sense of control, emotional comfort, and a sense of meaning. However, there is also evidence that at least for the nonreligious, some scientific beliefs can accomplish some of these roles too. The evidence therefore challenges both complete functional differentiation and complete functional overlap. A more serious limitation with respect to claims about explanatory coexistence and conjunctive explanation, however, comes from the fact that most of this research has considered religious and scientific belief quite broadly, as distinct from religious and scientific *explanations* per se. In the context of answering an existential question, such as how the universe came to exist, do religious and scientific beliefs play different explanatory roles? And how do these roles differ as a function of whether an individual favors scientific or religious explanations? In the next section, we introduce recent work that investigates the epistemic and non-epistemic features of explanations, and that ultimately supports a form of partial functional differentiation.

## Epistemic and Non-Epistemic Dimensions of Explanations

Figure 9.1 offers a visual representation of both complete functional differentiation and complete functional overlap with respect to the (perceived) epistemic and non-epistemic virtues of scientific and religious

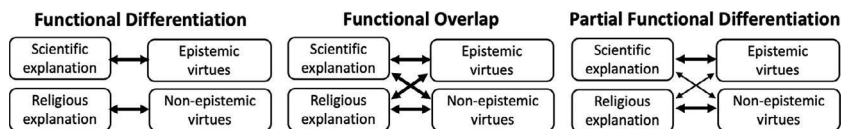
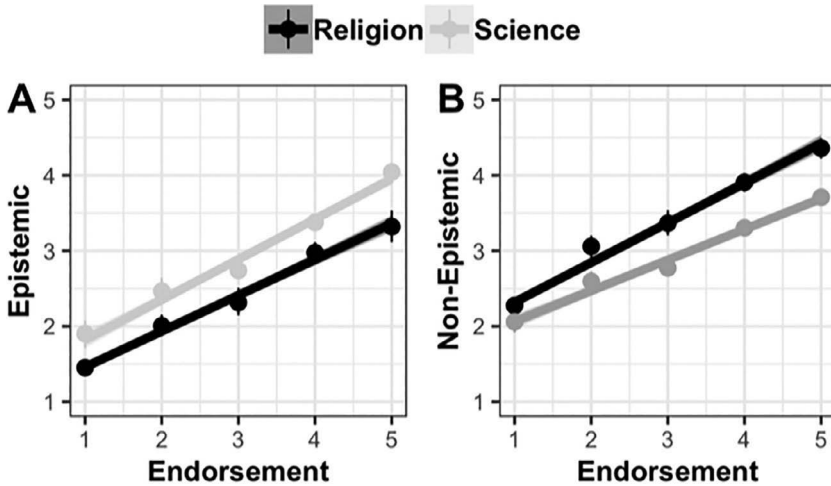


Figure 9.1 Models of the functional roles of scientific and religious explanations, depicting a possible set of associations between the domain of an accepted existential explanation, on the one hand, and whether it is attributed epistemic and non-epistemic virtues, on the other. The width of each arrow reflects the strength of association.

explanations. It also illustrates the possibility that we ultimately endorse: a form of partial functional differentiation, according to which scientific and religious explanation *both* have the potential to be attributed *both* epistemic and non-epistemic virtues, but where scientific explanations or explanatory elements are more likely to be attributed epistemic virtues, and religious explanations or explanatory elements are more likely to be attributed non-epistemic virtues. The studies reported in Davoodi and Lombrozo (2022), mentioned in the introduction, were designed to adjudicate between these models.

The most relevant results from Davoodi and Lombrozo are presented in Figure 9.2 and come from a study that used explanations different from those shared in the chapter epigraph. In the critical study, participants were presented with religious or scientific explanations in response to the question, “How did the universe come to exist?” For example, one of the scientific explanations read, “The universe began billions of years ago with the big bang: a single point with light and energy that expanded, eventually forming atoms, galaxies, and more.” One of the religious explanations read, “The creation of the universe was set into motion by God billions of years ago. It was not necessarily created in 6 literal days.” Participants were first asked to indicate how strongly they agreed that the explanation is true (from 1 = “strongly disagree” to 5 = “strongly agree”) and then to evaluate the explanation along epistemic and non-epistemic dimensions. For example, the epistemic items asked them to indicate their level of agreement with claims including “this explanation is based on evidence,” and “this explanation is based on logical reasoning.” The non-epistemic items asked them to indicate their level of agreement with claims including “this explanation tells me something important about who I am,” and “this explanation is comforting.” In total, there were five epistemic items and five non-epistemic items, with each set of items averaged to create a single composite of each type.

