Published in final edited form as:
Dev Psychol. 2014 October ; 50(10): 2380–2392. doi:10.1037/a0037715.

Approaching an Understanding of Omniscience from the Preschool Years to Early Adulthood

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Abstract

Individuals in many cultures believe in omniscient (all-knowing) beings, but everyday representations of omniscience have rarely been studied. To understand the nature of such representations requires knowing how they develop. Two studies examined the breadth of knowledge (i.e., types of knowledge) and depth of knowledge (i.e., amount of knowledge within domains) that preschoolers, elementary-school children, and adults (N = 180) attributed to an all-knowing being. Preschoolers often reported that an omniscient mind would lack many types of knowledge, and completely failed to understand the depth of omniscient knowledge. With increasing age, children approached an understanding of omniscience—attributing broader and deeper knowledge to an omniscient agent—but only adults firmly understood the depth of omniscient knowledge. We identify socio-cultural and cognitive factors that correlate with children's understandings of omniscience. Findings demonstrate that childhood representations of fallible, limited, human minds both make possible and constrain developing representations of radically non-human minds.

Keywords

theory-of-mind; counterintuitive concepts; conceptual development; cognitive science of religion

Individuals worldwide believe in beings with extraordinary mental capacities. An omniscient, or all-knowing, God is embedded in the belief systems of Judaism, Christianity, and Islam (Armstrong, 1993); in Buddhism, which holds that Guatama Buddha achieved an 'enlightened' state in which he possessed extraordinary knowledge (Pyysiäinen, 2003); and in Hinduism, which holds that Vishnu is omniscient (Kumar, 1998). Not only are concepts of omniscient beings found in the most widespread religions, "omni" qualities, such as omniscience, are central to many individuals' personal conceptualizations of a God (e.g., Barrett, 1998; Noffke & McFadden, 2001; Spilka, Armatas, & Nussbaum, 1964). Although such ideas are widely endorsed, they may be particularly difficult for us to fully cognitively represent because they do not accord with our everyday intuitions about human minds that are fallible, subject to ignorance and misperceptions. In the current studies we investigate

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how children and adults come to represent omniscient beings. These studies help reveal how we come to conceptualize counterintuitive ideas, and shed light on the ontogeny and flexibility of our everyday theory of mind.

In contrast to ordinary sentience, "omniscience" refers to knowing *everything*. Christian and Jewish scripture "declares that God's eyes run everywhere…He searches all hearts and observes everyone's ways…in other words, he knows everything about everything and everybody all the time. Also, he knows the future no less than the past and the present….all his knowledge is always immediately and directly before his mind" (Packer, 1993, pp. 31-32). Similarly, the Qur'an proclaims that, "Allah knows whatsoever is in the heavens and whatsoever is on the earth…Verily, Allah is the All-Knower of everything" (Surah Mujadila, 58: 7).

Such a mind is radically different from the fallible human minds with which we interact on a daily basis. A seminal study with college students sheds light on how adults cognitively represent such a mind (Barrett & Keil, 1996). A particular focus was the discursiveness of God's knowledge; God "sees all things not piecemeal or one at a time…he sees them all at once" (St. Augustine cited in Aquinas, 1265-1274/2006, p. 180). When asked directly, participants—whose religious backgrounds included Baha'ism, Buddhism, Christianity, Hinduism, and Judaism—overwhelmingly endowed God with omniscience, reporting that God "can read minds" and "knows everything." Then, participants read scenarios in which God faced simultaneous demands, such as a boy who prayed to God for help while God attended to someone else's prayers. When asked whether various statements were true of God (e.g., "God had just finished answering another prayer when God helped the boy"), participants often responded in the affirmative, suggesting that they defaulted to thinking of God as mentally constrained (i.e., God becomes aware of and responds to prayers sequentially). Moreover, when asked to paraphrase such narratives, they often referred to God as having human-like mental and spatiotemporal constraints. (See Barrett, 1998, for similar results from Hindu participants who reasoned about Vishnu.) Thus, although adults may report believing in God's total omniscience, in their everyday reasoning, they easily default to thinking of God as possessing a powerful yet *limited*, human-like mind.

Our research focuses on the development of such notions in childhood. Some theorists have argued that children are "prepared" to represent and believe in omniscient or mentally-infallible beings; so, to represent these ideas later in development merely requires that children retain these intuitive ideas into adulthood (e.g., Barrett & Richert, 2003; Richert & Barrett, 2005). Empirically, this *preparedness* position was inspired by research demonstrating that 3-year-olds over-attribute certain knowledge (e.g., knowledge of the contents of closed boxes) to ordinary people and to God (e.g., Barrett et al., 2001; Wellman & Bartsch, 1988), and that 5-year-olds attribute this privileged knowledge to God but not to ordinary people (Barrett et al., 2001). Thus, Barrett and Richert surmised that, "on many properties, young children seem equipped with default assumptions that better match theological descriptions of God than adult conceptions of people. Three-year-olds assume beliefs and percepts are infallible" (2003, p. 309).

In contrast, theorists who advocate an "anthropomorphism" perspective propose that young children have particular difficulty understanding extraordinary mental capacities and tend to conceive of even extraordinary agents' minds as human-like (Giménez-Dasi & Harris, 2005; Kiessling & Perner, 2014; Lane, Wellman, & Evans, 2010, 2012; Makris & Pnevmatikos, 2007). As their ideas mature, children increasingly appreciate omniscience, although, as just discussed, even adults may fall short of a full understanding. Whereas proponents of the preparedness hypothesis take 3-year-olds' over-attribution of knowledge to people (on classic theory-of-mind tasks) as evidence that they understand mental infallibility, proponents of the anthropomorphism perspective argue that 3-year-olds do not attribute *extraordinary* or *infallible* knowledge in these studies, but, instead, they are often focused on reality or on their own knowledge and viewpoint (e.g., Lane et al., 2010, 2012; Makris & Pnevmatikos, 2007).

Aside from their differing interpretations of early development, both of these positions—anthropomorphism and preparedness—concur that by about 5-years, children can distinguish between the enhanced, less limited knowledge of God and the more fallible, more limited knowledge of ordinary humans (e.g., Giménez-Dasí, Guerrero, & Harris, 2005; Knight, Sousa, Barrett, & Atran, 2004; Makris & Pnevmatikos, 2007). Moreover, 5-year-olds easily attribute certain sorts of extraordinary knowledge to beings with exceptional perception and to novel beings whom they are taught "know everything" (Lane et al., 2010, 2012). A key question, however, concerns whether 5-year-olds' attribution of privileged knowledge to God and to others reflects an attribution of anything like omniscience. Addressing this question could shed light on fundamentally contrasting positions within the cognitive science of religion, yet children's full understanding of omniscience remains untested. In research thus far, 5-year-olds attribute knowledge of easily-accessible information about the here-and-now (e.g., knowledge of the contents of closed or darkened containers, which children themselves have seen) to God and other extraordinary beings, but such research falls far short of considering the scope of omniscient knowledge as outlined earlier—knowledge of *everything about everything*; not just ordinary information about the here-and-now, but additionally knowledge of the past and future, and everyone's intents and behavior. Is conceptualizing this dramatically non-human capacity found early in childhood or does it emerge gradually over an extended developmental period?

In the current studies, we assess preschoolers', elementary-school children's, and adults' understanding of the breadth and depth of an all-knowing being's knowledge. By "breadth", we refer to the *types* or domains of knowledge that someone possesses; here we focus on an all-knowing agent's knowledge of facts about the past, present, and future, as well as knowledge of others' personal information (e.g., someone's thoughts and preferences). These forms of knowledge are suitably broad for a consideration of omniscience. We also assess participants' understanding of the "depth" of an all-knowing being's knowledge *within* domains. An omniscient agent's knowledge would be so deep that it would surpass even experts' knowledge within their domains of expertise. Children's understanding of expertise is well-researched, with prior studies indicating that preschoolers appreciate that experts know more than others about specific domains—for example, doctors know more about health than do mechanics (Lutz & Keil, 2002). To understand omniscience, children

and adults must conceptualize a being who knows more about health than doctors and more about cars than mechanics. Thus, we assess whether children and adults understand the distinction between knowing a lot about a specific domain (i.e., being expert) and knowing *everything* about every domain (i.e., being omniscient).

Given that religious beliefs, practices, and instruction vary across religions and cultures, a full account of the development of ideas of omniscience will require research in multiple settings. Here, we begin by examining these developments in a religiously-saturated culture —the United States. Over 90% of the U.S. public believes in a God (Pew Research Center, 2008) and they attend religious institutions more frequently than almost all other western societies (Bloom, 2012). Such cultural beliefs and messages may foster enhanced early ideas of omniscience. Previewing our results, however, we find early misunderstanding and prolonged difficulties in developing understandings of omniscience in the U.S.

