Developing Concepts of Ordinary and Extraordinary Communication

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Abstract

We examine how understandings of ordinary and extraordinary communication develop. Three to 10-year-old children and adults (N = 183) were given scenarios in which a protagonist wanted help from a human (their parent) or from God. Scenarios varied in whether protagonists expressed their desires aloud (by asking) or silently (by hoping), whether (for human scenarios) parents were nearby or far away, and whether (for God scenarios) protagonists expressed desires through ordinary means (asking or hoping) or more extraordinary means (praying). Following each scenario, participants were asked whether the recipient (either the parent or God) was aware of the protagonist's desire. Children as young as 3- to 4-years understood that both loudness and distance limit the effectiveness of human communication, reporting that humans would most likely be aware of desires when they were expressed both aloud and nearby. As well, by this age children reported that God would more often be aware of desires than would humans, but children of all ages often reported that God (like humans) would be more aware of desires expressed aloud (rather than silently). These concepts of ordinary and extraordinary communication continued to be refined through middle childhood. Children's performance on standard theory-of-mind tasks and participants' religious background predicted whether they attributed awareness to God.

KEYWORDS: theory-of-mind; communication; auditory perception; cultural input

Developing Concepts of Ordinary and Extraordinary Communication

A primary way that we communicate with one another is with spoken words—professors lecture to their students, we whisper secrets to friends, and we call across the house to make requests of family members. However, there is limited developmental research on children's understanding of how knowledge is transmitted verbally. Indeed, most research on theory-of-mind development has examined children's understanding of how knowledge is acquired via vision (for reviews, see Wellman, 2011, 2014). This research has revealed that even infants have an implicit understanding of the link between seeing and knowing (e.g., Onishi & Baillargeon, 2005). Children can articulate this understanding by the early preschool years—for example, 3-year-olds report that someone who has never seen inside a closed, novel container will not know what is inside (Pratt & Bryant, 1990). Studies have explored children's understanding of the connection between seeing and knowing in detail—exploring how children conceptualize visual limitations (e.g., whether someone knows about the identity or location of objects occluded from view, or whether someone's distance from an object influences their ability to see it; Flavell, Flavell, Green, & Wilcox, 1980; Flavell, Shipstead, & Croft, 1978; Pratt & Bryant, 1990), and their understanding of knowledge held by agents with varying visual abilities, including extraordinary agents (e.g., Barrett, Richert, & Driesenga, 2001; Lane, Wellman, & Evans, 2010).

In contrast, only a handful of studies have examined children's understanding of the connection between hearing and knowing or between verbal communication and knowing (e.g., Moll, Carpenter, & Tomasello, 2014; Mossler, Marvin, & Greenberg, 1976). Work with infants demonstrates that they possess a rudimentary understanding that verbalizations are used to exchange information between people (see Harris & Lane, 2014). Two- to 3-year-olds understand that someone who has not heard the sound that a novel object makes will not be

familiar with that sound (Moll et al., 2014). By three years, children appreciate that they must keep quiet if they want to avoid waking someone from sleep (Williamson, Brooks, & Meltzoff, 2015), or if they do not want adults to overhear their misbehavior (Melis, Call, & Tomasello, 2010). Research on children's trust in testimony reveals that preschoolers are highly sensitive to information transmitted through verbal communication—they selectively trust people's statements based on how the statements and the informants vary along a variety of dimensions (see Harris, 2012). Thus, it is clear that young children have some understanding of auditory perception and appreciate that knowledge *can be* transmitted through communication. Here, we examine children's developing understanding of *how* knowledge is transmitted through communication. Moreover, we assess flexibility in children's understanding of communication.

We focus on children's consideration of two factors when evaluating the effectiveness of communication: (1) whether communication occurs aloud, and (2) whether the intended recipient is nearby. To assess the flexibility and limits of children's early understanding of communication, we also examine their understanding of communication with God. Ordinary communication among humans—sans modern technologies like phones and computers—typically entails both loudness and proximity. However, individuals worldwide believe in non-human beings for whom one or both of these criteria do not necessarily apply—for example, individuals commonly pray silently or aloud to a divinity that is not obviously physically present. Recent research demonstrates that older preschoolers appreciate that God possesses knowledge that ordinary people lack—for example, they surmise that God would know the contents of the closed container discussed earlier (e.g., Barrett et al., 2001; Giménez-Dasí, Guerrero, & Harris, 2005; Kiessling & Perner, 2014; Lane et al., 2010, 2012; Makris & Pnevmatikos, 2007). However, like research on children's understanding of ordinary minds, this work has focused

almost exclusively on the link between visual perception and knowledge; here, we examine children's understanding of the connection between verbal communication and knowledge.

In the current study, children and adults heard about a protagonist who attempted to communicate either with an ordinary human or with an extraordinary agent, God. In the human-communication scenarios, the protagonists expressed their desires aloud or silently, and the recipients, the parents, were either nearby or far away. Participants were asked if the recipients would be aware of each desire. This design allowed us to examine when children account for loudness and distance in evaluating the effectiveness of communication. If they understand ordinary human communication as adults do, then children should report that communication is most effective if desires are expressed aloud and if the recipient is nearby. Based on past research on children's understanding of vision and hearing (e.g., Flavell et al., 1980; Moll et al., 2014), we predicted that, by the early preschool years, children will take both of these factors into consideration, though they might not yet produce an adult-like response pattern.

In the God-communication scenarios, as in the human-communication scenarios, protagonists either expressed their desires aloud or silently. This allowed us to examine whether children and adults consider communication with God to be constrained by the loudness of the communication, and to compare this with their understanding of communication between ordinary humans. Based on prior research on children's interpretation of God's knowledge (for a review, see Heiphetz, Lane, Waytz, & Young, in press) and research demonstrating that children tend to conceptualize God much like a person (e.g., Nye & Carlson, 1984; Pnevmatikos, 2002; Shtulman, 2008), we predicted that young preschoolers will attribute knowledge to God similarly to how they attribute knowledge to humans. Thus, they would report that God, like humans, would be less aware of information expressed silently. However, older preschoolers—at least

those raised in religious communities—should report that God will be aware of desires even if they are expressed silently (see Woolley & Phelps, 2001). By this age children will have been exposed to cultural input—others' verbal testimony, religious literature, and cultural practices—that reinforce this idea; prior research has documented that older preschoolers use their firmer understanding of ordinary causality to scaffold culturally-provided concepts for which ordinary causality is defied (for a review, see Lane & Harris, 2014).

