

God's Beliefs versus Mother's: The Development of Nonhuman Agent Concepts

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Little research exists on how children understand the actions of nonhuman agents. Researchers often assume that children overgeneralize and attribute human properties such as false beliefs to nonhuman agents. In this study, three experiments were conducted to test this assumption. The experiments used 24 children in New York (aged 2,11–6,11 years), 52 children in Michigan (aged 3,5–6,11 years), and a second group of 45 children in Michigan (3,4–8,5 years) from Christian backgrounds. In the first two experiments, children participated in false-belief tests in which they were asked about human and various nonhuman agents including animals and God. Experiment 3 consisted of a modified perspective-taking task, also including nonhuman agents. The results of the study suggest that children do not consistently use human agent concepts but instead can use different agent concepts for some nonhuman agents like God and special animals. Children are not bound to anthropomorphize, but they often do.

INTRODUCTION

Social interaction demands rich attributions of intentions, desires, and beliefs. People constantly try to explain others' behavior in terms of intentional states. These sorts of cognitive attributions are so ubiquitous that they are typically taken for granted. But imagine if people did not understand human agency, that people can initiate action on the basis of internal states and not only respond mechanically to environmental contingencies. If people did not understand each other as agents, they might not talk to each other to try to motivate action but might try to get others to act only through physical contact. People would be surprised when others got up and moved and would have no way to explain many actions. Agents are not merely acted upon but may begin causal chains of events. For this reason, "understanding" agents holds an important position in reasoning about causal events. (Throughout this discussion, "understanding" agents means that children or adults have cognitive expectations or intuitions about the thing in question—agents in this case—that minimally map onto the real world. Of course, this understanding need not be conscious or explicit but does have behavioral, measurable consequences.)

Abundant research documents children's acquisition of human concepts over the first several years of life. But what about nonhuman agents such as gophers, gorillas, ghosts, and God? People are not the only beings that are understood as agents. Conceptually speaking, "agents" refers to any objects or entities that are perceived to initiate action. People often attribute to animals and complicated machines intentions, beliefs, and desires (Caporael, 1986). For exam-

ple, the practice of verbally abusing computers to enhance their performance is not uncommon. Similarly, the world over people conceptualize and generate inferences about a multitude of other nonhuman agents such as ghosts, demons, and monsters.

Scholars have long assumed that as children's concepts of their own human agency develop, they are projected onto other human and nonhuman agents. It is proposed that this is not the case. The research reported here suggests that the development of agent concepts be slightly reframed: Children start with a broad, flexible concept of agency that is then refined into more specific and importantly different agent concepts for some nonhuman agents, such as God and some animals. After a brief description of the development of agent concepts through recent research and presenting the most common theoretical explanations, three experiments addressing the development of human and nonhuman agent concepts are presented. In conclusion, theoretical implications of the data for understanding the development of agent concepts in general and God concepts in particular are presented.

The Development of Agent Concepts

The development of human understanding of agency can be roughly divided into three phases: teleological agency, mentalistic agency, and representational agency. These divisions do not imply that each is radically different from the previous phases or that

characteristics of later phases are not present in earlier ones. Rather, it seems that through the course of development different forms of understanding agency become more assertive. Before any reasoning about agents is possible, however, distinguishing agents from nonagents is necessary.

In the first year of life, infants show remarkable achievements in understanding the differences between the movements of humans and those of inanimate objects. Unlike a rock or a ball, humans can move and act without that action being the physical consequence of direct contact. Infants are aware of this fact and so attempt to influence human action through nonphysical means (Spelke, Phillips, & Woodward, 1995). For example, Legerstee reported that 4-month-olds responded to the disappearance of a person behind an occluder by vocalizing rather than touching the occluder as they did when an inanimate object disappeared behind it (Legerstee, 1994). Seven-month-olds who significantly dishabituate to inanimate objects that violate the "contact principle" do not appear to find humans who move without contact the least surprising (Spelke, et al., 1995). Understanding that humans possess this property of "self-propelledness" is a fundamental step in developing a concept of agency, according to some theorists (Leslie, 1995; Premack, 1990).

Teleological agency: "She did that for a reason." Once infants distinguish which objects are self-propelled, they can begin to apply another early principle of agents: that they are goal-directed, which implies that children have a concept of teleological agency.

