

The Cognitive Science of Religion:
A Case for the Importance of Adolescence

Emily Nakkawita^a & Larisa Heiphetz^b

^a Department of Psychology, Columbia University. 1190 Amsterdam Ave., New York, NY
10027, United States. E-mail: ebn2111@columbia.edu. Phone: 917-474-9586. (Corresponding
Author)

^b Department of Psychology, Columbia University. 1190 Amsterdam Ave., New York, NY
10027, United States. E-mail: lah2201@columbia.edu. Phone: 212-854-1348.

Word count: 11,227

In press at *Adolescent Research Review*

Authors' Contributions

EN conducted the initial literature review and completed the first draft of the manuscript; LH provided detailed feedback on several iterations of the manuscript. All authors read and approved the final manuscript.

Conflict of Interest

The authors report no conflict of interests.

Funding

This publication was made possible through the support of grants #61080 and #61808 from the John Templeton Foundation to LH. The opinions expressed in this publication are those of the authors and do not necessarily reflect the views of the John Templeton Foundation. This work has also been supported (in part) by an award from the Russell Sage Foundation to LH. Any opinions expressed are those of the authors alone and should not be construed as representing the opinions of either the John Templeton Foundation or the Russell Sage Foundation.

Abstract

The cognitive science of religion proposes that religion and spirituality—including belief in God, conceptualizations of God’s mind, and reasoning about the religious beliefs of other people—are rooted in the same systems that underlie everyday cognitive processing. Because these systems change throughout development, the cognitive science of religion provides unique insight into how and why religious belief and reasoning develop. While a growing body of work has investigated these topics among children and adults, there are glaring gaps in the field’s understanding of adolescence. This article reviews what is known and unknown in this space. It also argues that applying the cognitive science of religion approach to adolescence would provide critical insight into the development of cognition in general and religious belief in particular.

Keywords: adolescence; cognitive science of religion; God concepts; religious development; social cognition; spiritual development

**The Cognitive Science of Religion:
A Case for the Importance of Adolescence**

Why do people believe in supernatural agents like God? How do they reason about God's mind and its contents? And how do they make sense of other humans' beliefs in God? The *cognitive science of religion* offers compelling answers to these questions, proposing that religious beliefs are grounded in fundamental cognitive processes. These cognitive processes undergo dramatic transformation throughout development, yet while much is known about the cognitive science of religion in childhood and adulthood, little research has applied this approach to adolescence. This article presents a case for why scholars interested in the cognitive science of religion should investigate these topics among adolescent populations. To do so, it focuses on a topic of great interest to cognitive psychologists—how people reason about the minds and beliefs of other agents—and applies it to the domain of religion. As such, this article reviews evidence examining how the cognitive systems that support ordinary social cognition underlie (a) conceptualizations of God's mind and its contents and (b) judgments about the religious beliefs of other people. Further, this article highlights what is known about these aspects of cognition at different stages of development and suggests where research on adolescents can offer critically needed insight into these developmental processes.

Cognitive Psychology and the Cognitive Science of Religion

Cognitive psychology investigates fundamental mental processes like perception, attention, thinking, decision-making, and memory. One distinctive aspect of cognitive psychology is its focus on experimental methods within which researchers manipulate the variable(s) that they hypothesize will affect a dependent measure while holding all other factors constant. By conducting this kind of carefully designed experimental research, cognitive

psychologists can investigate and establish causal relationships among these variables, rather than simply testing for associations. Additionally, cognitive psychologists increasingly use neuroimaging methods to examine the patterns of brain activity associated with these variables. This approach allows cognitive psychologists to draw inferences about the biological processes involved in a particular aspect of cognition or behavior.

Cognitive psychology interfaces closely with a range of other disciplines both within and outside of psychology. One example involves the study of religion and spirituality, which examines the beliefs, practices, and institutions associated with various religious traditions. In particular, the cognitive science of religion is an interdisciplinary field that lies at the intersection of cognitive psychology and the study of religion. The cognitive science of religion approach blends these perspectives and proposes that religious concepts are especially likely to arise and spread because they stem from ordinary cognitive processes that humans use to make inferences about other people and the world (e.g., Atran, 2002; Barrett, 2000; Boyer, 2001; Guthrie, 1993). The cognitive science of religion differs from traditional approaches to religion within anthropology (e.g., Malinowski, 1948), sociology (e.g., Durkheim, 1915), and philosophy (e.g., Hume, 1779), as these approaches primarily focus on how religion differs from everyday experience. In contrast, the cognitive science of religion emphasizes how ordinary human cognition gives rise to religious concepts and institutions.

While the cognitive science of religion examines religion and spirituality from a cognitive lens, its theories reach beyond strictly cognitive variables (e.g., religious beliefs). For example, this approach can inform the study of affective experience (e.g., the attribution of human-like emotions to other entities; Demoulin, Saroglou, & Van Pachterbeke, 2008) and religious behavior (e.g., associations between a lack of predictability in the environment and

expectations about engaging in rituals; Legare & Souza, 2014). More specifically, scholarship in the cognitive science of religion involves applying the theories and methods of cognitive psychology—which researchers typically use to study how people conceptualize human minds, beliefs, and practices—to the case of religion and supernatural agents. For instance, religious prescriptions of morality may be grounded in human social inference systems, which are attuned to prosocial ideas like fairness and reciprocity (Norenzayan, 2013). Similarly, religious rituals may build on cognitive systems related to social exchange and the avoidance of contamination (Boyer, 2001), mental representations of agentic action (McCauley & Lawson, 2002), and the imposition of control and structure within an uncertain world (Legare & Souza, 2014). In each of these cases, the cognitive processes that people use when understanding and navigating their everyday lives scaffold religious cognition and practice. As a result, the tools and methods that scientists use to study ordinary cognition—ranging from carefully-executed experiments to neuroscientific investigations—can also inform scholarship on the psychology of religion and spirituality.

The cognitive science of religion also interconnects with developmental psychology because the processes underlying religious cognition change throughout childhood, adolescence, and adulthood. As one example, theory of mind—the ability to accurately attribute mental states to agents, including both human and supernatural beings—emerges on explicit tasks around the age of four years (Wellman, Cross, & Watson, 2001) and continues improving throughout adolescence (Dumontheil, Apperly, & Blakemore, 2010). Similarly, epistemology—one’s understanding of the nature of knowing and knowledge—progresses through a series of developmental stages in which the perceived objectivity versus subjectivity of beliefs fluctuates (Kuhn, Cheney, & Weinstock, 2000). These general developmental shifts in cognition have

important implications for religion and spirituality. If everyday cognitive processes facilitate religious belief and practice, it follows that the religious concepts supported by these systems are also likely to change. Integrating cognitive and developmental psychology has led psychologists to generate and test new hypotheses about which aspects of religious cognition might transform versus remain stable throughout the lifespan. Interestingly, however, most of the research in this area has studied the development of religious cognition in children and adults only, without a direct focus on adolescence.

Although this dearth of research examining adolescence is striking, the reasons for this state of affairs are not completely clear. It is possible that scholars of the cognitive science of religion are primarily interested in aspects of cognition like mind perception and simply see religion and spirituality as a domain that allows them to better understand these cognitive processes. For such scholars, an important research question may be the degree to which these aspects of cognition are innate as opposed to dependent upon social experience. In this case, comparing young children and adults would clarify which processes operate before young children acquire such experience. Regardless of the reasons for the field's neglect of adolescence, one consequence is that the field lacks critical insight into why and how the cognitive processes underlying religion and spirituality change between childhood and adulthood.

Given the connections between cognitive psychology, the psychology of religion and spirituality, and developmental psychology, this article argues that adolescence constitutes a unique and important opportunity to better understand the development of cognition in general and religious belief in particular. Due to space constraints, this article's scope is limited to a topic of critical importance to cognitive psychologists: how reasoning about the minds and beliefs of

others changes throughout development. It reviews theories and findings grounded in the cognitive science of religion that probe two key questions. First, because understanding others' minds is central to human cognition, it begins by examining how the cognitive processes people use to conceptualize ordinary human minds support conceptualizations of God's extraordinary mind and its contents. Second, because religion is inherently social, it then reviews how the cognitive science of religion informs scientific understanding of how people reason about others' religious beliefs. Where research directly examining adolescents does not exist, the article reviews extant findings among children and adults, which may offer clues as to whether religious cognition appears to change or remain stable throughout development. It also highlights opportunities for novel lines of research with adolescents specifically.

Conceptualizing God's Mind and Mental States

What *Kind* of Mind Does God Have?