Often God is purported to be omnipresent and invisible, so specifying his location to participants might come across as counter-factual or, at the least, confusing; thus, we did not experimentally vary God's presence in the God scenarios. However, we did vary these scenarios along another dimension—whether desires were expressed through prayer or through other means (asking or hoping). Prayer is a form of extraordinary communication that is common practice in the U.S.—the majority of adults (75%) report praying at least once a week (Pew Research Center, 2008a). Children begin to develop concepts of prayer during the preschool years. Between five-years and middle childhood, children demonstrate an emerging understanding that prayer is a mental activity (involving thinking) and that another being (God) plays a role in granting prayers (Long, Elkind, & Spilka, 1967; Woolley & Phelps, 2001). During this period, children increasingly appreciate the goals of prayer, especially that prayer may be used to request assistance—*petitionary* prayer (Bamford & Lagattuta, 2010). Conceivably, prayer may be understood as capable of violating the constraints of loudness and distance that influence ordinary human communication. Thus, our experimental design allowed us to assess whether participants conceptualize prayer to be a special or especially effective form of communication with God.

The current study included participants from a wide age range—3- to 10-year-olds, and

adults—in order to investigate the developmental trajectory of these concepts. We focused on this age range because developmental differences in children's concepts of extraordinary mentality have been found during this period (Lane, Wellman, & Evans, 2014). As well, we included participants from religious and secular backgrounds to examine whether children who vary in their exposure to theological concepts and engagement in prayer differ in their understanding of extraordinary communication. Religiously-raised preschoolers have demonstrated an early understanding of extraordinary beings' knowledge, relative to their more secularly-raised peers (Lane et al., 2012, 2014). However, this past work does not address whether children attribute to extraordinary beings knowledge which others have intentionally communicated, as is the case of prayer. Prayer seems like an especially good candidate for detecting an early understanding of extraordinary knowledge—religiously-raised children may see their community engage in prayer and might themselves pray, specifically for the purpose of communicating with an invisible being. Thus, it is possible that we will find a particularly early-developed understanding of extraordinary communication and of God's extraordinary knowledge, among religiously-raised children. Participation in prayer seems a particularly good candidate for the transmission of cultural information about extraordinary communication. Thus we also assess relations between children's cultural exposure to prayer and their understanding of extraordinary communication with God.

To more fully examine the foundations of children's understanding of communication, we included several traditional measures of children's theory of mind (ToM). Researchers have claimed that a ToM both makes possible and constrains childhood representations of extraordinary minds (e.g., Kiessling & Perner, 2014; Lane et al., 2010, 2012, 2014); failures in understanding the representational nature of the mind may result in over-attributions of

knowledge to both ordinary and extraordinary beings. And more fully grasping the representational nature of the mind—as gauged with traditional explicit false-belief tasks—may contribute to more flexibly applying one's ToM to reason about different types of minds, including supernatural minds. Thus, we anticipate that performance on traditional ToM tasks will relate to children's attributions of knowledge to God in the current scenarios.

In summary, the current study has three primary aims: (a) to examine children's developing understanding of conditions that support ordinary human communication, (b) to examine flexibility in children's understanding of communication as gauged by their reasoning about communication with a non-human being (God), and (c) to examine the influence of socio-cultural input and practices in facilitating this flexibility. Concepts of God and prayer are ideal for identifying both conceptual flexibility and the role of socio-cultural factors in social-cognitive development.

Method

Participants

Participants included 3- to 10-year-olds and young adults from Southeast Michigan. The religious population of Michigan parallels that of the U.S. in general (Pew Research Center, 2008a, 2008b). The majority (78%) identify as Christian, 75% pray at least weekly, and 72% attend a place of worship at least monthly. By recruiting children from religious and more secular communities, we purposefully included participants from a range of backgrounds. Participants were interviewed individually in a quiet room, either in a university laboratory, where children were recruited through birth records, or were interviewed at (and recruited through) their school; adults were undergraduates who completed the study in a laboratory.

A goal of this study was to examine the influence of participants' religious background—

Judeo-Christian (religious) versus secular—on their concepts of communication. Thus, we established specific grouping criteria: Children were considered "religious" if they were attending one of four Christian schools (all of which mentioned "God", "Christ", or "Jesus" in their mission statements), and were considered "secular" if they were recruited through the laboratory or if they were attending one of four secular schools. Grouping participants based on school attendance is a common and fruitful way to explore social-cultural differences in conceptual development (e.g., Evans, 2001; Bering, Blasi, & Bjorklund, 2005; Lane et al., 2012). As we note later, parental and self-report data further validated these groups. Because all adults attended the same public universities, adults were considered "religious" if—on a questionnaire completed after the main interview—they identified as Christian or Jewish, identified with that belief system "strongly" or "very strongly" (on a 4-point scale ranging from "very little" to "very strongly"), and reported that religion was "important" or "very important" in their family's life (on a 4-point scale ranging from "not at all important" to "very important"). Adult participants were considered "secular" if they identified as either Atheist (n = 5) or Agnostic (n = 8), or if they identified as Christian or Jewish but identified with that belief system only "very little" or "somewhat" and felt that religion was "not at all" or only "somewhat" important in their family's life (n = 22). Adults who did not meet these criteria (n = 28) were not included in analyses. One child was excluded from analyses because he did not provide audible responses.

The final sample included 93 secular and 90 religious participants, divided into four age groups similar to those used in prior work (Lane et al., 2014). Secular participants included 20 3-4.5 year-olds (M_{age} = 4.19; SD = .31), 20 4.5-6 year-olds (M_{age} = 5.29; SD = .46), 18 6-10 year-olds (M_{age} = 8.34; SD = 1.35), and 35 adults (M_{age} = 19.55; SD = 1.20). Religious participants

included 15 3-4.5 year-olds (M_{age} = 4.16; *SD* = .29), 25 4.5-6 year-olds (M_{age} = 5.15; *SD* = .35), 31 6-10 year-olds (M_{age} = 7.96; *SD* = 1.11), and 19 adults (M_{age} = 19.45; *SD* = .86).

Procedure

Interviews began with participants hearing scenarios (with accompanying pictures) about child protagonists who were in need (e.g., a boy who falls and hurts his leg) and desired help from either their parents (human scenarios) or from God (God scenarios). The decision to have participants make requests for their personal wellbeing was based on prior work in which children indicated that these are acceptable requests to be made of God, in contrast to requests for material possessions (Woolley & Phelps, 2001). Half of the participants received the four human-communication scenarios first, followed by the four God-communication scenarios; the other participants received scenarios in the reverse order. Following these scenarios, participants completed three ToM tasks, a task in which they reasoned about improbable phenomena (not reported here), and answered questions about prayer. A questionnaire covering religious activities and affiliation was completed by children's parents and by adult participants.