In the first year of life, children begin to appreciate that humans do not merely propel themselves; rather, they do so in purposeful ways. For some time "proto-conversation" in 8-month-old infants, including turn-taking vocalizations, facial expressions, and common gaze, has been taken as evidence that infants understand humans as intentional (Poulin-Dubois & Shultz, 1988). But as Poulin-Dubois and Shultz argue, these child-parent interactions do not necessarily imply a mentalistic construal but only an assumption that humans act predictably and can be enlisted to perform purposeful behavior without physical contact. Pointing, among other gestures, emerges between 9 and 13 months (Lempers, Flavell, & Flavell, 1977; Masur, 1983; Zinober & Martlew, 1985), and also around this time infants couple pointing with checking parents' gaze to be sure they are looking to the right thing (Lempers et al., 1977; Masur, 1983). Around the end of the first year, infants respond appropriately to mothers' gestures, such as giving their mothers an object when the mothers hold their hands outstretched (Masur, 1983). All these behaviors

strongly suggest that infants expect humans to behave purposefully. More strikingly, babies as young as 9 months old understand tease-games by holding out objects to parents and then pulling them away, which gives an early indication that children know purposeful human action can be frustrated (Reddy, 1991).

Mentalistic agency: "He feels hungry. He will act." At some point, children begin to attribute internal, mental states to others. When this happens is unclear, but the estimates range from birth to well into the third year (Baron-Cohen, 1995; Leslie, 1995; Perner, 1991). Verbal use of mental state terms begins around age 2 but it is unclear whether or not the terms really have mental state referents and complex behavioral referents or merely follow discourse conventions (Shatz, Wellman, & Silber, 1983). Although the age when children begin to make mentalistic attributions is still debated, it is clear that they eventually appreciate the role of two particularly important mental states: desires and beliefs. If a person wants an apple, and he knows where the apple is, he reaches for it. Even in simple scenarios such as this, both states are useful in predicting or explaining action. For some time, however, children likely understand others' actions as motivated only by simple desires and not beliefs. This transition probably occurs during the middle or end of a child's fourth year (Wellman, 1990, 1993). Children at this phase tacitly understand that people have mental states akin to desires that lead them to act to obtain some object or goal specified by that mental state, but they do not understand mental states to possess any representational component (Gopnik & Wellman, 1992). That is, mental states do not represent a hypothetical state of affairs but only map onto reality.

Much of the evidence for 2- and 3-year-olds' non-representative understanding of agency is negative. Children at this age fail tests that clearly indicate representational reasoning. The bulk of the studies showing this deficit are versions of the false-belief task (Wimmer & Perner, 1983), although difficulty with representation in other theory-of-mind tasks such as deception (Sodian, Taylor, Harris, & Perner, 1991) and understanding differences in visual perspective (Flavell, 1993) has also been demonstrated. Not until children are 3 or 4 do they begin to clearly distinguish beliefs and real states and use them to predict or explain action (Flavell, Flavell, Green, & Moses, 1990; Moses & Flavell 1990; Perner, 1988). Not until children are 3 do they understand the ontological distinction between representational mental states and their real-world counterparts: that real dogs can be petted but not imagined ones (Estes, Wellman, &

Wooley, 1989; Harris, Brown, Marriot, Whithall, & Harmer, 1991). Only some 3-year-olds understand that emotions can be caused by actors' beliefs and desires (Harris, 1989; Stein & Levine, 1989). Linguistically, only by age 3 do children appropriately use terms referring to the full range of mental states, and even then they do not understand the terms in the same way adults do (Tager-Flusberg, 1993). The difficulty in understanding that beliefs do not need to match reality may be symptomatic of a general representational deficit and not a domain-specific difficulty with understanding mental states, as is evidenced by children's inability to understand the representational nature of other media such as photographs (Zaitchik, 1990; but also see Perner, 1995).

On the positive side, some older 2-year-olds and 3-year-olds appear to understand that goals or "simple desires" motivate action and that outcomes of actions need not agree with intended outcomes (Moses & Flavell, 1990; Wellman & Wooley, 1990). The emergence of understanding of nonrepresentational desires is supported by children's explanations of actions. Moses and Flavell (1990) found that 3-year-olds often explained actors' behavior in a false belief task in terms of goals or desires but rarely mentioned beliefs. In fact, already around the 2nd birthday children begin to use goal or desire verbs but not beliefs (Tager-Flusberg, 1993). The earlier understanding of something like desires is not surprising because goals, purposes, and drives can be used without representation and would spring naturally out of an earlier disposition to reason about action teleologically.