Study 1

In an initial study we outline trends that frame a more comprehensive follow-up study. In both studies, participants were questioned about a being that they were taught and shown "knows everything about everything," Ms. (or Mr.) Smart. We focus on Ms. Smart because a focus on God is problematic in several respects. Children in particular might just parrot certain sayings about God—"he knows everything"—in unreflective ways (Evans, 2001). Or they could legitimately underestimate and anthropomorphize God's mentality because God is often presented to children as human-like in stories and songs. Moreover, U.S. children vary in their exposure to ideas about the Judeo-Christian God. So, incorrect reasoning about God's omniscience might reflect lack of knowledge about God rather than a fundamental difficulty conceptualizing omniscience. Focusing on Ms. Smart allowed us to provide standardized information to all participants about the mind of a focal extraordinary being. We provided multiple pieces of evidence about her mental capacities, more direct, explicit input than many children may receive about God's mind. We reasoned that capitalizing on extensive and immediate input about Ms. Smart's mind would enable us to more sensitively and uniformly uncover any understanding that children have of extraordinary mentality. Empirically, use of Ms. Smart is supported by prior research by Lane et al. (2012), demonstrating that even religiously-schooled 4-year-olds more readily attributed extraordinary knowledge to Mr. Smart (whom they were taught and reminded "knows everything") than to God.

Method

Participants—Participants included 21 young children (3.5 to 6.5 years) and 19 older children (6.5 to 12 years) who attended schools or camp in southeastern Michigan. One preschooler was not fluent in English and one discontinued the interview, resulting in 19 children in the youngest group. Twenty-four university students (18 to 21 years) also participated. Participants were primarily White and of middle- to upper-middle-class socioeconomic status.

Procedure and Measures

Understanding experts' depth of knowledge: Participants saw drawings of four experts (gender-matched to the participant)—a doctor, mechanic, chef, and pilot—and were told about each one's area of expertise. For example, "This is a doctor. A doctor is a person who helps people when they are sick or hurt and makes sure that people are healthy," or "This is a mechanic. A mechanic is a person who fixes people's cars when there is something wrong, and makes sure cars run well." For each expert, participants were asked how much he/she knows about their domain; for example, "How much does a doctor know about being healthy? Some things, lots of things, or everything?" (for half of the sample, these choices were given in reverse order). As a visual aid, participants were shown a graph with three vertical bars reflecting each of the three amounts. For these and all questions that follow, if a participant responded "I don't know" or offered no answer, they were reassured that they could answer however they like and the question was repeated. The frequency of final "I don't know" responses ranged from 0-1 per question across all children. Such responses to Yes/No questions were coded 0 (where 1=Yes, and 0=No), and such responses to other questions were excluded from the composite measures.

Understanding domain-specific expertise: Following Lutz and Keil (2002), participants' understanding of expertise was assessed by asking them eight questions in which they compared the knowledge held by the different experts (e.g., the drawings of the doctor and mechanic were shown, and children were asked, "Who knows more about why you get a runny nose?"; for the full pool of questions, see the Supplemental Materials). Participants could respond by naming or pointing to the expert. Participants earned a point each time they identified the correct expert, for scores ranging from 0 to 8.

Understanding an all-knowing beings' breadth of knowledge: Participants were then introduced to Ms. Smart (for female participants) or Mr. Smart (for male participants), a character who "knows everything about everything" (hereafter we simply refer to "Ms. Smart"). As detailed in Appendix A, this included descriptions and demonstrations of Ms. Smart's ability to know information unknown to the experimenter or participants. Then they were asked six yes/no questions (see Table 1) concerning the types of knowledge she possesses. These included three questions about non-personal information about the past, present, and future, and three questions about personal information.

Understanding an all-knowing being's depth of knowledge: Omniscient knowledge is not just extraordinarily broad, but is also extraordinarily deep. To examine their understanding of the depth of omniscience, participants received 16 questions comparing the experts' and Ms. Smart's knowledge. Four questions were asked about each of the four experts, presented one at a time. To limit the influence of characters' appearance, images of the experts and Ms. Smart were turned over before asking the questions. Eight questions referred to knowledge *outside of the experts' domains* (e.g., when comparing Ms. Smart and a mechanic, "Who knows more about why you get a runny nose?"), and eight referred to knowledge *within the experts' domains* (e.g., when comparing Ms. Smart and a mechanic, "Who knows more about how you fix a broken car?"). For each item, participants earned a point each time they identified Ms. Smart as more knowledgeable. Composite scores were

created for knowledge *Outside Experts' Domains*, and for knowledge *Within Experts' Domains*, by summing across the 8 items (range: 0-8). (See Supplemental Materials for all questions.)

Results

Understanding Experts' Knowledge—Participants' understanding of expertise sets a baseline for their judgments about Ms. Smart. When asked to compare experts' knowledge (e.g., "Who knows more about why you get a runny nose, a doctor or mechanic?"), all participants were near or at ceiling. Children age 3.5-6.5 years (M = 7.58, SD = 1.43), children age 6.5-12 years (M = 8.00, SD = 0) and adults (M = 8.00, SD = 0) responded correctly. Participants were also asked how much each expert knows about his/her domain (e.g., "How much does a doctor know about medicine? Some things, lots of things, or everything?"). There was a significant age-group difference in whether participants attributed knowledge of "everything" to the experts, $\chi^2(2) = 8.61$, $p < .05$: 3.5-6.5-year-olds (50%); 6.5-12-year-olds (39%); adults (24%).

Understanding an All-Knowing Beings' Breadth of Knowledge—To assess participants' understanding of Ms. Smart's breadth of knowledge, they were asked whether she possessed six types of knowledge. As shown in Table 1, preschoolers attributed only one type of knowledge to Ms. Smart above chance—where to find the tallest tree in the world; essentially, accessible knowledge of the present. Older children additionally granted to her knowledge of their birthday and favorite food—personal information that is publicly displayed—but not knowledge of their own mental states or the future. In contrast, adults typically reported that she would know *all six* pieces of information. That preschoolers were particularly conservative in their estimations of Ms. Smart's knowledge is especially clear when considering who attributed *all* six pieces of information to her—only 16% of the youngest children did so, compared to 63% of older children and 83% of adults, $\chi^2(2) = 19.86$, $p < .001$.

Understanding an All-Knowing Being's Depth of Knowledge

Information outside of experts' domains of expertise: With respect to whether Ms. Smart or the experts know more about information *outside* of the experts' respective domains, as shown in Figure 1a, all age groups overwhelmingly attributed more knowledge to Ms. Smart, ts > 14.00, ps < .001. Yet there were age differences as well, $F(2, 59) = 6.12$, $p < .01$. Compared to older children and adults, the youngest children attributed somewhat less knowledge to Ms. Smart; $p < .05$ and $p < .01$, respectively, according to Tukey HSD comparisons. Tukey HSD tests will also be used in all pair-wise comparisons hereafter.

Information within experts' domains of expertise: More focally, at what age did individuals grant greater knowledge to Ms. Smart *within* experts' domains? This is the most direct test of whether participants understand the depth of Ms. Smart's knowledge—an omniscient being does not just know a lot, she knows *everything*, even more than experts. Such knowledge attributions differed significantly between the three age groups ($F(2, 59) = 9.02$, $p < .01$), with adults attributing to Ms. Smart much more knowledge than did preschoolers ($p < .001$) or elementary-school children ($p < .05$). In fact, analyzed separately,

the youngest children typically attributed greater knowledge to the experts ($t(18) = -4.76$, $p < .001$), and older children attributed knowledge equally to Ms. Smart and to the experts, $t(18) = -1.33$, *ns*. Only adults attributed greater knowledge to Ms. Smart, $t(23) = 2.29$, $p < .05$ (See Figure 1b).

Discussion

These results suggest a developmental trajectory of understanding omniscience framed by anthropomorphic, instead of extraordinary, conceptions of knowledge. Young children first understand what it means to have expansive, yet ordinary knowledge—knowledge about the here-and-now that could be obtained by an ordinary human—then later understand what it means to have some extraordinary knowledge—including knowledge that ordinary humans cannot possess—and only much later do they exhibit some understanding of total omniscience. The youngest children (3.5- to 6.5-year-olds) granted to Ms. Smart publicly-available knowledge of the present, nothing more. Older children (6.5- to 12-year-olds) granted her more types of knowledge (e.g., knowledge of the past and personal information), but only adults granted her the full range of knowledge, and adults were the only group who understood the *depth* of her knowledge. In Study 2, we elaborate these preliminary conclusions with larger samples and further controls. Study 2 additionally explored several cognitive and socio-cultural factors that might facilitate an emerging understanding of omniscience.

Study 2

In part, Study 2 addresses the possibility that children's understanding of Ms. Smart's knowledge may have been under-estimated in Study 1. Thus, in addition to the introduction used in Study 1, participants were told that Ms. Smart was born with a "very, very special brain," she was given a larger cranium (a tactic used by artists to highlight the intelligence of media characters), and she emitted a glow. Study 2 also included broader questions (e.g., "Who knows more about cars, a mechanic or Ms. Smart"?), in addition to the arguably narrower questions of Study 1 (e.g., "Who knows more about why some *cars go very fast*, a mechanic or Ms. Smart"?). These broader questions encompassed more information, allowing greater scope for the possible impact of Ms. Smart's all-knowingness.