To begin, it will be helpful to briefly review the theories and research that describe the kind of mind that people ascribe to supernatural agents like God before shifting to discuss the perceived contents of these minds. In order to understand how people conceptualize God's extraordinary mind, a cognitive science of religion approach would propose beginning by understanding how people conceptualize ordinary minds. The literature describes several related aspects of cognition that support people's representations of others' minds, including intuitive theories and agency ascription.

Intuitive theories. When making their way through the world, people rely on intuitive lay theories about social and natural phenomena (Spelke & Kinzler, 2007). Several of these theories investigate how people categorize the things and people that they encounter in the world (Wellman & Gelman, 1992). Although scholars debate which of these templates are the most

fundamental, there is some agreement that they include natural living kinds (*person, animal, plant*), naturally-occurring yet non-living things (*natural object*; e.g., a rock), and human-created artifacts (*tool*; e.g., a hammer, Keil, 1989). For instance, people react to other people differently than they react to hammers because they can classify people and hammers into different categories. Such categories emerge fairly early in development; by five years old, children correctly identify living kinds and differentiate them from artifacts (Brandone & Gelman, 2013).

How might these intuitive templates relate to belief in supernatural minds? Some cognitive science of religion scholars have proposed that people are more likely to acquire, remember, and communicate to others about concepts that contradict intuitive expectations about a given category in a relatively minimal way (Barrett, 2008). One early series of studies on this topic exemplified the experimental approach for which cognitive psychology and the cognitive science of religion are known (Boyer & Ramble, 2001). In this research, participants read stories that either violated intuitive expectations (e.g., furniture floated in the air if dropped) or conformed to these expectations (e.g., furniture could be moved by pushing it). Adults from France, Gabon, and Nepal were more likely to recall concepts that involved a template violation. Further research probing the level of counterintuitiveness that best facilitates memory revealed that *minimally* counterintuitive concepts that violate only one expectation (e.g., “flowering cars”) are more memorable than *maximally* counterintuitive concepts that violate several expectations (e.g., “giggling admiring horses”; Gonce, Upal, Slone, & Tweney, 2006). Similar studies conducted with children indicate that 7- to 9-year-olds also preferentially remember minimally counterintuitive concepts (Banerjee, Haque, & Spelke, 2013).

Follow-up research provides insight into the cognitive mechanism underlying these effects of “minimal counterintuitiveness” on memory. Although no differences in memory

emerged between intuitive versus counterintuitive items immediately following exposure, only memories of intuitive items degraded over time (Hornbeck & Barrett, 2013). This finding suggests that although people may not preferentially encode minimally counterintuitive concepts in memory, after encoding, people are more likely to retrieve them. As a result, these concepts are more accessible for transmission to others. Importantly, among the Western participants in Hornbeck and Barrett's (2013) study (who ranged from ten years old to more than sixty years old), the older participants were, the less likely they were to recall counterintuitive items after a delay. Thus, the memory benefits of minimally counterintuitive concepts may be particularly strong among young children and adolescents.

Given that minimally counterintuitive concepts appear more memorable than either completely intuitive or maximally counterintuitive concepts, if supernatural minds are minimally counterintuitive, this feature may help explain the prevalence of God concepts. These concepts are often grounded in the *person* template; for instance, the all-knowing God within Abrahamic faiths reflects a person with several counterintuitive properties, including an omniscient mind. Building on this notion, Boyer (2001) suggested that concepts involving supernatural *agents* are pervasive across cultures because, as minimally counterintuitive concepts, they are especially memorable and likely to be communicated to others. In line with this proposal, recent research suggests that counterintuitive concepts involving agents are more memorable than those involving non-agents (Porubanova, Shaw, McKay, & Xygalatas, 2014). But why agents?

Agency ascription. Scholars have long noted the systematic tendency to attribute minds to all kinds of inanimate objects and events (e.g., Guthrie, 1993; Nieuwboer, van Schie, & Wigboldus, 2015). In doing so, people appear to make two related sets of distinctions about the nature of these minds. The first distinction relates to a general sense of agency: Is the percept an

animate agent or inanimate object? Cognitive psychologists propose that this tendency to indiscriminately attribute agentic minds to a range of percepts is fundamental and not a conscious choice (Scholl & Gao, 2013). For this reason, the human mind may be a “hypersensitive agency detection device” that cannot help but perceive supernatural agents (e.g., Barrett, 2000). Indeed, this device may have evolved because it is evolutionarily adaptive (e.g., Barrett, 2004). For instance, if a person wandering alone in the woods heard a rustle nearby, the person would be more likely to survive in the long-term if he or she assumed that such sounds were created by a nearby agent and ran away. Incorrectly assuming that the sounds arose from a non-agentic source like the wind could lead to death if a dangerous agent were lurking nearby. As a result, people may attribute agentic minds even when presented with unclear evidence.

This kind of indiscriminate agency ascription may contribute to religious cognition. For instance, teleological reasoning—the tendency to reason about objects and events as if they were purposefully designed—is particularly common among young children (Kelemen, 2004). Not only do children use teleology to understand natural phenomena (e.g., “the first ever river existed to provide fish and crocodiles with somewhere to live”), they also tend to attribute the creation of natural events, natural objects, and animals to God. In other words, when children ponder *who* created natural phenomena for a purpose, they usually attribute such creation to a supernatural agent rather than to another person, nature, or an indeterminate agent (Kelemen & DiYanni, 2005). This line of work suggests that the development and use of God concepts may stem in part from a relatively early-emerging tendency to perceive agency.

Beyond a general sense of agency, God concepts can also vary depending on what *kind* of an agent God is: Is God a human-like agent or not? When people anthropomorphize, they attribute human characteristics and inner states to an animate agent (Guthrie, 1993). Like agency

attribution, anthropomorphism is pervasive, perhaps because it helps people understand, explain, and predict the behavior of other agents (Epley, Waytz, & Cacioppo, 2007). The anthropomorphic nature of God concepts appears to change throughout development and to depend on whether the topic is probed implicitly or explicitly (Heiphetz, Lane, Waytz, & Young, 2016). For instance, while adults often explicitly differentiate between human minds and God's mind in ways that reflect "theologically correct" teachings (e.g., reporting that God is not constrained by time and space; Barrett, 1999), their implicit, spontaneous responses appear to reflect a God that is bound by anthropomorphic constraints (e.g., the view that God can only accomplish one task after finishing a prior task; Barrett & Keil, 1996). In contrast, young children largely view God in anthropomorphic terms on an explicit level (e.g., they report that God does not know the contents of a box that are unknown by themselves; Kiessling & Perner, 2014), although the extent to which they do so can vary depending on sociocultural context (e.g., Christian children are more likely to anthropomorphize God than are Muslim children; Richert, Saide, Lesage, & Shaman, 2017). Additionally, children's explicit anthropomorphism appears to decrease with age (e.g., 5-year-olds anthropomorphize God more than 6-year-olds; Kiessling & Perner, 2014).

Several scholars (e.g., Baumard & Boyer, 2013; Oviedo, 2015) have argued that these seemingly inconsistent representations of God's mind are rooted in dual-process cognitive models (for an overview of such theories outside the context of religion, see Evans, 2008). Although their details vary, these models generally propose that cognition includes both fast, implicit components and slow, reflective, explicit components. Across development, individuals adopt religious teachings portraying God as quite different from a person, leading them to distinguish God and people on an explicit level (Demoulin et al., 2008). Nevertheless, adults'

responses on tasks that do not allow for deliberative thought, such as speeded reaction-time measures, often mirror children's explicit anthropomorphism, particularly when probing God's humanlike psychological (versus physiological) properties (Shtulman & Lindeman, 2016). Thus, both children and adults appear to anthropomorphize God on some level, although the extent to which they do so may differ across religious traditions and developmental stages.

Finally, some work suggests that anthropomorphizing God may offer important benefits to individuals' well-being. Because people perceive God as having some human qualities, human-like attachment to God may help satisfy the fundamental human need for secure attachment relationships (Miner, Dowson, & Malone, 2014). Such attachment to God appears especially valuable for adolescents with low levels of secure attachment with their parent, as despite these struggles in their parental relationships, it is still possible to maintain a secure and intimate relationship with God (Kimball, Boyatzis, Cook, Leonard, & Flanagan, 2013). This finding is particularly important because, despite the general stability of parental attachment among non-stressed individuals, a range of stressors such as poverty and depressive symptoms predict relative declines in the security of parental relationships in adolescence (Allen, McElhaney, Kuperminc, & Jodl, 2004).