Representational agency: "She thinks it is in the box, but it isn't." During the fourth or fifth year of life, probably the most dramatic and important shift in understanding agency occurs. Around this time, children normally begin to understand that human agents can represent counterfactual states and use these beliefs to motivate behavior. This occurrence has been referred to as a full-fledged "theory of mind" or a "belief-desire psychology" (Perner, 1991; Wellman, 1990).

Exactly when this transition takes place has been a matter of considerable debate generating an abundance of research focusing on this accomplishment (e.g., Astington, Harris, & Olson, 1988; Carruthers & Smith, 1996; Whiten, 1991). Although some evidence has emerged for the presence of representational reasoning in 3-year-olds (Chandler, Fritz, & Hala, 1989; Hala, Chandler, & Fritz, 1991; Lewis & Osbourne, 1990; Siegal & Beattie, 1991), the bulk of the data available suggests that this achievement is not stable nor robust until children are 4 and older (Bartsch &

Wellman, 1989; Flavell et al., 1990; Gopnik & Slaughter 1991; Moses & Flavell, 1990; Perner, 1988, 1989; Perner, Leekam, & Wimmer, 1987; Wellman & Bartsch 1988; Wellman & Wooley 1990; Wimmer & Perner, 1983); and the documented ability to pretend may not entail a fully developed ability to understand representation (Perner, 1995). Cross-cultural evidence suggests that the emergence of representational agency around age 4 may be a universal phenomenon (Avis & Harris, 1991).

Succeeding at various false-belief tasks is the hallmark for achieving a representational understanding of agents, for according to Sodian et al. (1991, p. 468), "To understand false beliefs is to appreciate that a person's mental perspective will have a causal impact on his or her actions, statements, and emotions, even when that perspective runs counter to current reality and cannot be derived from it." As long as an actor's behavior matches what a child understands to be reality, investigators cannot discern if children are understanding the role of beliefs or merely that people act in accordance with reality. After Dennett, (1978) laid out the theoretical groundwork for this method of measuring belief-based agency, Wimmer and Perner (1983) adapted the "false-belief" task for examining children. False-belief tasks measure children's understanding that people may hold beliefs about states of affairs that are incorrect or do not match reality, such as being mistaken about the contents of a cupboard or a container. Subsequent research has shown that 3-year-olds are accurate about 33% of the time on these types of tasks (Flavell et al., 1990); they confuse the actors' beliefs with actual states of affairs.

Along with false-belief tasks, the ability to make the appearance-reality distinction signals the acquisition of a representational concept of agency. This distinction occurs as a child realizes that an object can seem different from the way it really is (Flavell, 1986). For example, children who understand the appearance-reality distinction would say a fake rock looks like a rock even though they know it is a sponge. This ability emerges concurrent with passing false-belief tasks.

Successes on false-belief and appearance-reality tasks are not the only differences between 3- and 4-year-olds' reasoning about human agents. Three-year-olds also find it more difficult to remember where they got a belief (O'Neill & Gopnik, 1991; Taylor, Esbensen, & Bennett, 1994). They don't know how and when their beliefs change (Gopnik & Slaughter, 1991), don't understand surprise is the result of disconfirmed beliefs (Hadwin & Perner, 1991; Wellman & Banerjee, 1991), are less able to pair emotional out-

comes with confirmed or disconfirmed beliefs (Harris, 1989; Wellman & Bartsch, 1988), and are poorer at understanding the connection between perception and beliefs (Pratt & Bryant, 1990). Cumulatively, these differences amount to a significantly different set of expectations for agents by school-aged children.

To summarize, in the first year of life infants tacitly understand that humans can violate the contact principle and move without first being struck by another object. In the first 2 years children seem to interpret self-propelled action as goal-directed. Naive psychology emerges anywhere from infancy to age 3 with the first attributions of internal, mental states to other people. From this crude beginning, children in their fourth year start to distinguish reality from representational mental states leading to understanding humans as thinking beings who act on the basis of beliefs and desires. This distinction is widely regarded as a revolutionary development in conceptualizing agents.