In Study 1, children often denied Ms. Smart personal knowledge. This raises the question of whether children believed Ms. Smart to be ignorant of others' personal information in general, or were just asserting that their *own* personal information was private. Thus, Study 2 included additional questions that referred to personal information about others. More generally, someone with an understanding of extraordinary knowledge should simultaneously attribute extraordinary knowledge to Ms. Smart but *deny* that knowledge to an ordinary being. Thus, in Study 2 participants were also asked identical questions about an ordinary human—their mother. This is a particularly relevant comparison because (a) a child's mother has access to personal information (e.g., a child's favorite food and birth date), and (b) children are regularly exposed both to their mothers' knowledge and to her ordinary cognitive shortcomings. Moreover (c) mother has been used as a comparison in prior research on children's understanding of extraordinary minds (e.g., Barrett et al., 2001; Kiessling & Perner, 2014; Lane et al., 2010).

More substantively, Study 2 was designed to begin to identify contextual and cognitive factors that might support children's developing understanding of omniscience including (1) religious context, (2) the ability to imagine improbable phenomena, and (3) an understanding of limitlessness . An ability to *think* about some unusual, never-before-seen events (e.g., a dog that flies) emerges during the preschool years (Wellman & Estes, 1986). However, preschoolers are particularly doubtful that many improbable phenomena, which they have not personally seen, can actually occur (Shtulman, 2009). Rather, a willingness to entertain the idea that such events can occur increases throughout middle and late childhood. Conceivably, children's ability to imagine improbable phenomena may support their ability to entertain the idea of an omniscient mind; thus we examine relations among these factors. Mentally representing omniscience (particularly, the depth of omniscience) may require some of the cognitive faculties needed to represent extremely large quantities or limitlessness. Thus, we also assessed Study-2 participants' understanding of limitlessness in another domain—the infinity of numbers (Falk, 1994).

In Study 2 we also increased the sample size of children and adults and our coverage of the preschool years. A theory of ordinary minds develops rapidly during early childhood and so may an understanding of extraordinary minds. Thus to better capture a potentially rapid early developmental trajectory, Study 2 includes a sizeable number of children at an age before they typically develop a robust explicit representational theory of mind (3 to 4.5 years), and at an age shortly afterward (4.5 to 6.5 years), in addition to older school-children, and adults.

Method

Participants—Thirty-two 3- to 4.5-year-olds (*M* = 3.88, *SD* = .42 years), 29 4.5- to 6.5-year-olds (*M* = 5.27, *SD* = .69 years), 28 6.5- to 11-year-olds (*M* = 8.86, *SD* = 1.41 years) and 34 university students (*M* age = 19.35, *SD* = .78 years) participated, all from southeastern Michigan. Five children were not paying attention or ended the interview session early, resulting in a sample of 28, 3- to 4.5-year-olds, and 28, 4.5- to 6.5-year-olds. Participants were primarily White and of middle- to upper-middle-class socioeconomic status. Sixty-seven parents (80%) completed a follow-up questionnaire about children's engagement in religious activities, exposure to religious media, and religious attendance. All adult participants provided similar questionnaire data.

Procedure and Measures—For Study 2, to further emphasize Ms. Smart's (for male participants, Mr. Smart's) extraordinary mind, she was given a larger cranium, she emitted a glow, and participants were told that she was born with a "very, very special brain" (see Appendix A). To further reinforce the idea that Ms. Smart is extraordinary and all-knowing, following her introduction, participants were asked how much she knows ("some things, lots of things, or everything?"), and those who reported that she knew anything less than "everything" were told, " No. Remember, Ms. Smart knows *everything about everything*", while the interviewer spread her arms wide. For these and all following questions, if participants replied "I don't know" or did not provide an answer they were told that they could answer however they like, the question was repeated, and, for closed-ended questions, response options were given. Final "I don't know" responses to Yes/No questions were

scored 0 (where 1=Yes, 0=No). Such responses were offered by 0-2 participants per question for the Ms. Smart/Mom *Breadth-of-Knowledge* and *Imagination* questions; no such answers were given for *Depth-of-Knowledge* questions. For *Infinity* tasks, such responses were given by 2-6 participants per question, and were scored 0. For *Expert's Depth-of-Knowledge*, such answers were offered by 1-3 participants per question; those responses were excluded from composite scores.

Understanding experts' depth of knowledge: Participants saw the same four experts as in Study 1 and were asked how much each expert knows about their respective domain, "Some things, lots of things, or everything?" To avoid concretizing "everything", participants were not shown a graph representing the three amounts used in Study 1 (several 3-year-olds had difficulty answering questions without a visual aid, so interviewers resorted to using the graph for them). Participants were provided corrective feedback every time they reported that any expert knows everything, " No. ___ knows *lots* of things about ___, but not *everything* [spreading arms]."

Understanding an all-knowing being's depth of knowledge: Across 20 questions (five per expert), participants compared the knowledge held by Ms. Smart to the four experts. The procedures for this task were identical to those used in Study 1. Participants received the 16 items from Study 1—8 within experts' domains, and 8 outside of expert' domains—and an additional 4 items (one per expert) that referred more broadly to knowledge within the experts' domains (e.g., " Who knows more about being healthy, a doctor or Ms. Smart?"). Scoring for knowledge attributed to Ms. Smart *outside experts' domains*, and *within experts' domains* was as in Study 1, for scores ranging from 0-8. As well, a *broad-item* composite was computed for those four questions and multiplying the sum by 2 yielded a 0-8 score comparable to those for the other composites. (See Supplemental Materials for all questions.)

Understanding an all-knowing being's breadth of knowledge: After being introduced to Ms. Smart, and reminded that she knows "everything about everything", participants were asked 14 yes/no questions about the types of knowledge she possesses. These 14 items fell into seven categories: three non-personal categories (facts about the past, present, and future) and four personal categories (facts about one's own and others' behavior, events, preferences, and thoughts). See Supplemental Materials for all items. Open-ended questions were asked following participants' answers to five of these items: knowledge of their father's favorite food, knowledge of their misbehavior, knowledge of what they are thinking, knowledge of their father's birthday, and knowledge of the weather next summer. For each of these items, if participants answered "Yes" they were asked, "How did she know?", and if they answered "No" they were asked, "Why not?" To assess the types of knowledge that participants attribute to ordinary humans, they were also asked whether their mother knows each of the same 14 items.

Imagining the improbable: Participants were asked whether they had seen, whether they could think about, and whether it was really possible for four improbable events to occur: someone drinking onion juice, someone painting polka dots on an airplane, someone making

purple applesauce, and someone having a lion for a pet (similar to items from Shtulman & Carey, 2007). Participants earned a point for each event that they reported either (a) they could think about, or (b) could really happen, yielding an *imagining-the-improbable* score (range: 0-4). A parallel *seen-the-improbable* score (range: 0-4) helped us check for spurious relations stemming from a general tendency to answer "Yes" to these Yes/No questions.

Understanding infinity: To assess participants' understanding of limitlessness, they completed three infinity tasks. First, based on an existing measure (Falk, 1994), they were presented two images (leaves and hairs) and were asked, "What are there more of, leaves on all the trees on Earth, or hairs on all people's heads?" The set that was judged larger was compared to the amount of sand ("What are there more of, [previous choice] or all of the grains of sand on Earth?"), as participants saw a picture of their previous choice and a picture of sand side-by-side. The set that was judged largest was then compared, in the target question, to all numbers: "What are there more of, [previous choice] or all the numbers?"; where "numbers" is the correct option.

For the second infinity task, participants were asked to name the largest number they could think of, whether there is a number bigger than that, and whether there is a number even bigger than that one (similar to questions in Hartnett & Gelman, 1998). Then, participants were asked the focal question: "Do numbers ever stop, or do they go on and on and on?"; the latter option was considered correct. For the third task, participants were shown a horizontal line with progressively smaller arrows on the right and told "This line shows how many things there are. This side [the left] shows that there are just a few things; and this side [the right] shows that there are lots and lots of things. So, if the amount of [participant's second-to-last choice for the first task: sand/leaves/hair] goes here [experimenter traces a hatch mark near the right end of the line], is it possible to show where the amount of numbers goes on this line?" If participants answered "no", they were asked "Why?" Participants were considered correct if they answered "no" and justified their answer by mentioning "infinity," stating that the number line was too short, or explaining that there are too many numbers to fit on the line. Participants earned a point for each infinity task that they passed (range: 0-3).