Human-communication scenarios. For four scenarios, each accompanied by two pictures, participants judged whether humans would hear and know about someone else's desires. In each scenario a child protagonist was in need and desired their parent's assistance. Protagonists either expressed their desires by asking aloud or silently hoping for help, and the parent was either nearby (and depicted in the pictures) or far away (and not depicted in the pictures). Examples of each of the four scenarios are in Appendix 1. Within this block, scenarios were presented in four different orders across participants. Following each scenario, participants were asked whether the parent would (a) *hear* that the child wants help, and (b) *know* that the child wants help. Half of the participants received these questions in this order, and half received

them in the reverse order (*know* then *hear* questions). “Yes” responses were scored as 1 and “No” responses were scored as 0. For these and subsequent questions, if participants provided a response other than “Yes” or “No”—e.g., they provided no answer or said “I don’t know”—they were assured that there are no wrong answers, the question was repeated and the response options (Yes or No) were stated. Final non-definitive (“maybe”) responses provided by two participants were scored as 0.5. Preliminary analysis indicated that the findings were largely parallel for *know* and *hear* questions—i.e., when participants attributed knowledge to an agent they tended to attribute hearing to that agent as well. Thus to increase statistical power, scores for *know* and *hear* questions were averaged to create a score ranging from 0 to 1 for each of the four conditions—aloud-close, silent-close, aloud-far, silent-far.

God-communication scenarios. The four God-communication scenarios were similar to the human-communication scenarios, except that the pictures never depicted God. In two scenarios protagonists made requests to God aloud, and in two the protagonists remained silent; half of the scenarios had protagonists express their desires by praying and the other half had them express their desires by asking or hoping (see Appendix 1). For each scenario, participants were asked whether God would *hear* and *know* that the child protagonist wants help. In total, there were four scenarios, representing four conditions—aloud-ask, aloud-pray, silent-hope, silent-pray. Scenario ordering, counterbalancing, and response scoring were similar to the human-communication scenarios. The situational details of each scenario (the protagonist’s name and plight) were presented in the same order across participants, but how their desires were expressed (asking, hoping, praying) and the intended recipient (parent or God) varied in order across participants (e.g., the very first scenario always had Billy hurting his leg, but for some participants he asked a parent for help, for others he asked God for help; for some participants he

expressed his desires aloud, for others he did so silently; and so on).

Theory-of-mind tasks. Following the communication tasks, participants completed three standard ToM tasks. A *knowledge-access task* (Pratt & Bryant, 1990) assessed participants' understanding that a person who has not seen inside a novel, closed container will not know the contents of the container. A *contents false-belief task* (Perner, Leekam, & Wimmer, 1987) assessed participants' understanding that someone who has not seen inside a familiar container will be unaware that the container actually contains unexpected contents. For the *explicit false-belief task* (Wellman & Bartsch, 1988), participants were told about a person who held a false belief about the location of an object, and participants were asked whether the protagonist would look for the object in its actual location or where they falsely believed it to be (See Appendix 2 for details). Participants earned 1 point on each task for which they correctly attributed ignorance or a false-belief to the protagonist for a maximum *theory-of-mind* score of 3. Children typically pass all three tasks by the late preschool years (Wellman & Liu, 2004), but there is substantial variability in children's performance (Wellman, Cross, & Watson, 2001).

Prayer participation. Children's parents were given a questionnaire covering their activities and religious backgrounds. Parents whose children participated in the lab were given questionnaires to complete (in a separate room) at the time of testing; parents whose children participated at school were mailed questionnaires with a self-addressed stamped envelope. Adult participants completed similar questionnaires following their interviews. Three questionnaire items measured participants' exposure to and engagement in prayer: (1) "You talk to your child about prayer" [for adults: "You discuss prayer with others"], (2) "Your child prays before going to bed" [for adults: "You pray before going to bed"], and (3) "Your child prays before a meal" [for adults: "You pray before a meal"]. Response options ranged from (1) Never, to (5) Daily.

Most of the children's parents—22 of 32 (69%) from the lab; 73 of 97 (75%) from schools—and all adult participants (n = 54) completed this questionnaire. These three items were highly inter-related both for children (α = .86) and adults (α = .88). Thus, a *prayer participation* variable was computed by averaging across the three items, for scores ranging from 1 to 5. As an additional measure of participants' engagement in prayer, at the conclusion of the interview, each was asked several questions about prayer, and focally, "Have you ever prayed for something?"

Results

Understanding Ordinary Human Communication

We begin by examining the development of an understanding of ordinary human communication, specifically an understanding that both loudness and distance influence the effectiveness of communication. Responses for the four human-communication conditions, per age group, are presented in Figure 1. Random or chance responding would be 50%—half of the time responding that the recipient is aware and half the time not. Collapsed across age groups, participants reported above chance that parent-recipients were aware of protagonists' desires when they were expressed *aloud* and parents were *nearby* (M = 76%, SD = 41%; $t(182) = 8.62$, $p < .001$, *Cohen's d* = 1.28); and reported that parents were *not* aware of protagonists' desires if either one or both of those conditions were not met (Ms = 11% - 20%, SDs = 29% - 36%; ts(182) < -11.50, ps < .001, *Cohen's d*s < -1.70). Moreover, an understanding that both factors influence the effectiveness of communication was found among even 3- to 4.5-year-olds—they reported above chance that parents were aware of protagonists' desires when they were expressed aloud and parents were nearby ($t(34) = 2.07$, $p < .01$, *Cohen's d* = .71), and that parents were not aware when desires were expressed silently and parents were far ($t(34) = -2.33$, $p < .05$, *Cohen's d* = -.80). However, 3-4.5 year-olds responded at chance for the two intermediate conditions.

To compare responses across the four conditions, we conducted a 4(age group) X 2(loudness: aloud, silent) X 2(distance: close, far) mixed-effects ANOVA for reports that parents were aware of protagonists' desires. There were significant effects of age group ($F(3, 179) = 5.56$, $p < .001$, $\eta^2_p = .09$), loudness ($F(1, 179) = 215.96$, $p < .001$, $\eta^2_p = .55$), distance ($F(1, 179) = 236.37$, $p < .001$, $\eta^2_p = .57$), as well as significant interactions of age X loudness ($F(3, 179) = 10.76$, $p < .001$, $\eta^2_p = .15$), age X distance ($F(3, 179) = 5.34$, $p < .01$, $\eta^2_p = .08$), and age X loudness X distance ($F(3, 179) = 11.54$, $p < .001$, $\eta^2_p = .16$). Participants more often judged that parents were aware of protagonists' desires when they were expressed aloud and parents were nearby. The significant interaction effects involving age indicate that responses to the four conditions became more differentiated with increasing age. As is clear in Figure 1, children 3-4.5 years were similar to the older groups when evaluating the effectiveness of communication made aloud and nearby. However, compared with participants in each of the older groups, these young children more often reported that communication made silently and far away would be effective (ps < .05, Bonferroni corrected), though to reiterate they were significantly below chance (50%) in doing so. These youngest children also more often reported that communication in the silent-close and aloud-far conditions would be effective than did 6-10 year-olds and adults (ps < .01, Bonferroni corrected).