Interim summary. Collectively, this work indicates that people conceptualize the extraordinary minds of supernatural agents using the same cognitive processes that they use to conceptualize the minds of human agents. Further, people are more likely to retrieve God concepts from memory because these concepts are minimally counterintuitive (e.g., involving a counterintuitive property like omniscience), and this effect of minimal counterintuitiveness on retrieval is stronger among children and adolescents than among adults. Given that God concepts are rooted in the *person* template, it is no surprise that people often anthropomorphize God,

although the degree to which they do so varies based on how this question is probed (implicitly versus explicitly) and the individual's developmental stage.

Future directions. Although explicit anthropomorphism clearly declines between childhood and adulthood, it is unclear precisely how this trend progresses throughout the course of adolescence. Does anthropomorphism on an explicit level decline steadily or drop suddenly? Adolescence is a time during which the adherents of many religions undergo rites of passage involving the transmission of sacred knowledge (e.g., bat mitzvah, confirmation; Alcorta & Sosis, 2020). Because these rites involve extensive teaching of theologically correct (i.e., non-anthropomorphic) knowledge about God, one possibility is that adolescents' explicit God concepts may change to reflect the knowledge gained in this process. If this is the case, adolescents who have completed rites of passage would be less likely to report an explicitly anthropomorphic conception of God than adolescents who have not yet undergone such a rite. Although many of these rites occur during early adolescence, the specific timing may vary, offering interested researchers an opportunity to conduct a natural experiment. Scholars could test adolescents' explicit anthropomorphism and compare demographically matched samples who have or have not yet completed their own rite of passage to probe the hypothesis that undergoing such rituals reduces explicit anthropomorphism. Further, within-person measures of explicit anthropomorphism may drop before versus after the completion of such a rite. By directly probing hypothesis such as these, studies that include adolescent participants can help both cognitive psychologists and scholars of religion and spirituality to understand the developmental process through which explicitly anthropomorphic conceptions of God's mind change.

What Are the *Contents* of God's Mind?

The research reviewed in the section above examined what kind of mind people perceive God to have. In addition to anthropomorphizing when answering items about what *kind* of mind God has, people may also use an anthropomorphic lens to draw inferences about the *contents* of God's mind. The next section turns to this question, focusing on people's judgments regarding the contents of God's mind (i.e., God's knowledge and beliefs). In line with the cognitive science of religion approach, the work reviewed here applies what researchers know about how people understand the contents of minds in general to the specific case of supernatural agents.

Reasoning about God's knowledge. How do people conceptualize God's knowledge and beliefs? One line of work (Barlev, Mermelstein, & German, 2017) tested whether adults possess distinct and conflicting God concepts reflective of the two sets of cognitive processes described in the previous section (i.e., implicit versus explicit). This work is a particularly good example of the methods used by cognitive science of religion scholars for two reasons. First, it applied a fundamental principle of cognitive science—that conflicting concepts create mental interference that produces measurable differences in the speed and accuracy of responses—to test for evidence that people possess two conflicting God concepts. Second, by using careful experimental manipulation, these researchers were able to identify a causal relationship between the variables of interest.

Across three studies, Barlev et al. (2017) manipulated statements about God on two dimensions: theological correctness within Christianity and reflectiveness of core intuitions about anthropomorphic minds. In some cases, the statements were consistent: either they were both theologically correct and anthropomorphically intuitive (e.g., “God has beliefs that are true”) or they were theologically incorrect and anthropomorphically counterintuitive (e.g., “All beliefs God has are false”). In other cases, the statements were inconsistent, whether

theologically correct but anthropomorphically counterintuitive (e.g., “All beliefs God has are true”) or theologically incorrect but anthropomorphically intuitive (e.g., “God has beliefs that are false”). Christian adults indicated whether each statement was true or false. Because religious adults typically endorse theologically correct beliefs in response to explicit questioning (Barrett, 1999), participants are likely to evaluate theologically correct statements as true and theologically incorrect statements as false. Researchers coded responses consistent with this assumption of theological correctness as accurate and inconsistent responses as inaccurate. Participants responded more slowly and less accurately when presented with inconsistent, versus consistent, statements. These results suggest the coexistence of two competing God concepts in these religious participants’ minds, which produced slower and less accurate responses when they conflicted within a single statement about God. In other words, participants may have represented God both in a theologically correct way (e.g., as having only true beliefs) and in an anthropomorphic way (e.g., as having some false beliefs).

Another line of research examining how people reason about God’s mental states is grounded in the literature on theory of mind (Premack & Woodruff, 1978). This work probed how children and adults attribute mental states such as knowledge and beliefs to other humans (Wimmer & Perner, 1983). Although exact estimates regarding the developmental trajectory of theory of mind vary depending on the experimental paradigm, current consensus suggests that the ability to explicitly report that another person’s knowledge and beliefs might differ from one’s own emerges around the age of four to five years (Wellman, 2014), with performance on more complex theory of mind tasks continuing to improve throughout adolescence and even early adulthood (Valle, Massaro, Castelli, & Marchetti, 2015). Given that the ability to represent

ordinary human minds and beliefs increases throughout development, how might this change affect how people represent the contents of *extraordinary* minds?

The methods used to study theory of mind in children and adults have provided scholars with unique insight into how people perceive the contents of God's mind, particularly as they relate to the theologically correct notion of omniscience (i.e., supernatural knowledge). In recent years, false belief tasks that had previously been administered within theory of mind research helped resolve a key dispute in the cognitive science of religion literature about the degree to which children of different ages perceive God as omniscient. Some scholars have proposed a "preparedness" account in which children represent God as an agent, but not necessarily an anthropomorphic agent (Barrett & Richert, 2003). If this preparedness account were accurate, supernatural characteristics like omniscience would not be conceptually problematic for young children because these children would not expect God to be limited by anthropomorphic constraints. Initial evidence from false belief tasks appeared to support the preparedness account: After encountering a saltine cracker box filled with rocks, 3- to 6-year-olds reported that God would know that the box contained rocks, while their mothers would believe it contained crackers (Barrett, Richert, & Driesenga, 2001). Similar findings have emerged across cultures and religious traditions, including United States children from mainstream Christian and Latter-Day Saints backgrounds as well as Indonesian children from Muslim and Catholic backgrounds (Nyhof & Johnson, 2017). Scholars originally interpreted these results as indicating that children do represent God as possessing supernatural knowledge and perceptual abilities. However, additional research has found that children in preschool and early elementary school only attribute to God knowledge that they themselves possess (Kiessling & Perner, 2014; Lane, Wellman, & Evans, 2010; Makris & Pnevmatikos, 2007). These results contradict the

“preparedness” account because they suggest that children do not, in fact, attribute all possible knowledge to God; in contrast, these young children appear to conceptualize the contents of God’s mind as subject to human constraints.

When and through what process do children begin to distinguish between ordinary and extraordinary minds? Research examining beliefs about omniscience among young children (3.5- to 6.5-year-olds), older children (6.5- to 12-year-olds), and adults (18- to 21-year-olds) may provide clues to this developmental trajectory (Lane, Wellman, & Evans, 2014). Across two studies, participants learned about a being named Ms. Smart who “knows everything about everything” and then answered questions about the extent of Ms. Smart’s knowledge as compared with the extent of an expert’s knowledge. While both older children and adults attributed greater knowledge to Ms. Smart *outside* of the experts’ domains of expertise (e.g., they reported that Ms. Smart knew more than a doctor about how to fix a broken car), adults were far more likely than children in either age group to attribute greater knowledge to Ms. Smart *inside* the experts’ domains of expertise (e.g., they were more likely to report that Ms. Smart knew more than a doctor about why one might get a runny nose). This finding indicates that a full understanding of the depth of omniscience does not develop until after twelve years of age; until this point, children struggle to conceptualize knowledge that is far deeper than human expertise. To summarize, in combination with work testing the anthropomorphism versus preparedness accounts (e.g., Makris & Pnevmatikos, 2007), these results suggest that children initially generalize qualities from human minds to God’s mind and only sometime between the ages of 12 and 18 gain a more complete appreciation of potential differences between the two, including a more complete understanding of the breadth and depth of God’s supernatural properties (Lane et al., 2014).

Reasoning about God's moral beliefs. Most studies examining how children and adults conceptualize the contents of God's mind have focused on factual knowledge. However, some work has shown that people believe God is especially concerned with moral (versus nonmoral) information (Purzycki, 2013). Because people sometimes process moral claims as if they are objectively true or false (i.e., like facts; Theriault, Waytz, Heiphetz, & Young, 2020), scholars have used similar methods to study how people perceive God's moral knowledge. This research has revealed that adults generally perceive God as knowing and caring about people's moral behaviors (Norenzayan, 2013), particularly their transgressions (Purzycki et al., 2012). In other words, adults distinguish God's extraordinary mind from ordinary human minds, as people do not necessarily expect other people to know about all transgressions that occur or to care in the same way that God might.