Religious exposure: Children's parents were given a questionnaire that included four questions about their children's exposure to media about God: "How often do you read to/ tell your child stories about God?"; "How often does your child listen to music that mentions God?"; "How often does your child watch movies or TV shows that mention/portray God?"; and "How often does your child play games or play with toys that depict or mention God." Responses to each question could range from (0) Never to (4) Daily. An *exposure-to-God* score was computed by averaging across these four items (Cronbach's $\alpha = .89$). The questionnaire also asked how often children attend a place of worship; response options ranged from (1) Never, to (5) Daily. Sixty-seven parents (80%) completed this voluntary questionnaire. All adult participants completed a similar questionnaire, including four questions about their participation in activities involving God concepts (e.g., listening to music about God, reading about God; Cronbach's $\alpha = .68$), and a question about how often they attend a place of worship. *Exposure-to-God* scores were highly correlated with

religious attendance for children and for adults (*r*s = .57-.78, *p*s < .001). Thus scores for these measures were standardized and averaged for a single *religious exposure* score.

Coding: Participants' open-ended responses, such as responses to questions about Ms. Smart's breadth of knowledge, were categorized independently by JDL and one research assistant. Discrepancies were discussed, and the system was modified accordingly. After a criterion of at least 85% inter-rater agreement was reached for each question, across 15% of the data (20 interviews), the remaining open-ended responses were coded by the research assistant. The final coding system is presented in Table 4.

Results

The revised protocol effectively increased the depth as well as the breadth of knowledge that participants granted to Ms. Smart (see Supplemental Materials). Subsequent analyses use the full sample from Study 2 and arrange participants into four age groups: 3- to 4.5-year-olds, 4.5- to 6.5–year-olds, 6.5- to 11-year-olds, and young adults.

Understanding Experts' Depth of Knowledge—As in Study 1, there was a significant age difference in (incorrectly) attributing knowledge of "everything" to the first expert, $\chi^2(3) = 9.50$, $p < .05$. Roughly half (54%) of 3- to 4.5-year-olds attributed knowledge of "everything" to this expert, compared to 46% of 4.5- to 6.5-year-olds, 21% of 6.5- to 11-year-olds, and 12% of adults. In contrast to Study 1, for Study 2, if participants reported that an expert knew "everything" about their domain, they were told that the expert knows "lots of things, but not everything." The corrective feedback reduced children's attributions of "everything" to the experts (*Z*s < −2.40, *p*s < .05)—only 17% of 3- to 4.5-year-olds and 12% of 4.5- to 6.5-year-olds attributed knowledge of everything to the last expert they encountered—and there was no difference between age groups in attributions of "everything" to the last expert, $\chi^2(3) = 3.00$, *ns*.

Understanding an All-Knowing Being's Depth of Knowledge

Information outside of experts' domains of expertise: As shown in Figure 2a, participants in every age group were near or at ceiling in attributing greater knowledge to Ms. Smart than to the experts (for the two youngest age groups, *t*s(27) > 11.00, $p < .001$; the two oldest groups performed at ceiling). Thus even the youngest children judged Ms. Smart to be very knowledgeable about a variety of domains. Nonetheless, a one-way ANOVA revealed that knowledge attribution varied significantly between the four age groups, $F(3, 114) = 9.87$, $p < .001$, with 3- to 4.5-year-olds' being slightly less consistent than each of the other age-groups (*p*s < .05).

Information within experts' domains of expertise: Figure 2b shows how participants judged Ms. Smart's knowledge *within* experts' domains of expertise. Paralleling Study 1, the youngest children typically attributed greater knowledge to the experts than to Ms. Smart ($t(27) = -3.99$, $p < .001$), children in both middle age groups equally attributed knowledge to Ms. Smart and the experts (*t*s(27) = −1.21 and −.25, *n.s.*), and adults typically attributed greater knowledge to Ms. Smart, $t(33) = 8.04$, $p < .001$. A one-way ANOVA confirmed

significant differences in knowledge attributions between the four age groups, $F(3, 114) = 16.89$, $p < .001$.

Study 2 included four additional broader items within experts' domains (e.g., "Who knows more about cars; Ms. Smart or a mechanic?") that could have elicited greater knowledge attribution to Ms. Smart. However, a 2 (question type: narrow, broad) X 4 (age group) repeated measures ANOVA for attributions of knowledge in experts' domains to Ms. Smart revealed no effect of question type, and no interaction between question type and age; only a main effect of age, $F(3, 114) = 19.18$, $p < .001$. Thus, for broad and narrow items, the youngest children maintained that experts knew *more* than Ms. Smart.

Understanding an All-Knowing Beings' Breadth of Knowledge

Knowledge Attributed to Ms. Smart: We examined participants' conceptualization of the breadth of Ms. Smart's knowledge by asking them if she possessed each of 14 pieces of information, comprising 7 categories. Participants who attributed to Ms. Smart *both* pieces of information in a category were judged to have attributed that category of knowledge to her (see Table 2). The 3- to 4.5-year-olds consistently attributed to Ms Smart knowledge of the present and future, as well as knowledge of others' thoughts and preferences. The 4.5- to 6.5-year-olds additionally attributed to her knowledge of the past and knowledge of others' personal events (their own and their father's birthdays) and personal actions (their own and their friend's naughty behavior). However, omniscience is more than holding several kinds of knowledge, it involves holding *all* forms of knowledge. There were significant differences between age groups in attributing *all seven* categories of knowledge to Ms. Smart ($\chi^2(3) = 22.98$, $p < .001$), with only the oldest children (6.5 to 11 years) and adults doing so above chance.

Ms. Smart versus Mom: As noted earlier, it is important to know if such knowledge attribution is particular to Ms. Smart rather than characteristic of children's knowledge attribution more generally. To assess this, participants were asked if their mothers held the same 14 pieces of knowledge. As shown in Table 3, children in all age groups as well as adults attributed to their mothers knowledge of personal preferences and personal events. However, no other knowledge was attributed, above chance, to mothers, even among the youngest children.

Importantly, participants in every age group attributed to Ms. Smart more knowledge than to mom. In particular, they attributed to Ms. Smart more knowledge of non-personal facts about the present and future, and more knowledge of others' personal thoughts, and all but the youngest children attributed to her more knowledge of the past. Appropriately, participants of all ages did *not* differ in their attributions of certain personal information to Ms. Smart and to mom--knowledge of their own and their fathers' personal events and preferences. Whereas the youngest children (3 to 4.5 years) were equally skeptical that their mothers or Ms. Smart would know about their personal actions (i.e., their naughty behavior), older participants attributed more of such knowledge to Ms. Smart than to their mothers. In sum, children understood that Ms. Smart's knowledge exceeded that of ordinary people

(even their mothers). Nonetheless, the youngest children remained relatively conservative in their estimates of Ms. Smart's knowledge

Reasoning about Ms. Smart's knowledge: The reasoning that participants used in making their decisions about Ms. Smart's knowledge sheds further light on their estimation of her capacities. Following their response to each of five questions about Ms. Smart's knowledge —knowing (1) what the participant is thinking, (2) whether the participant did something naughty, (3) the participant's dad's favorite food, (4) the participant's dad's birthday, and (5) the weather next summer—participants were asked either "How?" if they had judged that Ms. Smart would know, or "Why not?" if they had judged she would not know.

The reasoning that participants used to explain affirmative judgments—why Ms. Smart *would* know—sheds the most light on their understanding of Ms. Smart's powers and how she acquires knowledge. Participants' responses fell into six frequently-used categories: (1) explicit reference to "*knowing everything*", (2) reference to Ms. Smart's *intelligence* (e.g., "She's got the smartest brain"), (3) explanation about how Ms. Smart would acquire information through *ordinary experience* (e.g., "She was spying on me", "She would ask people "), (4) participants' citing their *own knowledge* (e.g., "Because I'll know", "I'm really thinking about pizza right now"), (5) *other* reasoning which was informative but did not fit into any other category (e.g., "He'd be guessing"), and (6) *uninformative* responses, including "I don't know" and "Because."

The proportions of responses (across the five questions) for which each category of reasoning was used are presented in Table 4. These data reveal two noteworthy developmental trends. First, participants' mention of Ms. Smart's capacities—her knowledge of everything or her intelligence—increased from the preschool years, through the elementary-school years, to early adulthood ($r_{pb}(110) = .46$, $p < .001$), having been mentioned by only 30% of the youngest children but by 96% of adults. Second, there was an age-graded decrease in participants' use of alternate forms of reasoning ($r_{pb}(110) = -.26$, $p < .001$)—for example, reasoning that Ms. Smart would possess knowledge because the children themselves held the information, or because she would acquire it through ordinary experiences. Uninformative responses decreased with age as well, $r_{pb}(110) = -.37$, $p < .001$.

Relations between Understanding Omniscience and Imagining the Improbable

—To assess whether understanding Ms. Smart's extraordinary knowledge is related to an ability to imagine unusual phenomena, participants were asked whether they could think about or whether it was possible for four improbable events to occur, and earned a point for each event that they reported could happen or that they could think about (means and *SD*s are presented in Supplemental Materials). We assessed relations between this ability and children's knowledge attributions in ANCOVAs including age as categorical variable (the three child age groups) and children's imagining-the-improbable score as a covariate. Imagining the improbable was a strong predictor of children's understanding Ms. Smart's breadth of knowledge (a composite summing across all knowledge categories), $F(1, 78) = 8.39$, $p < .01$. Separate ANCOVAs revealed that imagining the improbable was not significantly related to the depth of knowledge that children attributed to Ms. Smart or to the breadth of knowledge that they attributed to their mothers. In additional ANCOVAs,

children's *seen-the-improbable* scores were unrelated to their attributions of knowledge to Ms. Smart and to their mothers.