Understanding Extraordinary Communication

We next compared participants' reasoning about human communication to their reasoning about communication with God, an analysis designed to assess the flexibility of a naïve theory of communication. Thus, the two human-communication scenarios where protagonists either asked aloud or hoped silently and parents were far (so not visually depicted) were compared with responses on the two parallel God-communication scenarios (God was

never depicted). Responses about God's awareness of protagonists' desires were quite different from responses about humans' awareness for all ages (see Figure 2). Recall, participants typically reasoned that parents would not be aware of protagonists' desires when they were far, regardless of whether desires were expressed aloud or silently. In contrast, participants reported (>50%) that God *would* be aware of such desires, whether expressed aloud (M = 74%, SD = 43%; $t(182) = 7.56$, $p < .001$, *Cohen's d* = 1.12) or silently (M = 64%, SD = 46%; $t(182) = 4.01$, $p < .001$, *Cohen's d* = .59). Even the youngest children (3-4.5 years) exhibited this pattern, although their responses for God were not significantly above 50% (*t*s(34) < 1.70, *ns*).

To compare participants' responses across these conditions, we conducted a 4(age group) X 2(loudness: aloud, silent) X 2(recipient: human, God) mixed-effects ANOVA, which revealed a marginal effect of age group ($F(1, 179) = 2.39$, $p = .07$, $\eta^2_p = .04$), a significant effect of loudness ($F(1, 179) = 27.57$, $p < .001$, $\eta^2_p = .13$), and a significant effect of recipient ($F(1, 179) = 246.28$, $p < .001$, $\eta^2_p = .58$) subsumed under a significant age X recipient interaction ($F(3, 179) = 8.59$, $p < .001$, $\eta^2_p = .13$). As depicted in Figure 2, participants more often reported that God (in contrast to humans) was aware of the protagonists' desires; this effect was apparent even among the youngest children (3-4.5 years, $p < .001$, with Bonferroni correction) but was stronger among older participants (*p*s < .001, for each older age group). As well, participants reported that recipients—both humans and God—were aware of the protagonists' desires more often when desires were expressed aloud rather than silently.

Modes of Extraordinary Communication and the Influence of Religious Background

For the God-communication scenarios, we manipulated an additional factor—mode of communication—which might influence the assumed effectiveness of extraordinary communication. This allowed us to compare secular and religious participants' reasoning about

how communication with God might vary depending upon how desires are expressed—via ordinary means (asking, hoping) versus means reserved for communication with supernatural beings (praying) (see Figure 3). Religious participants overall reported that God would be aware of the protagonists' desires for each of the four conditions significantly above chance (*M*s = 82% - 91%, *SD*s = 29% - 36%; *t*s(89) > 8.40, *p*s < .001, *Cohen's d*s > 1.78)—this was found in all age groups except for the youngest children (3-4.5 years), who reported above chance only that God would be aware of desires expressed aloud through ordinary means ($t(14) = 2.81$, $p < .05$, *Cohen's d* = 1.50). In contrast, secular participants as a group did not differ from chance for any of the four conditions (*M*s = 45% - 59%, *SD*s = 46% - 47%; -.90 < *t*s(92) < 1.80, *ns*); this was true of all age groups with the exception of children 6-10 years who reported that God would be aware of the desires expressed aloud through prayer ($t(17) = 3.01$, $p < .01$, *Cohen's d* = 1.46) or aloud through ordinary means ($t(17) = 2.76$, $p < .05$, *Cohen's d* = 1.34).

We compared responses across the four God-communication scenarios with a 4(age group) X 2(loudness: aloud, silent) X 2(mode: ordinary, prayer) X 2(religious background: religious, secular) mixed-effects ANOVA. There was a marginal effect of age group ($F(3, 175) = 2.17$, $p = .09$, $\eta^2_p = .04$), significant effects of religious background ($F(1, 175) = 35.90$, $p < .001$, $\eta^2_p = .17$) and of loudness ($F(1, 175) = 22.58$, $p < .001$, $\eta^2_p = .11$), and an interaction of age X loudness ($F(3, 175) = 3.33$, $p < .05$, $\eta^2_p = .05$) subsumed under an interaction of age X loudness X mode X religious background ($F(3, 175) = 3.83$, $p = .01$, $\eta^2_p = .06$). As depicted in Figure 3, religious participants more often attributed to God awareness of the protagonists' desires than did secular participants. Intriguingly, both religious and secular children more often reported that God would be aware of the protagonists' desires when they were expressed aloud rather than silently; this pattern was significant at 4.5-6 years and 6-10 years (*ps* < .001, in post-hoc

comparisons with Bonferroni correction), not among the youngest children or adults. As indicated by the 4-way interaction effect, this aloud vs. silent distinction varied by the mode of expression (ordinary vs. prayer) and participants' religious backgrounds. For secular participants, this distinction was significant at 4.5-6 years for ordinary communication ($p < .001$), and at 6-10 years for both ordinary communication ($p < .001$) and prayer ($p = .001$). Among religious children 4.5-6 years, the aloud vs. silent distinction was significant for prayer ($p < .05$) and marginally significant for ordinary communication ($p = .06$); comparisons Bonferroni corrected.

Order Effects

The order in which participants reasoned about humans' and God's awareness of protagonists' desires was counterbalanced across participants—half of the participants reasoned about humans for the first block of scenarios and about God for the second block. Conceivably, responses might vary depending upon the order in which participants reasoned about humans and God. To assess this possibility, we added order (God first vs. humans first) as an additional factor into the first two mixed-effects ANOVAs reported earlier (those for Understanding Ordinary Human Communication and for Understanding Extraordinary Communication, that address our most basic questions). Importantly, all of the significant effects reported thus far remained significant after accounting for order. In the first ANOVA, predicting children's attributions of knowledge to humans, there was an additional main effect of agent presentation order ($F(1, 175) = 3.87$, $p = .051$, $\eta^2_p = .02$)—participants attributed slightly more awareness to humans when participants reasoned about God first ($M = .36$, $SE = .03$) rather than humans first ($M = .29$, $SE = .03$). This main effect was subsumed under an interaction of order X age group X distance ($F(3, 175) = 2.86$, $p < .05$, $\eta^2_p = .05$). The effect of agent presentation order was significant among the youngest children (3-4.5 years) only, when they reasoned about

communication nearby (God presented first: M = .66, SE = .07; humans presented first: M = .45, SE = .07, $p < .05$, Bonferroni corrected) and especially when they reasoned about communication at a distance (God first: M = .52, SE = .07; humans first: M = .24, SE = .06, $p <$ .01, Bonferroni corrected).