Nonhuman Agents

Note that by and large the research pertaining to agent concept development deals exclusively with *human* agent concepts: how children's concepts of agency become increasingly specialized from general teleological agency to the more distinctively human representational agency. In false-belief tasks and deception tasks, as well as most other studies on children's understanding of agency, experimenters have asked children to reason about human action, beliefs, desires, and emotions. When using puppets, experimenters typically name them and treat them as representing humans or human-like beings. Consequently, very little available research addresses the generalizability of children's understanding of agents to nonhumans. Agent concepts of humans become more refined, but are other agents treated increasingly like humans? The little research that pertains to nonhuman agency is ambiguous, and current theoretical explanations of how children come to understand agency are of limited help.

Two main theoretical camps disagree in how to explain the development of agent concepts. The theory theorists believe that children have a "folk-psychological theory of the structure and functioning of the mind" (Carruthers, 1996). Children are like little scientists in that they draw theoretical conclusions on the basis of available data and then use these theories to generate predictions, explanations, and inferences about novel cases or hypothetical situations. They may then revise these theories on the basis of new evidence (Ruffman, 1996). Put more simply, children understand others' beliefs and desires by posit-

ing theoretical principles that govern how beliefs and desires motivate behavior and then applying this theory to themselves and others.

In contrast, simulation theorists claim that children predict others' mental states and behaviors by imagining what they themselves would do in the other's situation (Gordon, 1996; Harris, 1992). That is, they run a "simulation" in their minds on what another agent is likely to do in a particular situation using themselves as the model of intentional agency. Simulation theory (Ruffman, 1996, p. 389) "requires a child to (a) input various beliefs, desires, percepts, etc. into her own mind (imagine having these states), and (b) run a simulation (imagining what she herself would think or feel, or how she might act given such inputs)."

Though both theoretical perspectives would accommodate anthropomorphic agent attributions, theory theory would better account for flexible reasoning about different sorts of agents. The simulation theory would predict that because the (human) self is used as an exemplar for generating all predictions about actions and intentions, all agents will be treated the same, provided human "inputs" are used. That is, if children don't have any salient reasons to think that a nonhuman agent does not have access to the same information a human would, they will tend to treat the agent like a human or anthropomorphize. The theory theory offers more potential for nonanthropomorphic attributions because theoretical understandings of other agents could be used to predict internal states or behaviors. For example, if a child knows that Superman "can see through things," this theoretical knowledge could be imported into a theory of mind task. Because, however, such theoretical statements about other agents' mental and perceptual properties are likely to be rare and lack salience for children, they are unlikely to factor into most theory of mind problems.

Probably the most relevant body of research systematically exploring concepts of a nonhuman agent is the research on concepts of God. Following Piaget's lead, cognitive accounts primarily deal with the cognitive limitations people have at various stages of development and what these limitations mean for the physical, biological, and psychological attributes incorporated in superhuman concepts. Piaget saw concepts of God inextricably connected to children's understanding of their parents. Rather than this relationship being cashed out in terms of the psychological need to project a protecting parent figure (Freud, 1927/1961), Piaget emphasized children's cognitive representations and understandings of their parents and the origins of the world (Piaget, 1969). He understood children's concepts of God to be based in an-

thropomorphism of a "crudely physical kind" (Goldman, 1964).

Under Piaget's theory of cognitive development, children simply don't have the faculties to deal with a more abstract concept of God until they pass out of the stage of concrete operations, sometime in early adolescence (Gorsuch, 1988; Piaget, 1969). Consequently, concepts of God begin crudely anthropomorphic but become abstract by adulthood.

Several theoretical works have incorporated Piagetian thinking into the exploration of developing God concepts (e.g., Elkind, 1970; Goldman, 1964, 1965). Likewise, many empirical studies have turned up evidence of the concrete-to-abstract shift by using interviews with children and young adults (Pealting, 1974; Tamminen, 1991), asking children to draw pictures of God (e.g., Pitts, 1976), and asking children to write letters to God (e.g., Heller, 1986); however, some of these tasks may bias children toward anthropomorphism (Petrovich, 1997). Repeatedly the Piagetian notion that "the term God for a young child is likely to mean big person" (Paloutzian, 1996), echoes throughout the literature.