Relations between Understanding Omniscience and Understanding Infinity— Relatedly, entertaining the idea that Ms. Smart possesses extraordinary knowledge may depend on an ability to conceptualize very large amounts or limitlessness, an ability that is reflected in an understanding of infinity (see Supplemental Materials for means and *SD*s). We assessed relations between children's understanding of infinity and their knowledge attributions in ANCOVAs with age as categorical variable (the three child age groups) and infinity-understanding score as a covariate. There was a strong statistical interaction between age group and infinity understanding in predicting the depth of knowledge that children attributed to Ms. Smart (i.e., her knowledge within experts' domains), $F(1, 78) = 3.21$, $p < .05$. Follow-up correlations, within each age group, revealed that this relation was strongest for the oldest children (6.5 to 11 years), $r(26) = .36$, $p = .06$, and non-significant for the two younger age groups (rs(26) = −.17 to −.25, ps ≥ .20). Separate ANCOVAs revealed no significant relations between infinity understanding and the breadth of knowledge that children attributed to Ms. Smart or to their mothers.

Relations between Understanding Omniscience and Religious Exposure—Data on participants' religious affiliation, exposure to media and activities involving ideas of God, as well as frequency of attending a place of worship were provided by 80% of parents, and by all adult participants. Among the 67 children whose parents provided data, 42 children (63%) attended a place of worship—11 rarely, 9 monthly, and 22 weekly. Parents of 51 of these children (76%) identified with Christianity. Among the 34 adult participants, 23 (68%) attended a place of worship; 7 rarely, 8 monthly, and 8 weekly. The most common belief systems identified were Christianity (59%) and Agnosticism (12%). Participants' exposure to media about God was similar across the age groups (see Supplemental Materials for means and *SD*s).

Relations between children's religious exposure and their knowledge attributions were examined with ANCOVAs including age as categorical variable (the three child age groups) and the *religious exposure* composite as a covariate. There was a marginally-significant interaction between age group and religious exposure in predicting the breadth of knowledge that children attributed to Ms. Smart, $F(1, 61) = 2.97$, $p = .059$. Follow-up correlations, within each age group, revealed this relation was significant for 4.5-6.5 year-olds ($r(17) = .56$, $p < .05$), but non-significant for younger and older groups (rs = −.23 to .14, ps ≥ .25). In s eparate ANCOVAs, religious exposure was not related to the depth of knowledge that children attributed to Ms. Smart or to the breadth of knowledge that they attributed to their mothers.

General Discussion

Concepts of beings with extraordinary mental capacities, including complete omniscience, are prominent in many religions (Armstrong, 1993; Kumar, 1998; Packer, 1993; Pyysiäinen, 2003) and also central to believers' personal conceptualizations of such beings (Noffke & McFadden, 2001; Spilka, 1964). Yet such ideas differ dramatically from our everyday

conceptions of fallible and constrained minds. We comprehensively examined understandings of omniscience in studies where children and adults attributed knowledge to an omniscient being that they were instructed “knows everything about everything." Using this novel omniscient agent—Ms. (or Mr.) Smart—allowed us to provide elaborate and standardized information to all participants about an extraordinary mind, regardless of their prior exposure to such ideas.

Conceptualizing the Breadth and Depth of Omniscient Knowledge

Advocates of a *preparedness* hypothesis have argued that, “ children should easily be able to incorporate the sense of infallibility into their concepts, even of nonreligious entities” (Richert & Barrett, 2005, p. 286). Given this hypothesis, young children should attribute all types of knowledge (as well as complete knowledge about every domain) to Ms. Smart. However, in our studies children considered Ms. Smart to have a limited breadth of knowledge. Even in Study 2, where Ms. Smart’s extraordinary capacities were further emphasized, only 29% of preschoolers attributed to her all categories of knowledge. It was not the case that young children simply assumed that Ms. Smart was just like any ordinary person. On the contrary, they attributed more knowledge to Ms. Smart than they did to their own mothers. However, their understanding of Ms. Smart’s breadth of knowledge was nothing like the full understanding of omniscience as outlined earlier and as usually understood by adults.

By the time children entered grade school, they grasped that an extraordinary being has broader knowledge, including knowledge that children themselves and indeed most ordinary humans do not hold: specifically, knowledge of others’ personal events and private behaviors, and knowledge of the distant past. However, not until middle childhood did children consistently attribute *all* categories of knowledge to Ms. Smart. Participants’ reasons for attributing knowledge to Ms. Smart shed additional light on their thinking. Reference to Ms. Smart’s extraordinary capacities—her knowledge of everything or her intelligence—was rare among preschoolers but increased steadily from the school years to early adulthood. Instead, preschoolers used alternative explanations, including egocentrically reasoning that Ms. Smart holds knowledge because children themselves hold the information, or because she would *acquire* it through everyday experiences (e.g., by asking someone).

Reasoning about the *depth* of Ms. Smart’s knowledge was especially difficult for children. In fact, when considering who holds more knowledge within experts’ domains—Ms Smart or the experts—preschoolers in both studies overwhelmingly attributed greater knowledge to experts. Older children performed better, but only adults consistently attributed greater knowledge to Ms. Smart.

Thus, in accord with earlier research our findings demonstrate that young children, 4- and 5-year-olds, can entertain ideas of knowledge that goes beyond that attributed to ordinary humans. However, we demonstrate they have protracted difficulty with the idea of infallible or complete knowledge. These studies indicate that young children tend to think of extraordinary agents as more human-like than supernatural, subject to ordinary mental limits. This constraint is relaxed over the course of development, as children grant an

increasingly broad and deep body of knowledge to extraordinary beings, including knowledge that ordinary people are not likely to possess. Importantly, even for adults, an understanding of total omniscience may remain counterintuitive and difficult to fully represent (Barrett & Keil, 1996).

Relations between Understanding Omniscience and other Cognitive Competencies

Relations between understanding omniscience and understanding improbable events and limitless amounts—both of which develop during early and middle childhood (Falk, 1994; Shtulman, 2009)—highlight some conceptual difficulties that may constrain a full representation of omniscience. Because children (and adults) do not actually witness the powers of omniscient beings first-hand, they may have difficulty imagining a being that possesses types of knowledge that no human would hold. Consistent with this hypothesis, children who were better at imagining novel, improbable phenomena attributed to Ms. Smart broader knowledge. Similarly, an ability to represent limitlessness may well contribute to understanding omniscience (unlimited, perhaps infinite knowledge). Indeed, understanding the infinity of numbers was related to understanding the depth of Ms. Smart's knowledge.

Our data suggest that these capacities are important to consider in future investigations of the development of certain counterintuitive concepts, such as concepts of omniscience. Potentially, other capacities that we did not measure, such as working memory or inhibitory control, might also support children's ability to imagine a fully omniscient mind. An important point is that if young children simply assume that minds are all-knowing, these developing capacities should be unrelated to understanding omniscience—but they are related.

Relations between Understanding Omniscience and Socio-cultural Input

Messages that children receive and activities they engage in influence how they learn about a range of ideas (Evans, 2001; Harris & Koenig, 2006). In Judeo-Christian families, children may receive explicit instruction as well as informal messages about God's omniscience which might foster an understanding of novel omniscient beings, like Ms. Smart. Indeed, in our data both children's exposure to media about God and how frequently they attended a place of worship were correlated with attributions of broader knowledge to Ms. Smart. Notably, this was true only for children 4.5 to 6.5 years, a period shortly after children typically develop a robust representational theory of mind signified, in part, by an understanding of false belief. Achieving an explicit understanding of false-beliefs might mark a broader shift in children's reasoning about minds, and thus at this point they may be especially receptive to testimony about omniscient minds. These findings provide further support for the hypothesis that socio-cultural input plays a facilitative role in developing understandings of extraordinary minds (see also Lane et al. 2012), much like social messages and interactions facilitate children's developing understanding of ordinary minds (Carpendale & Lewis, 2004).

The finding that exposure to ideas about God relates to understanding the breadth (but not depth) of an extraordinary being's knowledge, may reflect the messages that children receive about God's extraordinary mind. We hypothesize that such messages might address

the specific *types* of knowledge that God holds (e.g., “God knows what is in your heart”, “God knows if you misbehave”). Thus, these messages facilitate the general idea that God knows many things, even things that ordinary people do not know. This is precisely the understanding that children need to apply when considering Ms. Smart’s breadth of knowledge, but not necessarily to appreciate the full depth of omniscience. Future studies should systematically examine the formal and informal messages that children receive about God’s and other beings’ (e.g., superheroes’) extraordinary knowledge and mental powers.