Three aspects of the findings are especially revealing. First, and perhaps least surprising, participants were more inclined to attribute epistemic



*Figure 9.2* Associations between endorsing the truth of a given explanation and attributing (A) epistemic virtues to that explanation (e.g., being logical and based on evidence) and (B) non-epistemic virtues to that explanation (e.g., having moral, social, or emotional benefits). Panel A shows higher epistemic attributions for scientific versus religious explanations (at each level of endorsement), and panel B shows higher non-epistemic attributions for religious versus scientific explanations (at each level of endorsement). Dots represent means at each level of endorsement. Error bars represent 95% confidence intervals. Taken from Davoodi and Lombrozo, 2022—Study 2.

and non-epistemic virtues to explanations the more strongly they took them to be true. This is reflected in the positive slope relating endorsement to attribution, and it held for both scientific and religious explanations. Importantly, it also held for both epistemic and non-epistemic attributions in both domains, challenging complete functional differentiation. Second, and more revealing, epistemic and non-epistemic virtues were attributed *differentially* across domains. At each level of endorsement, scientific explanations were attributed more epistemic virtues than religious explanations, but religious explanations were attributed more non-epistemic virtues than were scientific explanations. This challenges complete functional overlap. Indeed, the results are uniquely consistent with partial functional differentiation. A third feature of the results is that the *slope* relating endorsement to epistemic attribution was steeper for science than for religion, whereas the slope relating endorsement to non-epistemic attribution was steeper for religion than for science. In other words, domain did not just influence whether epistemic or non-epistemic attributions were higher (at a given level of endorsement), but also the extent to which endorsement translated into more favorable



attributions, with endorsement more strongly related to attributing epistemic virtues to scientific (vs. religious) explanations and more strongly related to attributing non-epistemic virtues to religious (vs. scientific) explanations.

While the findings just reviewed concerned the evaluation of explanations that were scientific or religious *but not both*, they have implications for accounts of explanatory coexistence and conjunctive explanation. Specifically, to the extent that scientific and religious explanations exhibit functional differentiation, appealing to both (in response to different explananda or in a single explanation) will satisfy more functional ends. In target-dependent thinking, those aspects of a given phenomenon that prompt epistemic curiosity can be satisfied with a natural/scientific explanation (e.g., how does the physical body shut down?), whereas aspects that give rise to non-epistemic concerns can be satisfied with a supernatural/religious explanation (e.g., what remains of us after death?). Models of functional differentiation thus predict that the relationship between a target of explanation and the domain of a favored explanation can be explained in large part by the epistemic or non-epistemic goal that prompts the need for explanation. Davoodi and Lombrozo (2022) report some evidence consistent with this prediction: relative to a baseline condition, prompting participants to answer an existential question with an explanation that had epistemic merits (logical, based on evidence) increased the rate at which scientific explanations were offered, whereas prompting participants to answer an existential question with an explanation that had non-epistemic merits (emotional comfort) increased the rate at which religious explanations were offered.

What about cases in which coexistence happens through integration? That is, why is the *same* phenomenon sometimes explained in terms of both the natural and the supernatural (e.g., “the big bang was set into motion by God”)? As stated before, the advantages of such integrated forms of coexistence might be the provision of multiple, independently sufficient explanations, or flexibility in incorporating various explanatory frameworks that serve common functions. Our model of partial functional differentiation offers these benefits of potential overlap, in addition to the benefits of functional differentiation. That is, an integrated explanation can meet an explanatory demand with both epistemic and non-epistemic dimensions, satisfying epistemic demands with scientific components and non-epistemic demands with religious components. At least on average, we would expect a strictly scientific explanation to be less satisfying non-epistemically and a strictly religious explanation to be less satisfying epistemically. Someone who endorses both explanatory frameworks can therefore achieve the best of both worlds by conjoining scientific and religious components.