On the basis of past research, it seems likely that children anthropomorphize God, but what about other potential agents? Research on children's understanding of animals suggests that animals are anthropomorphized as well. For example, Inagaki and Hatano (1987) found that kindergartners were prone to overextend human traits to rabbits and tulips when asked to reason about psychological attributes. Forty percent of the children said a tulip can feel happy, 72% said it can feel pretty, and 72% said it can feel pain. More recently, upwards of 80% of the time kindergartners agreed that primates, other mammals, birds, reptiles, and fish possess various psychological properties (e.g., thinking, feeling pain, being smart, feeling angry; Coley, 1995).

Previous research on God concepts and concepts of animals has focused on the sorts of human properties that are attributed to them by children. What is lacking is a systematic comparison of children's developing concepts of human agents versus other agents on central agent properties such as the nature and function of beliefs. Perhaps the emphasis on human features has obscured real differences in how different agent concepts develop. Different agent concepts may converge on similar surface features while having different developmental histories and possibly different cognitive architecture.

The present experiments attempt to address this shortcoming by comparing the development of a central component of human agent with other agent concepts. Because the acquisition of a "theory of mind"

or understanding humans as having beliefs and desires that motivate and guide behavior is widely acknowledged as a watershed event in the development of agent concepts and cleanly dissociates human agency from most if not all animals, these experiments examine whether children acquire a similar theory of nonhuman agents' minds simultaneously with acquiring a representational theory of human minds. This transition is particularly important because it is when children first begin to appreciate that other humans may have different perspectives on reality and different beliefs and also because only when children make the distinction between beliefs and reality may they understand God's (or other agents') beliefs as fallible like humans. This point in development holds promise for falsifying the hypothesis that children are capable only of representing agents as having human agent properties.

Provided the human agency hypothesis is correct and assuming mentalistic attributions can be made to God in the same way that they are made to other nonhuman agents, up until around age 4 children would understand God as a nonrepresentational, mentalistic agent, as human agents are understood. The difference is that understanding God as a nonrepresentational agent does not present the problems that understanding humans as nonrepresentational does, because God cannot have misperceptions or false beliefs. God, as characterized in the Abrahamic religious traditions, is omniscient. What this suggests is that until about age 4, assuming God is understood as an agent, children can have a more accurate understanding of God's agency than that of humans. If, however, children have only one way for understanding agents and that is anthropomorphically, then when children acquire an understanding of agents as directed by fallible, representational beliefs, they will also attribute fallible beliefs to God and other agents. On the basis of previous scholarship, anthropomorphic attributions to God and animals seem likely. Consequently, the 3-year-old's theologically accurate representation of God would disintegrate with acquiring a "theory of mind."

Alternatively, the development of agents concepts may not be only a refinement of human agent properties. Perhaps teleological agency is modified through the course of development to accommodate and distinguish various classes of agents, thereby rendering children capable of reasoning about various agents in importantly different, nonanthropomorphic ways. Evidence against the human agency hypothesis would be any demonstration that young children can reason about fundamental agent properties (such as the nature of beliefs) as different from humans in predicting behavior of nonhuman agents.

Assuming, then, that the human agency hypothesis is accurate, it would be expected that when children start attributing to humans false beliefs, they will likewise attribute false beliefs to God and other agents. Alternatively, radically different treatment of God or other agents from the onset of a representational understanding would suggest a more flexible, general concept of intentional agents.

To test these predictions, two false-belief experiments and one level-2 perspective-taking experiment were conducted with 3- to 8-year-old children. What makes these experiments different from previous theory of mind experiments is that the children answered questions about the perception, beliefs, and consequent actions of nonhuman agents as well as a human.

EXPERIMENT 1

Method

Participants. Twenty-four children ranging in age from 2 years, 11 months to 6 years, 11 months participated. To maximally ensure that the children knew who God is, all children were recruited from Christian families either from a nondenominational evangelical Christian family camp or from an interdenominational Bible study. Both groups comprised primarily Protestants from an Anabaptist theological orientation. One child claimed she did not know who God was so she did not answer the questions about God. The children were all residents of Maryland or New York State.

Materials and procedure. Children were shown a closed saltine cracker box and a closed, unmarked, brown paper bag. They were asked what they believed to be inside the cracker box, and because the box had pictures of crackers on it, they responded "crackers." (Children who did not guess that there were crackers in the box guessed something semantically similar such as "cookies." One hopeful 6-year-old did guess that there might be a toy in the box but admitted that crackers were typically in this type of container.) The experimenter then showed them the inside of the box, which contained small rocks. The children were shown that the crackers were inside the bag. After reclosing both the bag and the box, the experimenter checked that the children were still clear on where the crackers and rocks were located. The experimenter then asked the children the false-belief questions.