For these initial studies, we chose a cultural context in which concepts of extraordinary religious figures abound—in the U.S. most children are exposed to ideas about the Judeo-Christian God, with 92% of adults believing in God (or a universal spirit) and 63% of parents engaging their children in religious practice at home (Pew Research Center, 2008). Indeed, most of the participants in Study 2 (79%) identified with a religion (primarily Christianity) or came from religious households, and two-thirds attended a place of worship. Future work should examine concepts of omniscience among individuals with different backgrounds and faiths.

In our studies, participants reasoned about the knowledge held by an all-knowing, yet human-like, novel being—Ms. Smart. Use of Ms. Smart allowed us to provide all participants with exactly the same information about her extraordinary mind, thus participants' responses did not reflect a mere lack of knowledge about her mental capacities. If children had reasoned about God instead, might they have demonstrated an earlier understanding of omniscience? We think this is unlikely, at least for participants from these populations. Christian children are exposed to doctrine not just about God but also about Jesus—as the son of God or God in human form—which might reinforce anthropomorphic notions of God. Moreover, studies have shown that Christian children often understand supernatural entities as special kinds of humans (e.g., Pnevmatikos, 2002; Shtulman, 2008). So a focus on God alone would not eliminate use of an anthropomorphic agent. Moreover, Lane et al. (2012) empirically demonstrated that religiously-raised children (predominately Christian) more easily attributed extraordinary knowledge to a novel being (Mr. Smart) whom they had been instructed “knows everything” than they did to God. Yet, it could be argued that more constant and consistent exposure to testimony about God’s mind might lead children to grasp God’s omniscience earlier than was found for Ms. Smart. In future research it would be advisable to assess how children reason about God’s mind using the current omniscience tasks.

Conclusions

Omniscience is both ordinary and extraordinary. It is ordinary in that belief in beings with omniscient minds is widespread, found in religions the world over. It is extraordinary because it is a mentality that is dramatically different from that of the fallible minds that are part of our everyday experience. This paradox raises questions concerning the nature, ontogeny, and cultural origins of concepts of omniscience. Results of prior studies (e.g., Barrett et al., 2001; Knight et al., 2004) have been interpreted as evidence of children’s early grasp of mental infallibility or omniscience (e.g., Barrett & Richert, 2003). However, that work did not directly examine children’s grasp of omniscience. The current research reveals

that young children are *unprepared* to understand complete omniscience. Indeed, young preschoolers were especially conservative in the knowledge they attributed to all-knowing beings—their concepts of very knowledgeable minds are grounded in a theory of everyday human cognition. It is likely adaptive for children to have an early understanding of ordinary, fallible human minds—*these* are the minds with which children will interact and from which they will learn. Nevertheless, even young children demonstrated some flexibility in their theory-of-mind—attributing some knowledge to a novel extraordinary being that they denied their own mothers. This flexibility increased throughout development. These findings are consistent with studies indicating that young children are particularly skeptical of extraordinary or improbable occurrences, and that supernatural notions and beliefs increase over development (Legare, Evans, Rosengren, & Harris, 2012; Woolley & Ghossainy, 2013).

Yet even older children in our study (and adults in prior studies; e.g., Barrett & Keil, 1996) found it difficult to represent completely omniscient minds, and more easily represented extraordinary-but-limited minds. These findings may speak to what types of "omniscient" minds we typically contemplate and why ideas of such minds are so widespread. There are, arguably, both evolutionary (Bering, 2006; Boyer, 1994) and everyday advantages (Epley, Waytz, & Cacioppo, 2007) to representing an extraordinary-yet-human-like (or quasi-omniscient) deity in comparison to conceptualizing a completely omniscient diety. Speculatively, a more human-like divinity could promote a sense of social connectedness with the divine (Epley et al., 2007); whereas a truly omniscient, supreme mind—one that knows our every action, thought, and desire—may be alien and alienating. Moreover, if notions of divine judgmental minds are useful for inspiring prosocial behavior (Atran, 2002; Norenzayan & Shariff, 2008), those minds need not know *everything*—they need only know about morally-relevant actions in order to administer reward and punishment accordingly (Purzycki, Finkel, Shaver, Wales, Cohen, & Sosis, 2012). As for the epidemiology of these concepts, because anthropomorphic ideas are easily represented (Boyer, 1996; Guthrie, 2001), and because minimally counterintuitive ideas are attention-grabbing and memorable (Atran & Norenzayan, 2004; Boyer, 2000) notions of human-like-yet-extraordinary minds are arguably easier to remember and transmit, potentially accounting for the ubiquity of these concepts among adults.

Much like recent efforts in research on children's acquisition of counterintuitive natural concepts (e.g., Evans, Rosengren, Lane & Price, 2012), future work should examine how particular kinds of cultural messages at specific junctures in development gradually contribute to a full-fledged understanding of omniscience as well as to other supernatural counterintuitive concepts. This work will be integral to the cognitive science of religion as well as to our understanding of conceptual development more broadly.

Supplementary Material

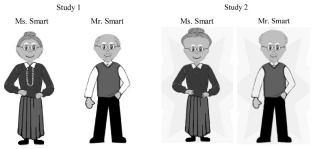
Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Funding for this research was provided by a Rackham School of Graduate Studies Research Grant to Jonathan D. Lane, and by a National Institute of Child Health and Human Development Grant 22149 to Henry M. Wellman. We thank Chelsea Hetherington, Becca Leider, and Amanda Nagrotsky for their help interviewing participants; and we thank Daniel Blumer and Jennifer Elledge for their help coding data. Finally, we are grateful to the children and parents who participated in this study, and to the teachers and staff at the University of Michigan Children's Centers and the Saline Public Schools.

Appendix A

Introduction to Ms./Mr. Smart



This is Ms./Mr. Smart. Ms./Mr. Smart **was born with a *very*, *very* special brain.** S/he knows *everything* about *everything* [spread arms].

[Show child closed opaque container that has a ball inside].

Do you know what's inside here? [Child responds: "No"]. Well, this is the first time that I've played with this, so I don't know what's inside either. Ms./Mr. Smart *also* hasn't played with this before. But because s/he's so smart s/he still knows what's inside. We would have to look inside, but s/he doesn't even need to look.

Let's ask Ms./Mr. Smart what's inside. Ms./Mr. Smart, what do you think is in here?

Ms./Mr. Smart says: "I know there's a stapler inside."

Let's see. [Open container and show child the stapler]. Ms./Mr. Smart was right!

Remember, Ms./Mr. Smart knows *everything* about *everything*, not just everything about boxes. Let me tell you about some other things Ms./Mr. Smart knows…

Do you know where this stapler was made?

Ms./Mr. Smart says: "I know it was made in Canada."

Let's take a look. [Look at bottom of stapler] Yep, it says "Canada."

Do you know how many staplers are made in Canada each year? Me neither. But Ms./Mr. Smart does, because remember s/he knows *everything* about *everything* [spread arms]—about boxes, about staplers, about Canada, *everything*.

Note. Bolded text was used in Ms./Mr. Smart's description for Study 2 only.

References

Atran, S. In gods we trust: The evolutionary landscape of religion. Oxford University Press; New York: 2002.

Atran S, Norenzayan A. Religion's evolutionary landscape: Counterintuition, commitment, compassion, communion. Behavioral and Brain Sciences. 2004; 27:713–770. doi: 10.1017/S0140525X04000172. [PubMed: 16035401]

Aquinas, T. Summa Theologiae: Questions on God. Leftow, B.; Davies, B., editors. Cambridge University Press; Cambridge, UK: 2006. (Original work written 1265-1274)

Armstrong, K. A history of God: The 4,000-year quest of Judaism, Christianity and Islam. Ballatine Books; New York: 1993.

Augustine. Sermons on selected lessons of The New Testament. J. H. Parker; Oxford: 1844.

Barrett JL. Cognitive constraints on Hindu concepts of the Divine. Journal for the Scientific Study of Religion. 1998; 37:608–619. doi: 10.2307/1388144.

Barrett JL, Keil FC. Conceptualizing a nonnatural entity: Anthropomorphism in God concepts. Cognitive Psychology. 1996; 31:219–247. doi: 10.1006/cogp.1996.0017. [PubMed: 8975683]

Barrett JL, Richert RA. Anthropomorphism or preparedness? Exploring children's god concepts. Review of Religious Research. 2003; 44:300–312. doi: 10.2307/3512389.

Barrett JL, Richert RA, Driesenga A. God's beliefs versus mother's: The development of nonhuman agent concepts. Child Development. 2001; 72:50–65. doi: 10.1111/1467-8624.00265. [PubMed: 11280489]

Bering JM. The folk psychology of souls. Behavioral and Brain Sciences. 2006; 29:453–498. doi: 10.1017/S0140525X06009101. [PubMed: 17156519]

Bloom P. Religion, morality, evolution. Annual Review of Psychology. 2012; 63:179–199. doi: 10.1146/annurev-psych-120710-100334.