Interestingly, even newer research indicates that 4- to 5-year-old children attribute to God more knowledge of their prosocial actions rather than their transgressions, suggesting that "wishful thinking" may play a role in this process in early childhood (Wolle, McLaughlin, & Heiphetz, under review). Young children may report that God lacks knowledge of their transgressions relative to their prosocial actions because they do not want God to know about their transgressions. Wishful thinking decreases throughout childhood, with 10-year-olds displaying less wishful thinking than 3-year-olds (Wente et al., 2019), and a progressive decline in wishful thinking across groups of 6-year-olds, 8-year olds, and 10-year-olds (Bamford & Lagattuta, 2019). Undergraduate students display even less wishful thinking than 9- to 10-year-olds; for instance, they are less likely to rate their own abilities more highly than others' abilities after both parties experience a failure (Schuster, Ruble, & Weinert, 1998). Based on these results, adolescents might display a middling level of wishful thinking that falls between those of

older children and college-age adults. Thus, adolescents may be more likely than younger children, but less likely than adults, to attribute to God knowledge of their own transgressions; however, only by conducting future research that explicitly examines adolescents can scholars test this prediction.

Finally, beyond moral *knowledge* (i.e., knowledge of whether a morally praiseworthy or blameworthy behavior occurred), adults and children also reason differently about God's versus humans' moral *beliefs*. In one study (Heiphetz, Lane, Waytz, & Young, 2018), adults distinguished between God's mind and human minds with regard to judgments of certain behaviors. For instance, they reported that they were more likely than God to think that morally good behaviors as well as morally controversial behaviors (which elicit societal disagreement about whether or not they are acceptable; e.g., hurting one person in order to save five people) were acceptable. In contrast, 5- to 8-year-olds attributed similar moral beliefs to God and to humans. Although no research has explicitly probed how adolescents might respond within the same paradigm, based on the developmental difference Heiphetz et al. (2018) detected between children and adults, adolescents' responses may fall between these two extremes.

Interim summary. The work reviewed in this section reveals that, in addition to anthropomorphizing when thinking about the *kind* of mind God has, people also anthropomorphize under certain circumstances when reasoning about the *contents* of God's mind. Adults tend to conceptualize these contents—that is, God's knowledge and beliefs—in two competing ways. One implicit concept reflects a God whose mind is bound by human constraints, while a second explicit concept reflects a God with superhuman knowledge. Interestingly, very young children may not possess these discrepant concepts; instead, research investigating different potential accounts of anthropomorphism collectively indicates that

children younger than approximately five years of age only attribute to God knowledge that they personally possess. Then, throughout childhood, adolescence, and early adulthood, people develop a more refined, explicit understanding of the breadth and depth of God's knowledge. Finally, people believe that God is especially knowledgeable about moral behavior. While adults report that God cares most about negative transgressions, children tend to report that God knows more about their own positive prosocial behavior. It is likely the case that adolescent populations would report beliefs that fall between these two extremes, but additional work is needed to test this prediction.

Future directions. Research examining how people reason about the contents of God's mind throughout development suggests a number of opportunities for future work. One avenue for future research stems from work indicating that older children (6.5- to 12-year-olds) show less comprehension of omniscience than do young adults (18- to 21-year-olds; Lane et al., 2014). Although this work did not include adolescents, the difference between children and adults suggests that the adolescent years may be a critically important time in the development of an adult-like understanding of God's omniscience. Interestingly, despite this evidence for an important change in conceptualizing the contents of God's mind between the ages of 12 and 18, no follow-up work (to our knowledge) has studied adolescents to investigate exactly when, why, and how this change takes place. Are these conceptualizations revised slowly over the course of adolescence, or is there a common precipitating event that produces a sudden change? Future work should examine beliefs about God's mind during this important period of development.

Additionally, while much work within the cognitive science of religion tradition has focused on religious belief, adolescence is also a time of religious doubting (Fisher, 2017; for a broader perspective on adolescent religious exploration beyond doubt, see Layton, Hardy, &

Dollahite, 2012). The objects of such doubt include aspects of God concepts that fit with the notion of counterintuitiveness described earlier: “the divinity of Christ, some attribute of God (as His goodness or justice), His existence, and immortality” (Starbuck, 1899, p. 236). Years later, in a series of studies examining the religious beliefs of college students, between 57% and 79% of students reported experiencing a period during which they reacted against the beliefs they had been taught (Hastings & Hoge, 1976). Interestingly, these doubts began to emerge between fourteen and sixteen years old. While some research has sought to identify the identity-related underpinnings of this period of adolescent doubt (e.g., Puffer et al., 2008) as well as its consequences for the individual (e.g., Hunsberger, Pratt, & Pancer, 2002), far less work has examined the cognitive processes comprising religious disbelief.

The limited research that does examine this topic suggests that the same cognitive systems that shape belief also shape disbelief (Norenzayan & Gervais, 2013). One such factor appears to be analytic processing, a style of processing in which people prioritize slow, deliberative reasoning over fast, intuitive judgments. Recent work indicates that performance on analytic thinking measures is positively associated with religious disbelief (Shenhav, Rand, & Greene, 2012), and these findings have replicated in large cross-cultural studies conducted in India and the UK (Stagnaro, Ross, Pennycook, & Rand, 2019). Given that this style of deliberative processing emerges later in development than intuitive processing systems (Kokis, Macpherson, Toplak, West, & Stanovich, 2002), future research should directly probe the cognitive factors underlying adolescents’ disbelief. For instance, it is possible that significant increases in religious disbelief emerge during phases in adolescence in which students are intensively trained in analytic thinking (e.g., in preparation for standardized tests like the SAT). It is also important to note that analytic processing is not necessarily preferable to intuitive

processing. In fact, beyond its associations with religious belief, intuitive thinking is associated with positive outcomes such as creativity (Zhu, Ritter, Müller, & Dijksterhuis, 2017). Although adolescent education may tend to prioritize analytical thinking, each cognitive style provides individuals with distinct strengths.

Finally, some work has investigated the associations between education and declines in religiosity among adolescents and young adults. For instance, longitudinal research indicates that exposure to scientific knowledge in late adolescence and early adulthood does not itself predict religiosity; instead, only individuals who report that they consider science and religion to be incompatible are more likely to disaffiliate (Uecker & Longest, 2017). These findings raise interesting questions about the associations between scientific education, analytic thinking, and religious disbelief. If people's ability to reconcile these seemingly conflicting beliefs moderates the hypothesized relation between analytic thinking and religious disaffiliation, what factors predict such reconciliation in adolescence? Although research examining religious disbelief in college students may provide some insight into this question (e.g., teachers' commitment to secular thought; academic engagement; Hill, 2011), further work is needed to understand if the same factors apply earlier in adolescence.

Reasoning About Other People's Religious Beliefs

As discussed above, much of the research in the cognitive science of religion tradition has asked how people at different developmental stages conceptualize God's mind and its contents. But religion is not just defined by how people think about the minds of supernatural beings. For many people, religion is also *social* and involves thinking about the religious beliefs that other people hold. Importantly, the cognitive science of religion approach is not limited to studying strictly cognitive processes; scholars can use its methods to study psychology more

broadly, including social processes, to the extent that cognitive functioning informs these processes. It follows that this should also be true for the case of reasoning about others' religious beliefs.

How Do People Perceive Religious Beliefs as Compared with Other Mental States?

One foundational question that cognitive science of religion scholars have asked is how people conceptualize other individuals' religious beliefs. Some researchers have proposed that religious beliefs are qualitatively similar to factual beliefs and vary only with respect to their content (Boudry & Coyne, 2016; Levy, 2017; Oviedo & Szocik, 2020). In contrast, others have argued that religious beliefs are fundamentally different from facts (Atran, 2002; Van Leeuwen, 2017, 2018). For instance, Van Leeuwen (2014) has asserted that while factual beliefs guide action across different settings and are vulnerable to conflicting evidence, religious beliefs only apply to a limited group of contexts and are relatively immune to falsification.