In the second ANOVA, predicting attributions of awareness to God vs. humans, there was a significant interaction of order X age group X recipient ($F(3, 175) = 3.51$, $p < .05$, $\eta^2_p = .06$). The distinction made between humans' awareness and God's awareness was significant for all groups (ps < .001, Bonferroni corrected) except among 3-4.5 year-olds who first reasoned about God's awareness (humans' awareness: M = .52 SE = .07; God's awareness: M = .66, SE = .10, p = .19, Bonferroni corrected). These converging analyses indicate that the youngest children were the most susceptible to effects of presentation order, in some cases attributing more awareness to humans when they had first reasoned about God.

Participation in Prayer and Theory of Mind

How does exposure to and participation in prayer relate to an understanding of extraordinary communication? As well, how do other developments in theory of mind (ToM) relate to concepts of extraordinary communication? Average parent-reported (or self-reported, for adults) prayer-participation ratings and ToM scores are presented in Table 1. In the analyses that follow, predicting an understanding of extraordinary communication, main effects of prayer participation and ToM and interactions between age and these variables are the primary focus.

Prayer participation. As is clear in Table 1, participants categorized as religious participated in prayer activities much more often than participants categorized as secular, and this was true for each of the four age groups (all ts > 3.80, ps < .01, *Cohen's d*s > 1.24), correcting for unequal variances between religious vs. secular groups). This validates our

religious versus secular groupings. We examined relations between participants' prayer participation and their reports that God would be aware of story protagonists' desires with an ANCOVA including age as a between-subjects variable and the prayer-participation composite as a covariate. This analysis yielded a strong main effect of prayer participation ($F(1, 141) = 26.42$, $p < .001$, $\eta^2_p = .16$). Consistent with the earlier findings using the more general estimate of participants' religious background, children and adults who engaged more frequently in prayer-related activities attributed to God greater awareness of protagonists' desires. Importantly, this effect of prayer participation was specific to participants' reasoning about God's awareness, not all agents' awareness—a similar ANCOVA predicting participants' attributions of awareness to humans (averaged across the silent-close, aloud-far, and silent-far human-communication scenarios) revealed no effect of prayer participation ($F(1, 141) = 2.21$, *ns*).

At the end of the interview, participants were asked, "Have you ever prayed for something?" For this question, answers were available for every participant (even for children whose parents did not return questionnaires). As shown in Table 2, these data further validate our grouping of participants as religious or secular—children who attended religious schools (and thus categorized as "religious") were significantly more likely to have engaged in prayer. No difference was found among adult participants. Children who reported having prayed ($n = 88$) attributed significantly more awareness to God about protagonists' desires (using the composite averaging across the 4 God-communication scenarios) compared to children who reported having never prayed ($n = 41$), Ms = .79, .53, respectively; SDs = .33, .41, respectively; $t(64.89) = 3.56$, $p < .001$, *Cohen's d* = .88*;* correcting for unequal variances between groups.

Theory of mind. An ANCOVA for reports of God's awareness of protagonists' desires (a composite averaging across the four God-communication scenarios), with age group as a

between-subjects variable and with ToM as a covariate, revealed a significant main effect of age group ($F(3, 175) = 3.42$, $p < .05$, $\eta^2_p = .06$) and an interaction of age X ToM ($F(3, 175) = 4.96$, $p < .01$, $\eta^2_p = .08$). The interaction was explored within each of the four age groups, with Pearson correlations between ToM and judgments about God's awareness. Among 3-4.5 year-olds, a more advanced ToM was significantly related to granting God less awareness of protagonists' desires ($r(33) = -.48$, $p < .01$). In contrast, among 6-10 year-olds, a more advanced ToM was significantly related to granting God more awareness of protagonists' desires ($r(47) = .29$, $p < .05$). A similar ANCOVA predicting participants' attributions of awareness to humans (a composite averaging across the silent-close, aloud-far, and silent-far human-communication scenarios) also revealed a main effect of age group ($F(3, 175) = 6.98$, $p < .001$, $\eta^2_p = .11$)—older participants more often attributed non-awareness to humans—as well as a significant effect of ToM ($F(1, 175) = 3.91$, $p < .05$, $\eta^2_p = .02$), and an interaction of age X ToM ($F(3, 175) = 4.93$, $p < .01$, $\eta^2_p = .08$). This interaction was explored within each age group: Among 3-4.5 year-olds and 4.5-6 year-olds, a more advanced ToM was related to granting humans less awareness of protagonists' desires ($r(33) = -.55$, $p < .001$; $r(43) = -.39$, $p < .01$, respectively). No significant correlations were found involving ToM for still older participants.

Discussion

We often exchange information with one another verbally. This communication frequently occurs in-person and indeed was necessarily done in-person prior to the development of telecommunications. The current study examined children's understanding of how two factors—loudness and distance—influence the effectiveness of such communication. We find that as early as 3-4 years children appreciate that communication between humans (e.g., between a child and parent) is successful when two conditions are met: when the persons are near one

another (rather than far away) and when the communication is made aloud (rather than silently). If one or both of these conditions are not met, children (and adults) tend to report that the intended recipient of the communication will not be aware of the communicator's message. This understanding of ordinary communication is refined over the course of middle to late childhood. This finding speaks to children's understanding of auditory perception—not only do they understand that such perception is constrained by the loudness of the stimulus (Williamson et al., 2015), but by distance as well. Thus, by the early preschool years, children appreciate that both visual perception (Flavell et al., 1980) and auditory perception are influenced by the distance between the stimulus and the perceiver.

We further demonstrate that preschoolers' understanding of communication is flexible and not limited to understanding how information is exchanged verbally between ordinary humans. Children as young as 3-4 years reported that God would perceive people's silent communication much more often than humans would. Concepts of humans' and God's awareness became increasingly differentiated across middle to late childhood.

Participants' cultural background appeared to play a critical role in their understanding of communication with God. Religious participants as young as 3- to 4-years reported that God would possess knowledge of protagonists' desires whether protagonists made requests aloud or silently, and whether protagonists prayed, asked for, or hoped for their desires to be fulfilled. Although we favor interpreting this effect in terms of cultural differences in children's concepts of communication, there is an alternative explanation: children from less religious households might have been skeptical that praying works or skeptical that God exists, and this led to their reports that God would not be aware of the protagonists' desires. Indeed, secular adults attributed less awareness to God than did religious adults, and this likely reflects their reluctance to accept

premises about prayer's effectiveness or about God's existence rather than their difficulty grasping the underlying concepts. Future research should be conducted to tease apart these two interpretations to account for the cultural differences found among young preschoolers' responses.