Boyer, P. The naturalness of religious ideas: A cognitive theory of religion. University of California Press; Berkeley, CA: 1994.

Boyer P. What makes anthropomorphism natural: Intuitive ontology and cultural representations. Journal of the Royal Anthropological Institute. 1996; 2:83–97. doi: 10.2307/3034634.

Boyer P. Evolutionary psychology and cultural transmission. American Behavioral Scientist. 2000; 43:987–1000. doi: 10.1177/00027640021955711.

Carpendale JIM, Lewis C. Constructing an understanding of mind: The development of children's social understanding within social interaction. Behavioral and Brain Sciences. 2004; 27:79–96. doi: 10.1017/S0140525X04000032. [PubMed: 15481944]

Epley N, Waytz A, Cacioppo JT. On seeing human: A three-factory theory of anthropomorphism. Psychological Review. 2007; 114:864–886. doi: 10.1037/0033-295X.114.4.864. [PubMed: 17907867]

Evans EM. Cognitive and contextual factors in the emergence of diverse belief systems: Creation versus evolution. Cognitive Psychology. 2001; 42:217–266. doi: 10.1006/cogp.2001.0749. [PubMed: 11305883]

Evans, EM.; Rosengren, K.; Lane, JD.; Price, KS. Encountering counterintuitive ideas: Constructing a developmental learning progression for biological evolution. In: Rosengren, KR.; Brem, S.; Evans, EM.; Sinatra, G., editors. Evolution Challenges: Integrating research and practice in teaching and learning about evolution. OUP; New York, NY: 2012. p. 174-199.

Falk R. Infinity: A cognitive challenge. Theory & Psychology. 1994; 4:35–60. doi: 10.1177/0959354394041002.

Giménez-Dasí M, Guerrero S, Harris PL. Intimations of immortality and omniscience in early childhood. European Journal of Developmental Psychology. 2005; 2:285–297. doi: 10.1080/17405620544000039.

Guthrie, S. Why gods? A cognitive theory. In: Andresen, J., editor. Religion in mind: Cognitive perspectives on religious belief, ritual, and experience. Cambridge University Press; New York, NY: 2001. p. 94-111.

Harris PL, Koenig MA. Trust in testimony: How children learn about science and religion. Child Development. 2006; 77:505–524. doi: 10.1111/j.1467-8624.2006.00886.x. [PubMed: 16686784]

Hartnett P, Gelman R. Early understandings of numbers: Paths or barriers to the construction of new understandings? Learning and Instruction. 1998; 8:341–374. doi: 10.1016/S0959-4752(97)00026-1.

Kiessling F, Perner J. God-Mother-Baby: What children think they know. Child Development. 2014; 85:1601–1616. doi: 10.1111/cdev.12210. [PubMed: 24350816]

Knight N, Sousa P, Barrett JL, Atran S. Children's attribution of beliefs to humans and God: Cross-cultural evidence. Cognitive Science. 2004; 28:117–126. doi: 10.1016/j.cogsci.2003.09.002.

Kumar, V. 108 names of Vishnu. Sterling Publishers; New Delhi: 1998.

Lane JD, Wellman HM, Evans EM. Children's understanding of ordinary and extraordinary minds. Child Development. 2010; 81:1475–1489. doi: 10.1111/j.1467-8624.2010.01486.x. [PubMed: 20840235]

Lane JD, Wellman HM, Evans EM. Socio-cultural input facilitates children's developing understanding of extraordinary minds. Child Development. 2012; 83:1007–1021. doi: 10.1111/j.1467-8624.2012.01741.x. [PubMed: 22372590]

Legare CH, Evans EM, Rosengren KS, Harris PL. The coexistence of natural and supernatural explanations across cultures and development. Child Development. 2012; 83:779–793. doi: 10.1111/j.1467-8624.2012.01743.x. [PubMed: 22417318]

Lutz DJ, Keil FC. Early understanding of the division of cognitive labor. Child Development. 2002; 73:1073–1084. doi: 10.1111/1467-8624.00458. [PubMed: 12146734]

Makris N, Pnevmatikos D. Children's understanding of human and super-natural minds. Cognitive Development. 2007; 22:365–375. doi: 10.1016/j.cogdev.2006.12.003.

McCauley RN, Whitehouse H. New frontiers in the cognitive science of religion. Journal of Cognition and Culture. 2005; 5:1–13. doi: 10.1163/1568537054068705.

Noffke JL, McFadden SH. Denominational and age comparisons of God concepts. Journal for the Scientific Study of Religion. 2001; 40:747–756. doi: 10.1111/0021-8294.00089.

Norenzayan A, Shariff AF. The origin and evolution of religious prosociality. Science. 2008; 322:58–62. doi: 10.1126/science.1158757. [PubMed: 18832637]

Packer, JI. Concise theology: A guide to historic Christian beliefs. Tyndale House Publishers; Wheaton, Illinois: 1993.

Pew Research Center. U.S. religious landscape survey. Pew Forum on Religion & Public Life. 2008. religions.pewforum.org

Pnevmatikos D. Conceptual changes in religious concepts of elementary schoolchildren: The case of the house where God lives. Educational Psychology. 2002; 22:93–112. doi: 10.1080/01443410120101279.

Pnevmatikos, D.; Makris, N. How do children acquire supernatural deity concepts that conflict with their intuitions?. In: Lane, JD., editor. The development of natural and supernatural counterintuitive concepts; Presented at the meeting of the Cognitive Development Society; Philadelphia, PA. 2011. (Chair)

Purzycki BG, Finkel DN, Shaver J, Wales N, Cohen AB, Sosis R. What does God know? Cognitive Science. 2012; 36:846–469. doi: 10.1111/j.1551-6709.2012.01242.x. [PubMed: 22462490]

Pyysiäinen I. Buddhism, religion, and the concept of "God". Numen. 2003; 50:147–171.

Richert RA, Barrett JL. Do you see what I see? Young children's assumptions about God's perceptual abilities. International Journal for the Psychology of Religion. 2005; 15:283–295. doi: 10.1207/s15327582ijpr1504_2.

Shtulman A. Variation in the anthropomorphization of supernatural beings and its implications for cognitive theories of religion. Journal of Experimental Psychology: Learning, Memory, and Cognition. 2008; 34:1123–1138. doi: 10.1037/0278-7393.34.5.1123.

Shtulman A. The development of possibility judgment within and across domains. Cognitive Development. 2009; 24:293–309. doi: 10.1016/j.cogdev.2008.12.006.

Shtulman A, Carey S. Improbable or impossible? How children reason about the possibility of extraordinary events. Child Development. 2007; 78:1015–1032. doi: 10.1111/j.1467-8624.2007.01047.x. [PubMed: 17517019]

Spilka B, Armatas P, Nussbaum J. The concept of God: A factor-analytic approach. Review of Religious Research. 1964; 6:28–36.

Wellman HM, Estes D. Early understanding of mental entities: A reexamination of childhood realism. Child Development. 1986; 57:910–923. doi: 10.2307/1130367. [PubMed: 3757609]

Wellman, HM.; Johnson, CN. Developing dualism. In: Antoniette, A.; Corradini, A.; Lowe, EJ., editors. Psycho-physical Dualism Today: An Interdisciplinary Approach. Lexington Books; Lanham, MD: 2008. p. 3-36.

Wellman HM, Bartsch K. Young children's reasoning about beliefs. Cognition. 1988; 30:239–277. doi: 10.1016/0010-0277(88)90021-2. [PubMed: 3215003]

Woolley JD, Ghossainy M. Revisiting the fantasy-reality distinction: Children as naïve skeptics. Child Development. 2013; 84:1496–1510. doi: 10.1111/cdev.12081. [PubMed: 23496765]

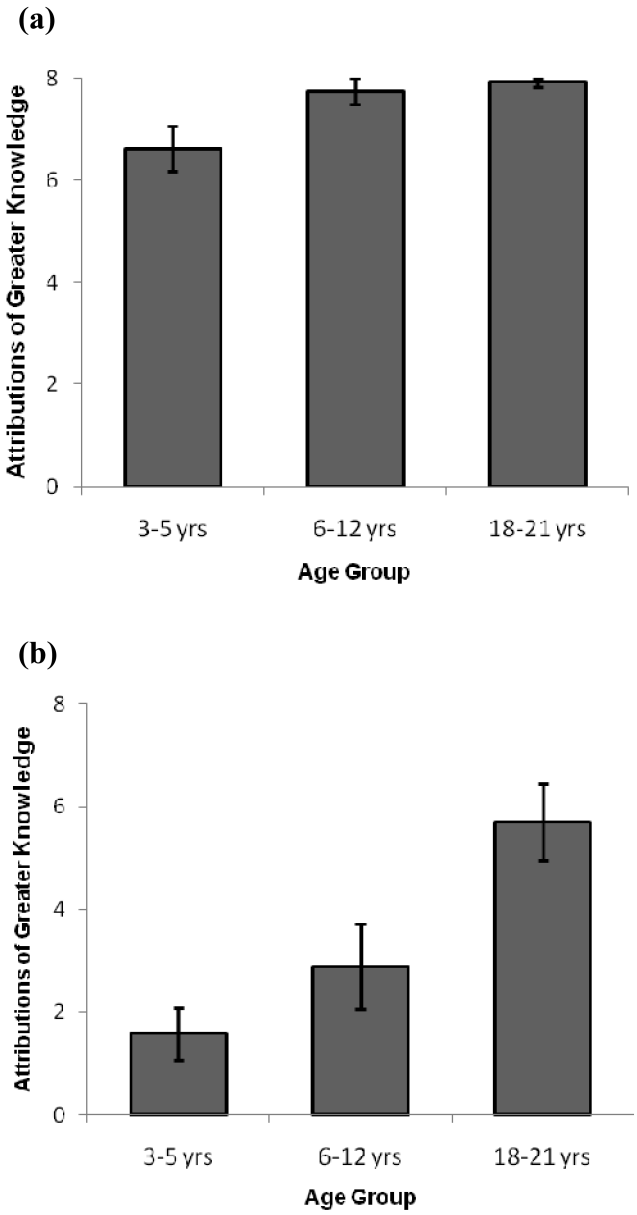


Figure 1.