The experimenter asked the children to reason about the thoughts and actions of a parent (usually "mother"), a bear, an ant, a tree, and God. For all five

of these "agents" the experimenter asked children an action question and a thought question. For all but God the action question was in the form, "If your mother wanted some crackers, where would she look first?" To avoid unfairly biasing children to anthropomorphize, the parallel question for God was, "If God wanted to show you some crackers, what would God show you the inside of?"¹ For all five "agents," the thought question was in the form, "If I showed your mother this closed box, what would she think is inside it?" The thought question always followed the action question.

For the bear, ant, and tree items, children were shown realistic pictures of each to ensure the children were thinking of *real* animals and trees, and not cartoon characters. For these three "agents," the experimenter first asked the children if the "agent" in question could think. If it could not, they were asked to pretend that it could think and that it wanted crackers.

So that children might develop some comfort with the task, the experimenter always asked the children about their mothers or fathers first, and then the other four "agents" in random order.

Results

Children's responses were scored 1 point for answers on each false-belief question suggesting an understanding of false beliefs and 0 points for a response suggesting infallible beliefs. That is, indicating that an agent would look for the crackers in the box was scored as 1 point, and answering that an agent would think there were crackers in the box was scored as another point. A score of 0 indicated that the child answered that the agent would look in the bag and would think that there were rocks in the box.

As expected on the basis of previous research, a simple linear regression examining answers to mother questions found a significant positive correlation with age, $r(22) = .59$, $t(22) = 3.541$, $p = .002$. Because age and answers to the items were both continuous measures in Experiment 1, regression analyses were performed. Regressions were also used in Experiments 2 and 3 for the sake of continuity. Older children were more likely to "pass" the false-belief task, that is, have a score of 2. The youngest chil-

¹ Eight participants were given the same "show" question for mother as for God, and also a "look" question for their mother. These questions were maximally distanced in the presentation order. For 7 of these children, the answers were identical. For the eighth, the false belief attribution was made for the "show" question but not the "look" question. It appears, therefore, that the "show" rephrasing is not markedly more difficult or simple than the "look" question.

dren to pass were 3,10. Twelve children passed and 11 failed.

Answers to the bear questions correlated positively with answers on the mother questions, $r(22) = .70$, $t(22) = 4.62$, $p < .001$, as did ant questions, $r(22) = .67$, $t(22) = 4.245$, $p < .001$. But the tree had the strongest relationship of all with the mother questions, $r(22) = .92$, $t(22) = 10.72$, $p < .001$.

When answering questions about God, children did not show a meaningful correlation with age, $r(21) = .15$, $t(21) = .72$, $p = .481$. Similarly, performance on the God questions was not significantly correlated with performance on the mother questions, $r(21) = .32$, $t(21) = 1.52$, $p = .142$. Overall, scores on the God questions averaged less than those for the mother questions. The mean score for the parent questions was 1.08 ($SD = 1.02$) versus .48 ($SD = .79$) for the God questions. A paired t test found this difference to be significant, $t(22) = 2.92$, $p = .008$. Figure 1 illustrates these results.

Naturally, the performance of children who passed the false-belief task when reasoning about parents primarily accounts for these differences. That is, children who scored 2 for the parent questions did not show a corresponding tendency to have higher scores on the God questions. Only 4 of 13 children who passed on the parent questions scored 2 on the God questions. Eight of these 13 children scored 0 for God, which suggests no anthropomorphism. Children 3,10 (the age at which they began to pass the false-belief task) and older had a mean score of 1.37 ($SD = .95$) for mother versus .50 ($SD = .86$) for God. This difference was also significant, $t(17) = 4.01$, $p = .001$.