Between 3- and 10-years, religiously-schooled children attributed to God greater awareness of protagonists' desires, consistent with research in psychology and anthropology showing that understandings of many supernatural concepts increase with age (Boyer & Walker, 2000; Lane & Harris, 2014; Legare, Evans, Rosengren, & Harris, 2012). In contrast, secular children from 3 to 6 years and secular adults tended to attribute knowledge to God at chance levels regardless of the requester's mode (e.g., praying vs. speaking) or the loudness of the request. This effect of religious background is likely attributable to differences in participants' exposure to other people who pray and their personal engagement in prayer. For children, the very fact that people regularly engage in prayer might provide evidence that there is something real and effective about this process of communicating with God. This might facilitate children's understanding of extraordinary communication and likely increases their belief in its efficacy. In support of these speculations, children's parent-reported engagement in prayer and children's self-reported engagement in prayer were especially strong correlates of children's reports that God would be aware of protagonists' desires.

Religiously-raised children's exposure to the practice of personal prayer and messages about the function of prayer might explain why religiously-raised children in the current study differentiated between humans' and God's knowledge earlier than they have differentiated between these agents' knowledge in prior research (e.g., Lane et al., 2012; Makris & Pnevmatikos, 2007). In Lane et al. (2012), for example, it was not until 5 years that children

consistently attributed to God knowledge about the contents of a novel closed box. However, parents are unlikely to have taught their children specifically that God knows what is inside closed containers; moreover it is impersonal information, and no one had communicated the information to God. In contrast, in the current study children reasoned about God's knowledge about communicated and personal information and it is likely that religious parents have specifically taught their children that God holds that type of knowledge, e.g., "God hears your prayers," "God knows what is in your heart".

Nevertheless, in the current study religious and secular participants across the age range sampled, tended to report that communication with God would be more effective—God would more likely be aware of the protagonists' desires—when the protagonists made requests aloud as opposed to silently. Thus, intuitions about what makes for successful communication with humans were not altogether discarded when participants reasoned about what makes for successful communication with the divine. This finding is consistent with many prior demonstrations of both children's and adults' tendency to attribute human-like qualities and limitations to God (for a review, see Heiphetz et al., in press). Intriguingly, this pattern was especially marked among older secular children (7-10 years) who responded at chance when reasoning about God's awareness of unspoken desires, but tended to report that God *would* be aware of protagonists' desires when requests were made *aloud*. Older children's tendency to report that God would be aware of others' desires (when spoken aloud) might reflect a more general willingness for U.S. children of this age to entertain notions of the supernatural. Other studies have demonstrated that U.S. children of this age—even those who are not raised in especially religious households—often hold creationist conceptions of human origins (Evans, 2001) and report that psychological functions will continue after death (Lane, Liqi, Evans, &

Wellman, in press). Religious practice and belief is normative in the U.S. (Pew Research Center, 2008a), and the accumulation of pervasive religious messages—found even in less devout U.S. communities—likely influences older children's attraction to such ideas.

In addition to religious exposure, children's developing theory-of-mind (ToM) constrains and supports their ability to grasp the concept of an agent—God—who is aware of information that is not accessible to ordinary humans (see Lane et al., 2010, 2014). We see evidence of this in the current study. Three- to 4-year-olds who performed more capably on standard ToM tasks attributed less awareness to God—that is, when they attributed limits to people's knowledge and beliefs on standard ToM tasks, they more often reported that God would *lack* awareness of protagonists' desires. Likewise, among 3- to 6-year-olds a more advanced ToM predicted attributions of less awareness to ordinary humans. However, among still older children (6-10 years)—most of whom normatively perform very well on these ToM tasks—it was those who performed less capably that attributed less awareness to God. This suggests that a developing ToM initially constrains concepts of extraordinary communication—very young children are prone to think that humans and non-humans have similarly limited minds (e.g., Lane et al., 2014). But after a point, ToM then increasingly supports understanding of extraordinary psychological capacities and processes, such as extraordinary communication.

Surprisingly, participants reasoned similarly about God's awareness of people's desires whether those desires were expressed through prayer or through other means (e.g., by speaking or hoping). Participants might have reasoned that all forms of communication directed toward God are prayers, and thus all are equally effective. Future research could address this possibility. As well, future studies should examine how concepts of ordinary and extraordinary

communication develop in different cultural contexts, including cultures that are less religiously-saturated or which have profoundly different prayer practices (e.g., Islam).

From the current research it is clear that young children demonstrate an impressive and flexible understanding of communication. They appreciate that the success of ordinary communication is limited by the loudness of the communication and distance between the communicator and the recipient. At a young age, children, especially those who are exposed to and engage in prayer, also differentiate between communication among ordinary humans and communication that is directed toward an extraordinary being—they understand that God may be aware of others' desires even when they are not expressed aloud. However, intuitions about the relation between loudness and perceptibility that children (and adults) readily apply to human communication continue to be applied (although to a lesser extent) to concepts of communication with God. Both an understanding of ordinary communication and extraordinary communication are refined over the course of middle childhood and the latter understanding is likely facilitated through specific cultural messages and practices involving prayer.

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Table 1

Average theory-of-mind and prayer-participation scores, by age group and religious background

	Theory of mind				Prayer participation			
	Secular		Religious		Secular		Religious	
Age group	*M*	*(SD)*	*M*	(*SD*)	*M*	*(SD)*	*M*	(*SD*)
3-4.5 years	1.95	(.76)	1.60	(.83)	2.73	(1.30)	4.38	(.55)
4.5-6 years	2.00	(.92)	2.16	(1.03)	2.40	(1.20)	4.67	(.53)
6-10 years	2.78	(.55)	2.94	(.25)	2.76	(1.65)	4.69	(.52)
Adults	2.91	(.28)	2.89	(.32)	1.78	(.67)	4.46	(.73)

Note*: Prayer participation* was based on responses to questionnaires. Some parents did not provide questionnaire data, and thus the sample sizes for each of the secular child groups are 16, 14, 11, respectively, and sample sizes for the religious child groups are 8, 20, 26, respectively.

Table 2

"Yes" responses to the question, "Have you ever prayed for something?"