Study 1: Mean attributions of greater knowledge to Ms./Mr. Smart, for (a) information outside of experts' domains of expertise, and (b) information within experts' domains of expertise. Participants could earn a maximum score of 8. Error bars represent standard errors of the mean.

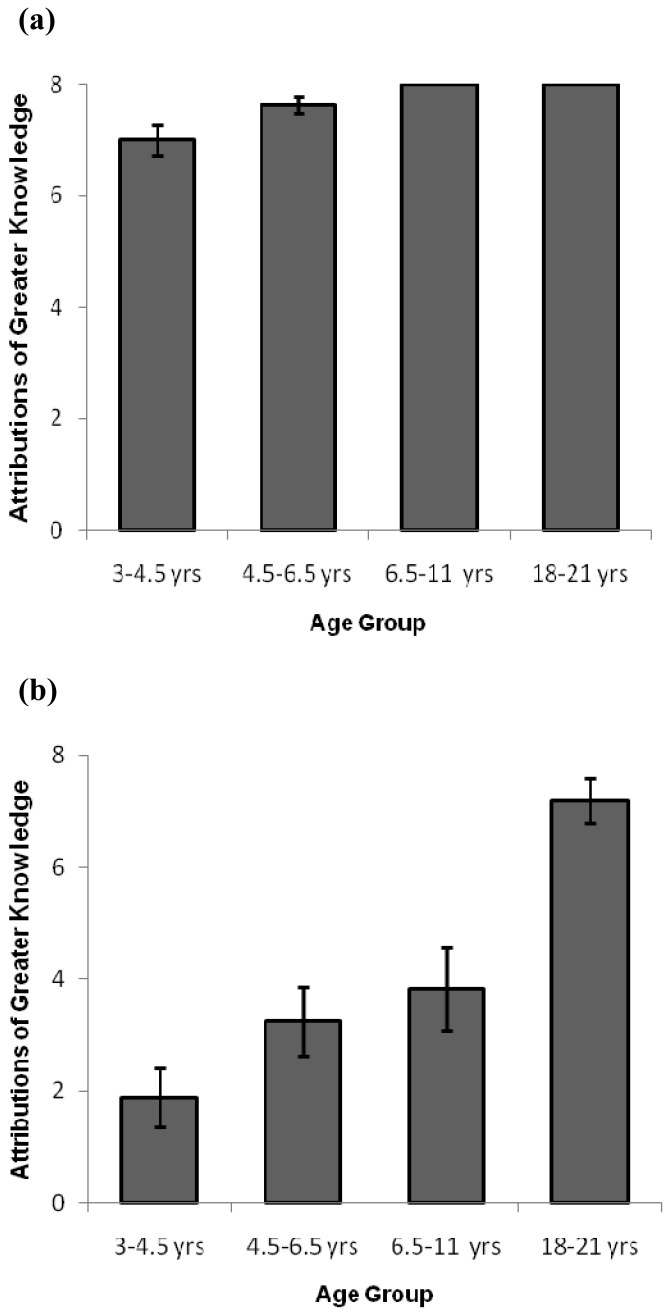


Figure 2.

Study 2: Mean attributions of greater knowledge to Ms./Mr. Smart, for (a) information outside of experts' domains of expertise, and (b) information within experts' domains of expertise. Participants could earn a maximum score of 8. Error bars represent standard errors of the mean.

Table 1

Study 1: Attributions of Knowledge to Ms./Mr. Smart

Does Ms./Mr. Smart know…	3 - 5 years	6 - 12 years	18 - 21 years
Where to find the tallest tree in the world?	84% **	90% ***	100% ***
When your birthday is?	56%	84% **	92% ***
What your favorite food is?	47%	79% *	92% ***
What the first dog looked like long ago?	68%	74% †	88% ***
Who will win the Super Bowl next year?	68%	68%	88% ***
What you're thinking right now?	32%	63%	91% ***
All six of the above items	16% ***	63%	83% **

Note. Asterisks indicate knowledge that was attributed to Ms./Mr. Smart at levels significantly different from chance (50%), according to binomial tests. Significantly fewer than 50% of 3- to 5-year-olds reported that Ms./Mr. Smart knew about all six items.

† $p < .10$,

* $p < .05$,

** $p < .01$,

*** $p < .001$

Table 2

Study 2: Attributions of Knowledge to Ms./Mr. Smart for Both Items in Category

Category	3 - 4.5 years	4.5 - 6.5 years	6.5 - 11 years	18 - 21 years
Present	71% *c	79% **c	93% ***c	97% ***c
Future	75% *b	86% ***c	75% *c	88% ***c
Past	61%	79% **c	86% ***c	91% ***c
Personal Preferences	82% ***	89% ***	82% ***	88% ***
Personal Thoughts	75% *a	79% **c	71% *c	85% ***c
Personal Events	61%	86% ***	79% **	91% ***
Personal Actions	54%	86% ***c	82% ***c	88% ***c
All seven of the above categories	29% *	64% c	71% *c	85% ***c

Note. Asterisks indicate knowledge that was attributed to Ms./Mr. Smart by significantly more or less than 50% of the sample, according to binomial tests. Superscript letters indicate significantly *greater* attributions of knowledge to Ms./Mr. Smart compared to mom, according to McNemar tests. Significantly fewer than 50% of 3- to 4.5-year-olds reported that Ms./Mr. Smart knew about all seven categories.

* $p < .05$,

** $p < .01$,

*** $p < .001$

a $p < .05$,

b $p < .01$,

c $p < .001$

Table 3

Study 2: Attributions of Knowledge to Mom for Both Items in Category

Category	3 - 4.5 years	4.5 - 6.5 years	6.5 - 11 years	18 - 21 years
Present	32%	4%	18%	6%
Future	46%	4%	0%	0%
Past	36%	7%	0%	0%
Personal Preferences	75% *	71% *	71% *	88% ***
Personal Thoughts	50%	11%	4%	0%
Personal Events	68% †	86% ***	100% ***	100% ***
Personal Actions	39%	21%	4%	0%
All seven of the above categories	14%	4%	0%	0%

Note. Asterisks indicate knowledge that was attributed to Mom by significantly more than 50% of the sample, according to binomial tests.

** $p < .01$,

† $p < .10$,

* $p < .05$,

*** $p < .001$

Table 4

Study 2: Reasoning Used to Justify Ms./Mr. Smart's Knowledge

		Age Group			
Reasoning Category	**Examples**	**3 - 4.5 years**	**4.5 - 6.5 years**	**6.5 - 11 years**	**Adults**
Knows Everything	"She knows everything about everything." "'Cause she knows everything"	11%	33%	63%	90%
Intelligence	"She's the smartest person in the world." "He's really smart" "He's got the smartest brain"	19%	36%	19%	6%
Ordinary Experience	"My mommy told her" (dad's food) "Maybe he would ask people" (self naughty) "I tell her" (self think) "She probably looked on TV at the weather"	8%	9%	8%	2%
Participant's Knowledge	"Because I'll know" (weather) "My dad['s birthday] is in the winter" (dad's birthday) "My dad likes rice" (dad's food) "I'm really thinking about pizza" (self think)	17%	4%	3%	0%
Other	"I'm a good boy and I don't do a lot of naughty things" (self naughty) "Because she's a grownup" (weather)	11%	1%	2%	5%
Uninformative	"I don't know" "Because" "She knows"	34%	17%	6%	1%

Note. Numbers reflect percentage of questions, per age group, for which participants used each of the six focal reasoning categories. Participants were allowed to use multiple forms of reasoning for each of the five questions, thus some columns total more than 100%. Participants who did not attribute knowledge to Ms. Smart for any of the five questions (five children and one adult) were not included in this analysis.