Neuroscientific evidence provides some insight into this debate, as well as a useful example of how the methods of cognitive psychology can help answer questions about religious belief. In an fMRI study conducted by Harris and colleagues (2009), participants evaluated the truth versus falsity of religious statements (e.g., "Jesus Christ really performed the miracles attributed to him in the Bible") and factual statements (e.g., "Alexander the Great was a very famous military leader"). When participants were evaluating *either* kind of statement as true (versus false), researchers detected increased activation in the ventromedial prefrontal cortex, a region associated with decision-making and reward learning (O'Doherty, 2011) as well as self-representation (Wagner, Haxby, & Heatherton, 2012). In addition, when participants responded to religious statements—but not factual statements—they showed increased activation in several additional regions: the anterior insula, which is associated with subjective well-being (Li, Zhu,

Zheng, Wang, & Li, 2020) and various aspects of social cognition, including the personal experience of disgust and the perception of disgust in others (Wicker et al., 2003) as well as empathy (Morelli & Lieberman, 2013); the ventral striatum, which is associated with the expectation of reward (de la Fuente-Fernández et al., 2002); and the anterior cingulate cortex, a region involved in determining the value of different options in an uncertain environment (Kennerley, Walton, Behrens, Buckley, & Rushworth, 2006).

These results suggest that while a general set of cognitive processes may be generally involved in belief evaluation, religious beliefs may preferentially involve neural processes related to emotion, social cognition, reward, and valuation. Importantly, neural regions perform a variety of functions, so it can be difficult to make strong inferences about the specific psychological processes associated with the activation of a region. However, neuroscientists commonly infer that if two processes elicit different patterns of neural activation, the processes must be psychologically distinct in some way (e.g., Gobbini et al., 2010; Mitchell, Macrae, & Banaji, 2006; Ochsner et al., 2008). In line with this reasoning, the fact that Harris and colleagues (2009) found unique patterns of neural activity for religious versus factual statements suggests the occurrence of distinct underlying processes, even if it is not clear precisely what those processes are. (For additional insight on neural activation during religious experiences broadly construed, see Ferguson et al., 2018.)

Behavioral research provides converging evidence for the distinction between religious and factual beliefs. In one line of work, adults spoke of “thinking” about a fact but “believing” a religious view, suggesting that they distinguish between these two types of mental states (Heiphetz, Landers, & Van Leeuwen, in press). Although this research only tested adults, other studies have probed when this differentiation between religious beliefs and other mental states

emerges in development. In one line of work (Heiphetz, Spelke, Harris, & Banaji, 2013), 5- to 10-year-olds and adults heard two characters disagree about a religious belief, factual belief, or opinion, and indicated whether both characters or only one character could be right. Participants in all age groups were most likely to say that only one person could be right when responding to disagreements about factual beliefs and least likely to give this answer when responding to disagreements about opinions, with religious beliefs falling between these extremes. Similar findings of a study conducted in Iran, a highly religious context, indicated that both 8- to 10-year-old children and adults report greater confidence in scientific versus religious beliefs (Davoodi et al., 2019). These results suggest that across cultures, both children and adults distinguish between factual and religious beliefs. The consistency in results among children and adults across cultures suggests that adolescents would similarly reason that religious beliefs are different from facts.

How might people use this capacity to distinguish between religion and fact? One possibility is that reasoning about others' religious beliefs helps people feel that they can make better inferences about other individuals and the world around them. A helpful theory in considering how people make inferences on the basis of religious beliefs is that of epistemological understanding, which posits that individuals progress through a series of developmental stages in which they perceive beliefs as more or less subjective (Hofer & Pintrich, 1997). This theory argues that early in development, children treat others' assertions as objective, factual information that the other people learned through experience in the external world. Next, people enter a multiplist phase within which they conceptualize others' assertions as subjective opinions grounded in the individual. Finally, people enter an evaluativist phase in which they view assertions as a mix of subjective and objective (Kuhn et al., 2000).

The literature on epistemology has traditionally studied judgment domains including value, aesthetics, and personal taste. However, recent work has applied this framework to the study of religious beliefs. Based on theories of epistemological understanding, this line of work (Heiphetz, Spelke, Harris, & Banaji, 2014) tested whether children and adults understand religious beliefs to reflect information about the external world or about the person who holds the belief. In this work, both 8- to 10-year old children and adults perceived religious beliefs as providing some information about the world (like facts) *and* some information about the person who holds the belief (like opinions). In other words, children and adults appear to reason that religious beliefs are somewhat like factual beliefs and somewhat like opinions without being identical to either of these other categories. Although both children and adults showed this pattern, children perceived religious beliefs as somewhat more fact-like (i.e., as providing more information about the world) than adults did. This finding suggests that life experience may contribute to development in this domain. As people are exposed to an increasingly diverse set of people and beliefs throughout childhood and adolescence, they may grow to realize that statements of religious belief reveal quite a bit about the believer. However, more work is needed to understand how such reasoning changes throughout adolescence.

Interim summary. Taken together, this work provides insight into how people reason about other individuals' religious beliefs. It reveals that religious beliefs and factual beliefs are cognitively distinct; not only do they involve distinct patterns of neural activity, but people actually speak about them differently (i.e., "believing" versus "thinking") and place differing levels of confidence in them. This distinction is useful because it allows individuals to make more accurate inferences about other people. Finally, despite some similarities in conceptualizing the information that religious beliefs provide, children and adults think about

religious beliefs differently; as individuals age, they seem to perceive religious beliefs as more like opinions and less like facts.

Future directions. This line of inquiry into the distinction between religious beliefs, facts, and opinions is still fairly new, and opportunities for future research abound. For instance, extant findings suggest that 8- to 10-year-old children perceive religious beliefs as more fact-like than do adults (Heiphetz et al., 2014). As discussed above, this age-related difference may arise because adults have more experience with religious diversity than do children and therefore view religious beliefs as less similar to factual beliefs, about which nearly everyone agrees.

Adolescence may serve as a key developmental milestone during which individuals begin to view religious beliefs as less fact-like. This hypothesis stems from research suggesting that close friendships become deeper and begin to involve increasing levels of self-disclosure during adolescence (Way & Silverman, 2012). These friendships may provide a context for adolescents to learn about others' religious beliefs at a deeper level than younger children do. Such learning, in turn, could lead individuals to view religious beliefs as more similar to opinion (e.g., mental states that differ across individuals and do not have one correct viewpoint) than to fact. Future work can test this hypothesis by replicating Heiphetz et al.'s (2014) procedure with adolescents and determining the extent to which their friendships with religiously diverse others shape their responses.

Another approach to testing the hypothesis that age-related changes in conceptions of religious belief stem from social experience is to examine how these concepts change throughout development in cultures with varying levels of religious diversity, specifically probing whether these changes depend on experiencing different religious perspectives. For instance, people living in dense cities containing a wide range of religious adherents (e.g., residents of Singapore)

may view religious beliefs much more like opinions than people living in smaller and more homogeneous communities (e.g., residents of a rural Midwestern town in the United States). Further, studying adolescents from each of these cultures could help reveal the extent to which cultural context interacts with developmental stage to shape adolescents' views of religious beliefs. If social experience with religious diversity drives the perception that religion is more opinion-like rather than fact-like, then adolescents growing up in religiously diverse cultures should perceive religious beliefs as more similar to opinions than would adolescents in religiously homogenous cultures (who have less exposure to religious diversity by virtue of the place where they live) or younger children in religiously diverse cultures (who have less exposure to religious diversity by virtue of having been alive for fewer years and therefore having fewer opportunities to get to know people from different religious groups). This hypothesized change in perspective among adolescents in diverse cultures may have both benefits and drawbacks. On one hand, perceiving religious beliefs as similar to opinions might allow for smoother social interactions when engaging with individuals with different beliefs. In support of this point, some work suggests that cross-religious friendships benefit adolescents' socioemotional functioning, particularly among members of minoritized groups (Eisenberg et al., 2009). On the other hand, perceptions that religious beliefs are similar to opinions might be detrimental to the strength of one's own religious convictions, which some people may view as a drawback.

Another opportunity for future research relates to a recent set of studies indicating that 8- to 10-year-olds and adults perceive that religious beliefs can change over time (Heiphetz, Gelman, & Young, 2017). Perhaps this perceived flexibility contributes to Heiphetz and colleagues' (2014) finding that both 8- to 10-year-olds and adults perceive religious beliefs to

provide some information about the person who holds the belief. In other words, individuals may perceive that beliefs that a person chose to adopt reflect more about that person than beliefs that he or she did not actively choose. For this reason, a person's choices to either endorse a given set of religious beliefs or change those beliefs may provide insight into the current contents of his or her mind. Future studies could test this possibility directly. Such research could offer useful insight on how people reason about other individuals' religious beliefs, which would help psychologists to better understand human cognition. For instance, researchers might reproduce the basic design of Heiphetz et al.'s (2014) study by asking children, adolescents, and adults whether they understand religious beliefs to provide information about the external world or about the person who holds the belief. This future study could further probe if these results change when the experimenter describes the target person as having recently changed their religious beliefs (e.g., by converting from one religion to another) versus having maintained the same religious beliefs throughout their life. Based on the logic outlined here, participants may rate changed (versus stable) beliefs as providing more information about the individual.