Age group	Secular	Religious	χ^2
3-4.5 years	20%	73%	9.96*
4.5-6 years	50%	84%	5.99*
6-10 years	67%	97%	8.43*
Adults	91%	95%	.20

*$p \leq .01$

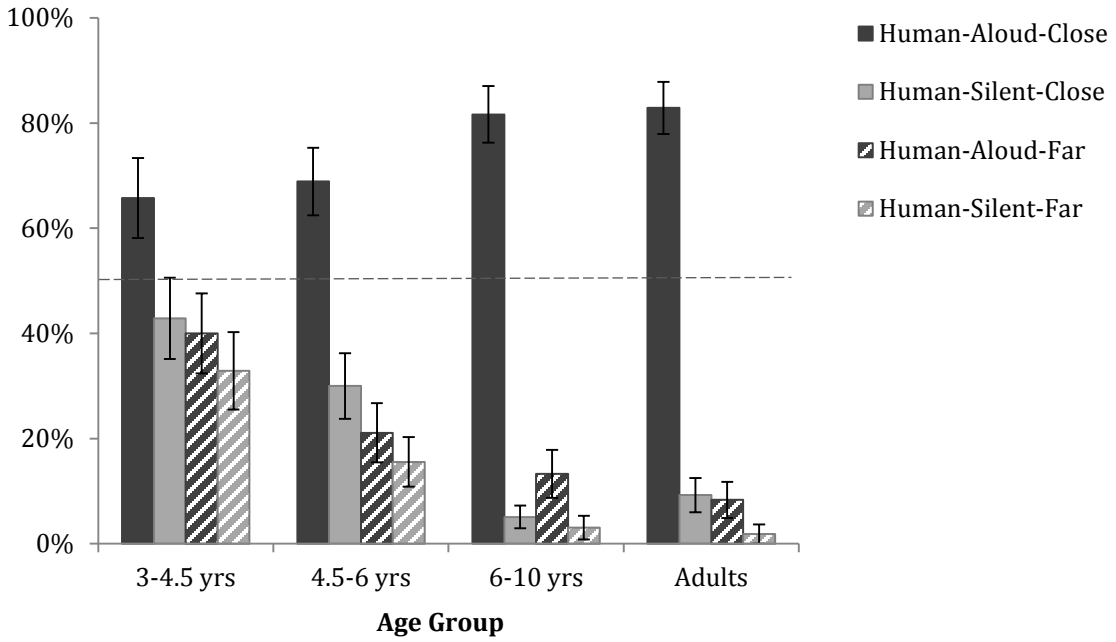

Figure 1. Percentage of each age-group's reports that humans will be aware of protagonists' desires expressed either aloud or silently, nearby or far away. (Error bars: +/- 1 standard error of the mean). Hashed line represents chance (50%).

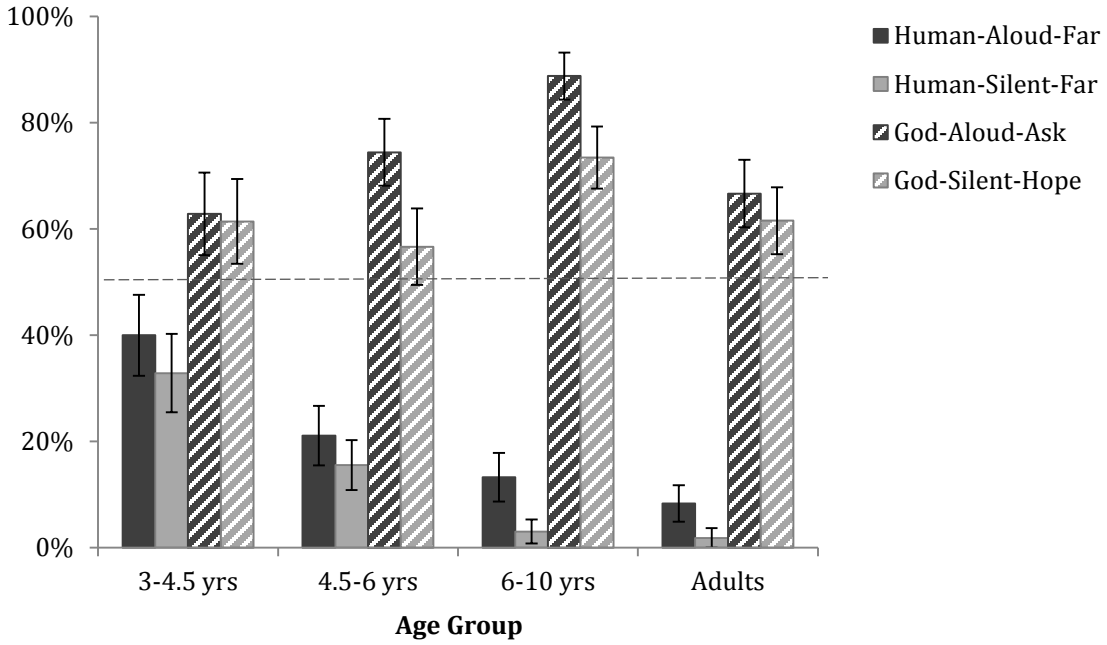

Figure 2. Percentage of each age-group's reports that humans and God will be aware of protagonists' desires expressed aloud or silently. (Error bars: +/- 1 standard error of the mean). Hashed line represents chance (50%).