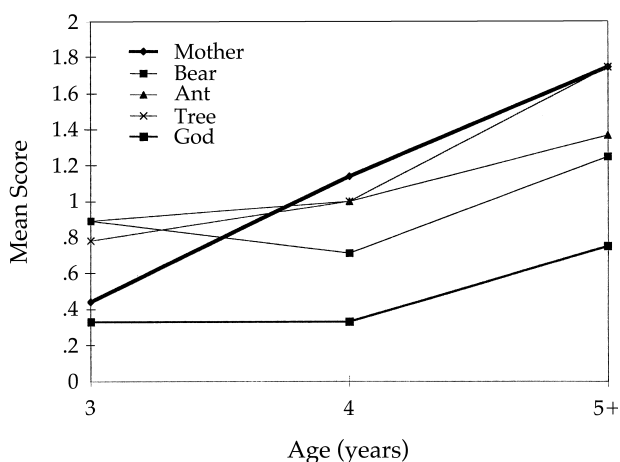


Figure 1 Experiment 1 results: Mean combined scores for false belief questions by age groups. A score of 2 indicated “passing” both false belief questions. A score of 0 indicated “failing” both false belief questions.

Discussion

The most straightforward explanation of the finding that children answered questions about the tree most similarly to questions about a parent is that children were confused by or rejected the idea of the tree really being an agent in its own right and so retreated to the most appropriate proxy concept: human agency. Bear and ant questions might have been answered similarly to human questions for the same reason but showed slightly more divergence because of increased knowledge about actual behaviors of these animals. For example, one 6-year-old reasoned that the bear would look in the bag and not the box for crackers because it would be able to smell where the crackers are.

Children seemed to treat God quite differently from the other agents, an existence proof that children are not doomed to anthropomorphize but can reason about different types of agency. Before this conclusion may be drawn with confidence, however, at least two potential shortcomings of Experiment 1 must be addressed. First, only one experimenter spoke with the children and, knowing the hypotheses, may have inadvertently biased the children’s responses. Second, the “look” question was included because of the strong precedent in previous research for this measure. Suggesting, however, that the animals (and God) might want some crackers and then asking the “look” question may have unfairly biased children toward anthropomorphism. Experiment 2 addresses these possible sources of bias, expands the range of animals introduced as possible agents, and uses a population from slightly different religious traditions.

EXPERIMENT 2

Method

Participants. The sample consisted of 52 children: twelve 3-year-olds (3,5–3,11), fourteen 4-year-olds (4,0–4,11), seventeen 5-year-olds (5,0–5,11), and nine 6-year-olds (6,0–6,11). Thirty were male. The children were recruited from Reformed and Lutheran Protestant churches in Michigan. No differences were detected between Lutheran and Reformed children; therefore, they are treated as one group for all analyses. Parents signed consent forms providing the name, age, and birthdate of each child.

Materials and procedure. The materials and procedure were nearly identical to those used in Experiment 1. Only four slight differences were introduced. First, to broaden the range of animals examined, a snake and an elephant were used with a bear, a tree, God, and mother as agents. Second, photographic

prints instead of realistic illustrations were uniformly used to introduce the children to the animals. Third, only one false belief question was asked for each “agent.” Children were asked what X would think is inside the box. Because the “Where would X look for crackers first?” question was answered essentially identically with the “think” question in Experiment 1, dropping the “look” question shortened the task, thereby allowing for more animals to be included, and reduced possible bias introduced by suggesting that the agents would want to look for crackers. Finally, to reduce experimenter bias, two naive experimenters gathered all of the data.

Results

Because the experimenter asked only the “think” question, each child had essentially a dichotomous score for each of the agents. They were scored 1 for answering “crackers” and 0 for all other answers—almost always “rocks.” Occasionally, children answered for the animals (as children are apt to do) with entirely unexpected answers such as that the box might contain water. These few cases were coded as 0 because they do not evidence the anthropomorphic response “crackers” but rather suggest thinking of the animal as having different beliefs than a human would have.

No developmental differences were found between mother, bear, elephant, snake, or tree. They all showed positive correlations with age, which indicates that as age increased, children were more likely to answer that the agent would think crackers were in the box. For example, 18% of the 3-year-olds said their mothers would think crackers were in the box compared with 87% of 6-year-olds. Replicating the well-documented improvement in passing false-belief tasks with age, the correlation between answers for mother and age was strong, $r(51) = .63$, followed by elephant, $r(51) = .61$, snake, $r(51) = .50$, and bear, $r(51) = .48$. Surprisingly, the strongest relationship with age was tree, $r(51) = .65$. Figure 2 illustrates these results.