Conclusion

The cognitive science of religion proposes that religion and spirituality are grounded in the systems underlying ordinary cognitive processing. Because these cognitive capabilities change as individuals age, this approach provides critical insight into how religious cognition might also change throughout development. However, while the cognitive science of religion literature has grown substantially in recent years, with a wealth of research on children and adults, very little work has examined adolescence. This near omission is striking because adolescence is a time of great change in multiple aspects of cognition, including cognitive processes related to religion. Past research on religious belief in adolescence suggests these

changes may have important implications for achievement and self-regulation (e.g., Abar, Carter, & Winsler, 2009). As such, applying a cognitive science of religion approach to adolescence would offer unique research opportunities to psychologists with wide-ranging interests. For instance, research investigating the cognitive underpinnings of adolescent religious doubt and disbelief may offer new insight to psychologists of religion and spirituality on how these changes emerge and whether they persist. Similarly, work examining how culture shapes adolescents' reasoning about factual beliefs versus religious beliefs may provide scholars interested in cognitive development with a broadened understanding of the interactions between social experience and cognition. Collectively, this work would contribute to psychologists' understanding of what makes the adolescent experience unique and, at the same time, help uncover the processes through which cognition develops. In doing so, these tools have the potential to advance the fields of developmental, cognitive, and social psychology as well as the cognitive science of religion.

References

- Abar, B., Carter, K. L., & Winsler, A. (2009). The effects of maternal parenting style and religious commitment on self-regulation, academic achievement, and risk behavior among African-American parochial college students. *Journal of Adolescence*, *32*(2), 259–273. doi: 10.1016/j.adolescence.2008.03.008
- Alcorta, C. S., & Sosis, R. (2020). Adolescent religious rites of passage: An anthropological perspective. In S. Hupp & J. D. Jewell (Eds.), *The encyclopedia of child and adolescent development* (Vol. 7, pp. 1–12). Hoboken, NJ: John Wiley & Sons. doi: 10.1002/9781119171492.wecad326
- Allen, J. P., McElhaney, K. B., Kuperminc, G. P., & Jodl, K. M. (2004). Stability and change in attachment security across adolescence. *Child Development*, *75*(6), 1792–1805. doi: 10.1111/j.1467-8624.2004.00817.x
- Atran, S. (2002). *In gods we trust: The evolutionary landscape of religion*. Oxford, UK: Oxford University Press.
- Bamford, C., & Lagattuta, K. H. (2019). Optimism and wishful thinking: Consistency across populations in children's expectations for the future. *Child Development*, Advance online publication. doi: 10.1111/cdev.13293
- Banerjee, K., Haque, O. S., & Spelke, E. S. (2013). Melting lizards and crying mailboxes: Children's preferential recall of minimally counterintuitive concepts. *Cognitive Science*, *37*(7), 1251–1289. doi: 10.1111/cogs.12037
- Barlev, M., Mermelstein, S., & German, T. C. (2017). Core intuitions about persons coexist and interfere with acquired Christian beliefs about God. *Cognitive Science*, *41*(S3), 425–454. doi: 10.1111/cogs.12435
- Barrett, J. L. (1999). Theological correctness: Cognitive constraint and the study of religion. *Method & Theory in the Study of Religion*, *11*(4), 325–339. doi: 10.1163/157006899X00078
- Barrett, J. L. (2000). Exploring the natural foundations of religion. *Trends in Cognitive Sciences*, *4*(1), 29–34. doi: 10.1016/S1364-6613(99)01419-9

- Barrett, J. L. (2004). *Why would anyone believe in God?* Walnut Creek, CA: AltaMira Press.
- Barrett, J. L. (2008). Coding and quantifying counterintuitiveness in religious concepts: Theoretical and methodological reflections. *Method & Theory in the Study of Religion*, 20(4), 308–338. doi: 10.1163/157006808X371806
- Barrett, J. L., & Keil, F. C. (1996). Conceptualizing a nonnatural entity: Anthropomorphism in God concepts. *Cognitive Psychology*, 31(3), 219–247. doi: 10.1006/cogp.1996.0017
- Barrett, J. L., & Richert, R. A. (2003). Anthropomorphism or preparedness? Exploring children's God concepts. *Review of Religious Research*, 44(3), 300–312. JSTOR. doi: 10.2307/3512389
- Barrett, J. L., Richert, R. A., & Driesenga, A. (2001). God's beliefs versus mother's: The development of nonhuman agent concepts. *Child Development*, 72(1), 50–65. doi: 10.1111/1467-8624.00265
- Baumard, N., & Boyer, P. (2013). Religious beliefs as reflective elaborations on intuitions: A modified dual-process model. *Current Directions in Psychological Science*, 22(4), 295–300. doi: 10.1177/0963721413478610
- Boudry, M., & Coyne, J. (2016). Disbelief in belief: On the cognitive status of supernatural beliefs. *Philosophical Psychology*, 29(4), 601–615. doi: 10.1080/09515089.2015.1110852
- Boyer, P. (2001). *Religion explained: The evolutionary origins of religious thought*. New York, NY: Basic Books.
- Boyer, P., & Ramble, C. (2001). Cognitive templates for religious concepts: Cross-cultural evidence for recall of counter-intuitive representations. *Cognitive Science*, 25(4), 535–564. doi: 10.1207/s15516709cog2504_2
- Brandone, A. C., & Gelman, S. A. (2013). Generic language use reveals domain differences in young children's expectations about animal and artifact categories. *Cognitive Development*, 28(1), 63–75. doi: 10.1016/j.cogdev.2012.09.002
- Davoodi, T., Jamshidi-Sianaki, M., Abedi, F., Payir, A., Cui, Y. K., Harris, P. L., & Corriveau, K. H. (2019). Beliefs about religious and scientific entities among parents and children in Iran. *Social*

- Psychological and Personality Science*, 10(7), 847–855. (Sage CA: Los Angeles, CA). doi: 10.1177/1948550618806057
- de la Fuente-Fernández, R., Phillips, A. G., Zamburlini, M., Sossi, V., Calne, D. B., Ruth, T. J., & Stoessl, A. J. (2002). Dopamine release in human ventral striatum and expectation of reward. *Behavioural Brain Research*, 136(2), 359–363. doi: 10.1016/S0166-4328(02)00130-4
- Demoulin, S., Saroglou, V., & Van Pachterbeke, M. (2008). Infra-humanizing others, supra-humanizing gods: The emotional hierarchy. *Social Cognition*, 26(2), 235–247. doi: 10.1521/soco.2008.26.2.235
- Dumontheil, I., Apperly, I. A., & Blakemore, S.-J. (2010). Online usage of theory of mind continues to develop in late adolescence. *Developmental Science*, 13(2), 331–338. doi: 10.1111/j.1467-7687.2009.00888.x
- Durkheim, É. (1915). *The elementary forms of the religious life* (J. W. Swain, Trans.). London, England: George Allen & Unwin.
- Eisenberg, N., Sallquist, J., French, D. C., Purwono, U., Suryanti, T. A., & Pidada, S. (2009). The relations of majority-minority group status and having an other-religion friend to Indonesian youths' socioemotional functioning. *Developmental Psychology*, 45(1), 248–259. doi: 10.1037/a0014028
- Epley, N., Waytz, A., & Cacioppo, J. T. (2007). On seeing human: A three-factor theory of anthropomorphism. *Psychological Review*, 114(4), 864–886. doi: 10.1037/0033-295X.114.4.864
- Evans, J. St. B. T. (2008). Dual-processing accounts of reasoning, judgment, and social cognition. *Annual Review of Psychology*, 59(1), 255–278. doi: 10.1146/annurev.psych.59.103006.093629
- Ferguson, M. A., Nielsen, J. A., King, J. B., Dai, L., Giangrasso, D. M., Holman, R., ... Anderson, J. S. (2018). Reward, salience, and attentional networks are activated by religious experience in devout Mormons. *Social Neuroscience*, 13(1), 104–116. doi: 10.1080/17470919.2016.1257437