Partial functional differentiation allows for other possibilities as well. For instance, if the epistemic virtues of a particular scientific explanation,

or the non-epistemic virtues of a religious explanation, are perceived to be relatively weak, conjunctive explanations could be preferred because of the flexibility afforded by being able to incorporate the perceived non-epistemic virtues of scientific explanations or perceived epistemic virtues of religious explanations. Relatedly, explanations with elements from both domains could satisfy distinct demands within the epistemic (or non-epistemic) realm in virtue of *partial* functional differentiation.

### **Beyond Science and Religion: Implications for Conjunctive Explanation More Generally**

Returning to the questions that motivated this chapter, what can we say about whether conjunctive explanations explain *better* (if they do)? Our functional approach suggests the following. Insofar as the distinct components of an explanation better achieve different explanatory goals, a conjunctive explanation will be better by virtue of satisfying more goals. That is, an explanation that satisfies both epistemic and non-epistemic goals is better than one that merely satisfies the former or the latter. But it doesn't follow that an explanation is necessarily better by virtue of satisfying each goal by appeal to a different explanatory framework. That is, a scientific explanation that satisfies both epistemic and non-epistemic criteria should be no worse (and perhaps even better) than an explanation that satisfies epistemic criteria by appeal to science, but non-epistemic criteria by appeal to religion. Likewise, for a religious believer, a religious explanation that is perceived as satisfying epistemic criteria, in addition to non-epistemic criteria, may be more appealing than an explanation that incorporates scientific elements.

As an analogy, an explanation should be better if it satisfies multiple explanatory roles, such as producing understanding *and* fruitfully guiding research. But it doesn't follow that an explanation is better if these elements are satisfied through distinct components (e.g., one explanatory component that supports understanding and a conjoined element that is fruitful). In fact, it's highly plausible that a single explanatory component that supports both understanding and fruitfulness would be favored over a conjunctive explanation that does the same. So the need for conjunctive explanations may arise when our explanatory goals are difficult to achieve in non-conjunctive form. For example, it could be that supporting understanding and being fruitful are sometimes in tension (if, for instance, an explanation that generates understanding is too vague to generate predictions, and an explanation that generates new predictions is too complicated to generate understanding). More plausibly, satisfying epistemic criteria may often be in tension with satisfying non-epistemic criteria, at least within a given explanatory framework. If this is correct, then we should expect the appeal of conjunctive explanations to depend upon the difficulty of achieving all of our explanatory goals within a

single explanatory framework. And moreover, we should expect this to hold quite generally—not specifically for the case of scientific and religious explanations for the existential. Future empirical research informed by our functional approach can directly test whether the appeal of conjunctive explanations indeed stems from functional differentiation and the trade-offs that may arise within a single explanatory framework.

### **But Are Non-Epistemic Virtues Really *Explanatory* Virtues?**

At this point, it's natural to question an assumption behind the way in which we have discussed epistemic and non-epistemic roles. It may well be that explanations in fact play both epistemic and non-epistemic roles, but it doesn't follow that satisfying non-epistemic roles is an *explanatory* goal or that it satisfies an *explanatory* virtue. As an analogy, it may well be that explanations play important psychological roles when they are funny (they make people laugh), or when they are loud (they wake people up). But it doesn't follow that being funny or loud is an explanatory virtue. It may not be a virtue at all, but more importantly, it may be a feature of the general communicative act, as opposed to a feature of the explanation qua explanation. Similarly, someone might reasonably object that we've been too liberal in describing non-epistemic explanatory goals as properly explanatory, and non-epistemic virtues as *explanatory* virtues. Perhaps what we've said explains why people answer questions in particular ways but without bearing on explanatory coexistence or conjunctive explanations as such.