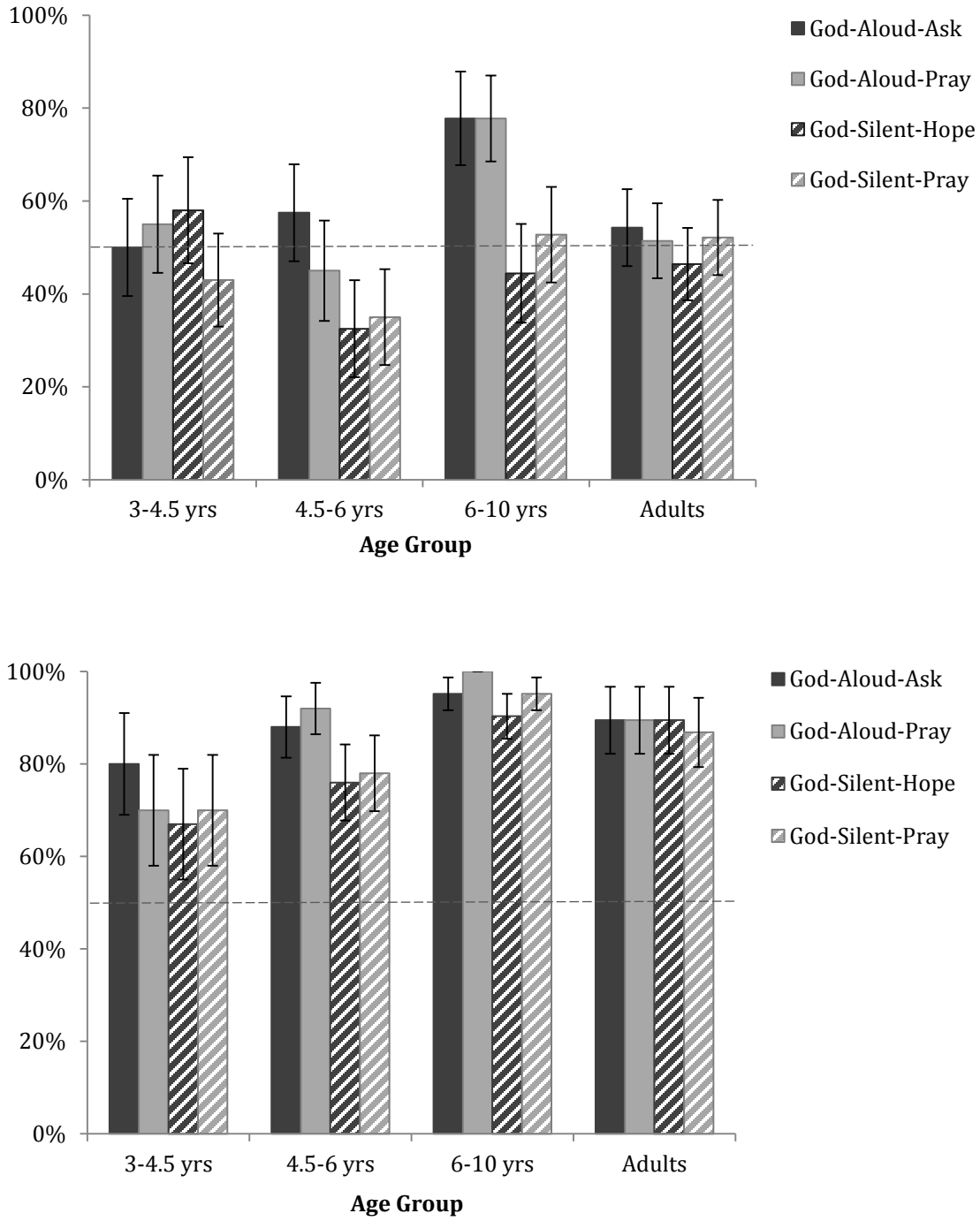

Figure 3. Percentage of each age-group's reports that God will be aware of protagonists' desires expressed through ordinary means or through praying. Top: secular participants. Bottom: religious participants. (Error bars: +/- 1 standard error of the mean). Hashed lines represent chance (50%).

Appendix 1

Example Communication Scenarios

Ordinary Human Communication

Aloud-Close

[show picture] This is Billy. He's jumping on his bed in his room. Billy's mom is close by, in the living room.

[show picture] Uh oh, Billy falls off his bed and hurts his leg. Billy says out loud, "Mom, come make my leg feel better".

Does Billy's mom *hear* that Billy wants help?

Does Billy's mom *know* that Billy wants help?

Aloud-Far

[show picture] This is Suzie. She's riding her bike on the sidewalk. Suzie's dad is far away, at a park.

[show picture] Uh oh, Suzie falls off her bike and scratches her arm. Suzie says out loud, "Dad, come make my arm feel better".

Does Suzie's dad *hear* that Suzie wants help?

Does Suzie's dad *know* that Suzie wants help?

Silent-Close

[show picture] This is Tom. He's eating a bunch of candy in the kitchen. Tom's dad is close by, in the living room.

[show picture] Uh oh, Tom gets a bad tummy ache from all the candy. Tom quietly thinks, "I hope my dad comes and makes my tummy feel better", but he doesn't say it out loud.

Does Tom's dad *hear* that Tom wants help?

Does Tom's dad *know* that Tom wants help?

Silent-Far

[show picture] This is Megan. She's searching for insects in her yard. Megan's mom is far away, at a friend's house.

[show picture] Uh oh, Megan gets her finger bitten by an ant. Megan quietly thinks, "I hope my mom comes and makes my finger feel better", but she doesn't say it out loud.

Does Megan's mom *hear* that Megan wants help?

Does Megan's mom *know* that Megan wants help?

Extraordinary Communication

Aloud-Ask

[show picture] This is Alice. She's climbing a chair in her bedroom.
[show picture] Uh oh, Alice falls off the chair and hurts her leg. Alice says out loud, "God, make my leg feel better".

Does God *hear* that Alice wants help?

Does God *know* that Alice wants help?

Aloud-Pray

[show picture] This is Robbie. He's riding his skateboard on the sidewalk.
[show picture] Uh oh, Robbie falls off his skateboard and scratches his arm. Robbie prays out loud, "God, make my arm feel better".

Does God *hear* that Robbie wants help?

Does God *know* that Robbie wants help?

Silent-Hope

[show picture] This is Dianne. She's eating a bunch of ice cream in the kitchen.
[show picture] Uh oh, Dianne gets a bad tummy ache from all the ice cream. Dianne quietly thinks, "I hope God makes my tummy feel better", but she doesn't say it out loud.

Does God *hear* that Dianne wants help?

Does God *know* that Dianne wants help?

Silent-Pray

[show picture] This is Eddie. He's playing with a cat in his yard.
[show picture] Uh oh, Eddie gets his finger scratched by the cat. Eddie quietly prays, "God, make my finger feel better", but he doesn't say it out loud.

Does God *hear* that Eddie wants help?

Does God *know* that Eddie wants help?

Appendix 2

Theory of Mind Tasks

Knowledge Access

[Show child closed drawers, containing a plastic toy turtle]

Here's a drawer. What do you think is inside the drawer?

[Open drawer and show child contents]:

Let's see…it's really a turtle inside! *[Close drawer]:* Okay, what is in the drawer? [*correct child if wrong*]

[Show figurine] Polly has never ever seen inside this drawer. Now here comes Polly.

[Focal question:] So, does Polly *know* what is in the drawer?

Contents False Belief

[Show child closed Band-Aid box, containing a plastic toy dog]

Here's a Band-Aid box. What do you think is inside the Band-Aid box?

[Open Band-Aid box] Let's see…it's really a dog inside!

[Close Band-Aid box] Okay, what is in the Band-Aid box? [*correct child if wrong*]

[Show figurine] Patty has never ever seen inside this Band-Aid box. Now here comes Patty.

[Focal question:] So, what does Patty *think* is in the box? Band-Aids or a dog?

Explicit False Belief

[Show child toy figure of a boy and a sheet of paper with a backpack and a closet drawn on it.]

Here's Sally. Sally wants to find her mittens. Her mittens might be in her backpack or they might be in the closet. Really, Sally's mittens are in her backpack. But Sally thinks her mittens are in the closet.

[Focal question:] So, where will Sally *look for* her mittens? In her backpack or in the closet?