- Fisher, A. R. (2017). A review and conceptual model of the research on doubt, disaffiliation, and related religious changes. *Psychology of Religion and Spirituality*, 9(4), 358–367. doi: 10.1037/rel0000088
- Gobbini, M. I., Gentili, C., Ricciardi, E., Bellucci, C., Salvini, P., Laschi, C., ... Pietrini, P. (2010). Distinct neural systems involved in agency and animacy detection. *Journal of Cognitive Neuroscience*, 23(8), 1911–1920. doi: 10.1162/jocn.2010.21574
- Gonce, L. O., Upal, M. A., Slone, D. J., & Tweney, R. D. (2006). Role of context in the recall of counterintuitive concepts. *Journal of Cognition and Culture*, 6(3–4), 521–547. doi: 10.1163/156853706778554959
- Guthrie, S. E. (1993). *Faces in the clouds: A new theory of religion*. New York, NY: Oxford University Press.
- Harris, S., Kaplan, J. T., Curiel, A., Bookheimer, S. Y., Iacoboni, M., & Cohen, M. S. (2009). The neural correlates of religious and nonreligious belief. *PLOS ONE*, 4(10), e7272. doi: 10.1371/journal.pone.0007272
- Hastings, P. K., & Hoge, D. R. (1976). Changes in religion among college students, 1948 to 1974. *Journal for the Scientific Study of Religion*, 15(3), 237–249. JSTOR. doi: 10.2307/1386087
- Heiphetz, L., Gelman, S. A., & Young, L. L. (2017). The perceived stability and biological basis of religious beliefs, factual beliefs, and opinions. *Journal of Experimental Child Psychology*, 156, 82–98. doi: 10.1016/j.jecp.2016.11.015
- Heiphetz, L., Landers, C. L., & Van Leeuwen, N. (in press). Does think mean the same thing as believe? Linguistic insights into religious cognition. *Psychology of Religion and Spirituality*. doi: 10.1037/rel0000238
- Heiphetz, L., Lane, J. D., Waytz, A., & Young, L. L. (2016). How children and adults represent God's mind. *Cognitive Science*, 40(1), 121–144. doi: 10.1111/cogs.12232

- Heiphetz, L., Lane, J. D., Waytz, A., & Young, L. L. (2018). My mind, your mind, and God's mind: How children and adults conceive of different agents' moral beliefs. *British Journal of Developmental Psychology, 36*(3), 467–481. doi: 10.1111/bjdp.12231
- Heiphetz, L., Spelke, E. S., Harris, P. L., & Banaji, M. R. (2013). The development of reasoning about beliefs: Fact, preference, and ideology. *Journal of Experimental Social Psychology, 49*(3), 559–565. doi: 10.1016/j.jesp.2012.09.005
- Heiphetz, L., Spelke, E. S., Harris, P. L., & Banaji, M. R. (2014). What do different beliefs tell us? An examination of factual, opinion-based, and religious beliefs. *Cognitive Development, 30*, 15–29. doi: 10.1016/j.cogdev.2013.12.002
- Hill, J. P. (2011). Faith and understanding: Specifying the impact of higher education on religious belief. *Journal for the Scientific Study of Religion, 50*(3), 533–551. doi: 10.1111/j.1468-5906.2011.01587.x
- Hofer, B. K., & Pintrich, P. R. (1997). The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning. *Review of Educational Research, 67*(1), 88–140. (Sage CA: Thousand Oaks, CA). doi: 10.3102/00346543067001088
- Hornbeck, R. G., & Barrett, J. L. (2013). Refining and testing “counterintuitiveness” in virtual reality: Cross-cultural evidence for recall of counterintuitive representations. *The International Journal for the Psychology of Religion, 23*(1), 15–28. doi: 10.1080/10508619.2013.735192
- Hume, D. (1779). *Dialogues concerning natural religion*. London, England: Penguin Books.
- Hunsberger, B., Pratt, M., & Pancer, S. M. (2002). A longitudinal study of religious doubts in high school and beyond: Relationships, stability, and searching for answers. *Journal for the Scientific Study of Religion, 41*(2), 255–266.
- Keil, F. C. (1989). *Concepts, kinds, and cognitive development*. Cambridge, MA: MIT Press.
- Kelemen, D. (2004). Are children “intuitive theists”? Reasoning about purpose and design in nature. *Psychological Science, 15*(5), 295–301. doi: 10.1111/j.0956-7976.2004.00672.x

- Kelemen, D., & DiYanni, C. (2005). Intuitions about origins: Purpose and intelligent design in children's reasoning about nature. *Journal of Cognition and Development, 6*(1), 3–31. doi: 10.1207/s15327647jcd0601_2
- Kennerley, S. W., Walton, M. E., Behrens, T. E. J., Buckley, M. J., & Rushworth, M. F. S. (2006). Optimal decision making and the anterior cingulate cortex. *Nature Neuroscience, 9*(7), 940–947. doi: 10.1038/nn1724
- Kiessling, F., & Perner, J. (2014). God–mother–baby: What children think they know. *Child Development, 85*(4), 1601–1616. doi: 10.1111/cdev.12210
- Kimball, C. N., Boyatzis, C. J., Cook, K. V., Leonard, K. C., & Flanagan, K. S. (2013). Attachment to God: A qualitative exploration of emerging adults' spiritual relationship with God. *Journal of Psychology and Theology, 41*(3), 175–188. doi: 10.1177/009164711304100301
- Kokis, J. V., Macpherson, R., Toplak, M. E., West, R. F., & Stanovich, K. E. (2002). Heuristic and analytic processing: Age trends and associations with cognitive ability and cognitive styles. *Journal of Experimental Child Psychology, 83*(1), 26–52. doi: 10.1016/S0022-0965(02)00121-2
- Kuhn, D., Cheney, R., & Weinstock, M. (2000). The development of epistemological understanding. *Cognitive Development, 15*(3), 309–328. doi: 10.1016/S0885-2014(00)00030-7
- Lane, J. D., Wellman, H. M., & Evans, E. M. (2010). Children's understanding of ordinary and extraordinary minds. *Child Development, 81*(5), 1475–1489. doi: 10.1111/j.1467-8624.2010.01486.x
- Lane, J. D., Wellman, H. M., & Evans, E. M. (2014). Approaching an understanding of omniscience from the preschool years to early adulthood. *Developmental Psychology, 50*(10), 2380–2392. doi: 10.1037/a0037715
- Layton, E., Hardy, S. A., & Dollahite, D. C. (2012). Religious exploration among highly religious American adolescents. *Identity, 12*(2), 157–184. doi: 10.1080/15283488.2012.668728
- Legare, C. H., & Souza, A. L. (2014). Searching for control: Priming randomness increases the evaluation of ritual efficacy. *Cognitive Science, 38*(1), 152–161. doi: 10.1111/cogs.12077

- Levy, N. (2017). Religious beliefs are factual beliefs: Content does not correlate with context sensitivity. *Cognition*, *161*, 109–116. doi: 10.1016/j.cognition.2017.01.012
- Li, R., Zhu, X., Zheng, Z., Wang, P., & Li, J. (2020). Subjective well-being is associated with the functional connectivity network of the dorsal anterior insula. *Neuropsychologia*, *141*, 1–8. doi: 10.1016/j.neuropsychologia.2020.107393
- Makris, N., & Pnevmatikos, D. (2007). Children's understanding of human and super-natural mind. *Cognitive Development*, *22*(3), 365–375. doi: 10.1016/j.cogdev.2006.12.003
- Malinowski, B. (1948). *Magic, science and religion and other essays*. Boston, MA: Beacon Press.
- McCauley, R. N., & Lawson, E. T. (2002). *Bringing ritual to mind: Psychological foundations of cultural forms*. New York, NY: Cambridge University Press. doi: 10.1017/CBO9780511606410
- Miner, M., Dowson, M., & Malone, K. (2014). Attachment to God, psychological need satisfaction, and psychological well-being among Christians. *Journal of Psychology and Theology*, *42*(4), 326–342. doi: 10.1177/009164711404200402
- Mitchell, J. P., Macrae, C. N., & Banaji, M. R. (2006). Dissociable medial prefrontal contributions to judgments of similar and dissimilar others. *Neuron*, *50*(4), 655–663. doi: 10.1016/j.neuron.2006.03.040
- Morelli, S. A., & Lieberman, M. D. (2013). The role of automaticity and attention in neural processes underlying empathy for happiness, sadness, and anxiety. *Frontiers in Human Neuroscience*, *7*. doi: 10.3389/fnhum.2013.00160
- Nieuwboer, W., van Schie, H. T., & Wigboldus, D. (2015). Priming with religion and supernatural agency enhances the perception of intentionality in natural phenomena. *Journal for the Cognitive Science of Religion*, *2*(2), 97–120. doi: 10.1558/jcsr.v2i2.24483
- Norenzayan, A. (2013). *Big gods: How religion transformed cooperation and conflict* (pp. xiii, 248). Princeton, NJ: Princeton University Press.
- Norenzayan, A., & Gervais, W. M. (2013). The origins of religious disbelief. *Trends in Cognitive Sciences*, *17*(1), 20–25. doi: 10.1016/j.tics.2012.11.006