We have two responses to this point. First, even if we grant that many non-epistemic goals (such as offering emotional comfort) are not best understood as “explanatory goals” or as exemplifying “explanatory virtues,” we think the broader lessons about (partial) functional differentiation are likely to hold. If we consider only more canonical explanatory virtues—such as simplicity, generality, fruitfulness, and so on—it's highly plausible that explanations will be better to the extent they exemplify more virtues and that conjunctive explanations will therefore dominate when multiple virtues trade-off within a given explanatory framework.

Second, we worry about the viability of a clear demarcation between bona fide explanatory virtues and other virtues of explanations, where those virtues also depend upon the structure or content of the explanations. Consider *why* participants may have rated religious explanations for what happens after we die more comforting (on average) than their scientific counterparts. It was presumably because they promised an opportunity for eternal life in some form, a chance to be reunited with loved ones, and a world in which the good are rewarded—all features or implications of the explanatory content. It wasn't because they were spoken in a more soothing voice or presented with a nicer font (they weren't). A more soothing voice might achieve a psychological goal to be comforting, but it wouldn't do so by virtue of the content of the explanation. If

explanations have certain virtues because of their explanatory content, we are inclined to admit those virtues as explanatory for the purposes of explaining coexistence and conjunctive explanations. This criterion is likely more liberal than that typically adopted by philosophers of science and epistemologists concerned with explanatory virtues, but it is not wholly unconstrained: the soothing voice in which an explanation is delivered, or the font with which it's presented, could well have psychological consequences that we would not admit as explanatory virtues for the purposes of explaining coexistence and conjunction through partial functional differentiation.

### Concluding Remarks

Explanations often appeal to elements from more than one explanatory framework. The coexistence of scientific and religious explanations is a case in point: when scientific and religious elements are combined to explain a common explanandum, they form a conjunctive explanation. Based on evidence from the psychological literature, we have argued for a form of partial functional differentiation to explain the appeal of conjunctive explanations. In individuals for whom science and religion are perceived to best satisfy different explanatory goals, conjunctive explanations will be better by virtue of satisfying more goals, as well as common goals with greater force or flexibility. Though our evidence comes from psychological findings concerning the perceived roles of science and religion, we extract a more general lesson. The more general lesson is this: explanatory goals or virtues can compete, with the explanation perceived to be best along some dimension (simplicity, breadth, fruitfulness, precision, etc.) potentially deficient along others. To the extent that different explanatory frameworks reflect different trade-offs along these dimensions (Shtulman & Lombrozo, 2016), an explanation within a single framework will typically satisfy only a subset of explanatory goals. By combining elements from different explanatory frameworks, conjunctive explanations have the potential to satisfy a broader range of explanatory goals with a single explanation.

### Notes

1. Of course, much could be said about how explanatory frameworks are individuated. One criterion could be that explanatory frameworks are distinct if and only if they are mutually inconsistent. We think this is too strong—for instance, two different scientific theories could be employed to explain a single phenomenon (e.g., incorporating elements of the “universal grammar” model and the “sociocultural” model to explain language development in humans). In what follows, we make the weaker assumption that conjunctive explanations conjoin elements that come from explanatory frameworks that are not fully *integrated*, even if they are potentially consistent.

2. The observed (as opposed to posited or perceived) relationship between religious belief and prosocial behavior at an individual level is more complex (see Preston et al., 2010 for a review). For example, religious priming has been shown to encourage prosocial behavior among Belgian undergraduate students (Pichon et al., 2007) and honesty among US undergraduate students (Randolph-Seng & Nielsen, 2007). However, religiosity itself is not uniformly associated with more moral behavior (see, e.g., Fishbach et al., 2003; Ginges et al., 2009; Saroglou & Pichon, 2009; Saroglou et al., 2009), and other work has documented a link between religiosity and behavior that is normally regarded as immoral. For example, religious priming in the form of a violent passage from the Bible has been shown to facilitate aggressive behavior among US and Dutch undergraduate students (Bushman et al., 2007), and positive correlations are documented between religiosity and racism among US adult participants (Hall et al., 2010).

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