- Nyhof, M. A., & Johnson, C. N. (2017). Is God just a big person? Children's conceptions of God across cultures and religious traditions. *British Journal of Developmental Psychology, 35*(1), 60–75. doi: 10.1111/bjdp.12173
- Ochsner, K. N., Zaki, J., Hanelin, J., Ludlow, D. H., Knierim, K., Ramachandran, T., ... Mackey, S. C. (2008). Your pain or mine? Common and distinct neural systems supporting the perception of pain in self and other. *Social Cognitive and Affective Neuroscience, 3*(2), 144–160. doi: 10.1093/scan/nsn006
- O'Doherty, J. P. (2011). Contributions of the ventromedial prefrontal cortex to goal-directed action selection. *Annals of the New York Academy of Sciences, 1239*(1), 118–129. doi: 10.1111/j.1749-6632.2011.06290.x
- Oviedo, L. (2015). Religious cognition as a dual-process: Developing the model. *Method & Theory in the Study of Religion, 27*(1), 31–58. doi: 10.1163/15700682-12341288
- Oviedo, L., & Szocik, K. (2020). Religious—and other beliefs: How much specificity? *SAGE Open, 10*(1), 1–11. (Sage CA: Los Angeles, CA). doi: 10.1177/2158244019898849
- Porubanova, M., Shaw, D. J., McKay, R., & Xygalatas, D. (2014). Memory for expectation-violating concepts: The effects of agents and cultural familiarity. *PLoS ONE, 9*(4), e90684. doi: 10.1371/journal.pone.0090684
- Premack, D., & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences, 1*(4), 515–526. doi: 10.1017/S0140525X00076512
- Puffer, K. A., Pence, K. G., Graverson, T. M., Wolfe, M., Pate, E., & Clegg, S. (2008). Religious doubt and identity formation: Salient predictors of adolescent religious doubt. *Journal of Psychology and Theology, 36*(4), 270–284. doi: 10.1177/009164710803600403
- Purzycki, B. G. (2013). The minds of gods: A comparative study of supernatural agency. *Cognition, 129*(1), 163–179. doi: 10.1016/j.cognition.2013.06.010

- Purzycki, B. G., Finkel, D. N., Shaver, J., Wales, N., Cohen, A. B., & Sosis, R. (2012). What does God know? Supernatural agents' access to socially strategic and non-strategic information. *Cognitive Science*, *36*(5), 846–869. doi: 10.1111/j.1551-6709.2012.01242.x
- Richert, R. A., Saide, A. R., Lesage, K. A., & Shaman, N. J. (2017). The role of religious context in children's differentiation between God's mind and human minds. *British Journal of Developmental Psychology*, *35*(1), 37–59. doi: 10.1111/bjdp.12160
- Scholl, B. J., & Gao, T. (2013). Perceiving animacy and intentionality: Visual processing or higher-level judgment? In M. D. Rutherford & V. A. Kuhlmeier (Eds.), *Social perception: Detection and interpretation of animacy, agency, and intention* (pp. 197–229). Cambridge, MA: MIT Press.
- Schuster, B., Ruble, D. N., & Weinert, F. E. (1998). Causal inferences and the positivity bias in children: The role of the covariation principle. *Child Development*, *69*(6), 1577–1596. JSTOR. doi: 10.2307/1132133
- Shenhav, A., Rand, D. G., & Greene, J. D. (2012). Divine intuition: Cognitive style influences belief in God. *Journal of Experimental Psychology: General*, *141*(3), 423–428. doi: 10.1037/a0025391
- Shtulman, A., & Lindeman, M. (2016). Attributes of God: Conceptual foundations of a foundational belief. *Cognitive Science*, *40*(3), 635–670. doi: 10.1111/cogs.12253
- Spelke, E. S., & Kinzler, K. D. (2007). Core knowledge. *Developmental Science*, *10*(1), 89–96. doi: 10.1111/j.1467-7687.2007.00569.x
- Stagnaro, M. N., Ross, R. M., Pennycook, G., & Rand, D. G. (2019). Cross-cultural support for a link between analytic thinking and disbelief in god: Evidence from India and the United Kingdom. *Judgment and Decision Making*, *14*(2), 179–186.
- Starbuck, E. D. (1899). Chapter XVIII: Adolescence—Doubt. In *The psychology of religion: An empirical study of the growth of religious consciousness*. London, England: Walter Scott.
- Theriault, J., Waytz, A., Heiphetz, L., & Young, L. (2020). Theory of mind network activity is associated with metaethical judgment: An item analysis. *Neuropsychologia*, *143*, 107475. doi: 10.1016/j.neuropsychologia.2020.107475

- Uecker, J. E., & Longest, K. C. (2017). Exposure to science, perspectives on science and religion, and religious commitment in young adulthood. *Social Science Research, 65*, 145–162. doi: 10.1016/j.ssresearch.2017.01.002
- Valle, A., Massaro, D., Castelli, I., & Marchetti, A. (2015). Theory of mind development in adolescence and early adulthood: The growing complexity of recursive thinking ability. *Europe's Journal of Psychology, 11*(1), 112–124. doi: 10.5964/ejop.v11i1.829
- Van Leeuwen, N. (2014). Religious credence is not factual belief. *Cognition, 133*(3), 698–715. doi: 10.1016/j.cognition.2014.08.015
- Van Leeuwen, N. (2017). Two paradigms for religious representation: The physicist and the playground (a reply to Levy). *Cognition, 164*, 206–211. doi: 10.1016/j.cognition.2017.03.021
- Van Leeuwen, N. (2018). The factual belief fallacy. *Contemporary Pragmatism, 15*(3), 319–343. Scopus. doi: 10.1163/18758185-01503004
- Wagner, D. D., Haxby, J. V., & Heatherton, T. F. (2012). The representation of self and person knowledge in the medial prefrontal cortex. *Wiley Interdisciplinary Reviews. Cognitive Science, 3*(4), 451–470. doi: 10.1002/wcs.1183
- Way, N., & Silverman, L. R. (2012). The quality of friendships during adolescence. In P. K. Kerig, M. S. Schulz, & S. T. Hauser (Eds.), *Adolescence and beyond: Family processes and development* (pp. 91–112). New York, NY: Oxford University Press.
- Wellman, H. M. (2014). *Making minds: How theory of mind develops*. New York, NY: Oxford University Press.
- Wellman, H. M., Cross, D., & Watson, J. (2001). Meta-analysis of theory-of-mind development: The truth about false belief. *Child Development, 72*(3), 655–684. doi: 10.1111/1467-8624.00304
- Wellman, H. M., & Gelman, S. A. (1992). Cognitive development: Foundational theories of core domains. *Annual Review of Psychology, 43*(1), 337–375. doi: 10.1146/annurev.ps.43.020192.002005

- Wente, A. O., Goddu, M. K., Garcia, T., Posner, E., Flecha, M. F., & Gopnik, A. (2019). Young children are wishful thinkers: The development of wishful thinking in 3- to 10-year-old children. *Child Development*, Advance online publication. doi: 10.1111/cdev.13299
- Wicker, B., Keysers, C., Plailly, J., Royet, J.-P., Gallese, V., & Rizzolatti, G. (2003). Both of us disgusted in my insula: The common neural basis of seeing and feeling disgust. *Neuron*, *40*(3), 655–664. doi: 10.1016/S0896-6273(03)00679-2
- Wimmer, H., & Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition*, *13*(1), 103–128. doi: 10.1016/0010-0277(83)90004-5
- Wolle, R. G., McLaughlin, A., & Heiphetz, L. (under review). *The role of theory of mind and wishful thinking in children's moralizing God concepts.*
- Zhu, Y., Ritter, S. M., Müller, B. C. N., & Dijksterhuis, A. (2017). Creativity: Intuitive processing outperforms deliberative processing in creative idea selection. *Journal of Experimental Social Psychology*, *73*, 180–188. doi: 10.1016/j.jesp.2017.06.009