In contrast, children clearly treated God differently from the other five. No correlation was detected between answers for God and age, $r(48) = .09$. Of course, the divergence between God and the other agents took place upon children passing the false-belief task. Of the 25 who passed the false-belief task for mother and answered for God, only 6 said God would think crackers were in the box. A Wilcoxon Signed-Ranks Test for matched pairs found significant differences in “cracker” responses between mother and God only for 5- and 6-year-olds, $z = 2.93$, $p = .003$; $z = 2.37$, $p = .018$, respectively. No differ-

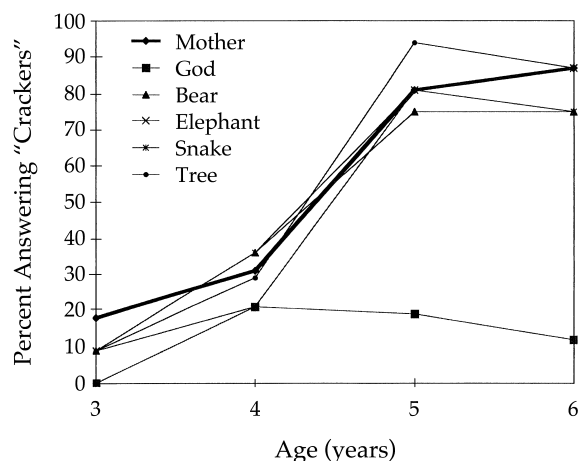


Figure 2 Experiment 2 results: Percent of children by age group reporting that the agent in question would believe crackers were in the box.

ences between mother and any of the other agents were found at any age.

Although there were no significant differences among the animal and tree correlations, as in Experiment 1, a suggestive trend in the correlations related to taxonomic differences from humans emerged. Of the animals, bear and elephant were most tightly correlated with mother, $r(51) = .66$, and snake was slightly worse, $r(51) = .62$. Tree, however, was the most closely correlated with mother, $r(51) = .73$, just as in Experiment 1.

Discussion

Potential sources of bias in Experiment 1 seemed to be of no consequence in Experiment 2. As in Experiment 1, all of the non-human agents, with the exception of God, were treated like a human (mother). Three- and 4-year-olds maintained that all agents would know there were rocks in the box. By age 5 and 6, the majority of children agreed that mother, the bear, the elephant, the snake, and the tree would believe that crackers were in the box, but God would still know better. No developmental lag was detected between children learning that people can have false beliefs and transferring this knowledge to the other agents, minus God.

A possible explanation of children treating God differently from the animals and tree is that God has different perceptual abilities. Perhaps God does not have infallible beliefs per se, but rather *sees* all. In both Experiments 1 and 2, when asked if God could see the cracker box at the time of the experiment, children overwhelmingly answered yes. In Experiment 2, only

8 of the 44 children who answered said God could not see the box; however, perspective on God's vision did not predict answers to the God item of the false-belief task, $r(48) = .17$, *ns*; even when considering only the children passing the task when reasoning about parents, $r(24) = .16$.² Thus, although children claiming that God could see the box either entails that God was present in the room (and invisible) or that God could see the box even when not present (both nonhuman properties), it does not appear to account for children's failure to attribute false beliefs to God. The issue of whether God's visual perception as well as beliefs are represented differently than humans' is addressed more directly in Experiment 3.

EXPERIMENT 3

Experiments 1 and 2 demonstrate that young children may reason about ontologically different agents as having importantly different properties. Specifically, children can use God's infallible beliefs to solve simple false-belief problems. The result is that, overall, children from ages 3 to 6 more accurately reasoned (theologically speaking) about God's beliefs than their parents'. This conceptual advantage might not be limited to false-belief situations and might not be limited to God but might also be true of visual perspective-taking for animals with superhuman vision.

Not until just before age 4 do children shift from what Flavell (1974) calls "level 1" knowledge of visual perception to "level 2" knowledge of visual perception (Masangkay et al., 1974). Level 1 is the ability to know if someone else can or cannot see something because of obstructed line of sight, whether or not you can see it. Level 2 is the more sophisticated understanding that one thing can look different from different perspectives. Before level 2 knowledge of visual perspective develops, children mistakenly assume that others see an object or scene in the most complete visual perspective possible (Liben, 1978; Light & Nix, 1983; Wimmer, Hogrefe, & Perner, 1988). That is, they assume the other person's perspective is an accurate and complete representation of reality as the child understands it. When reasoning about other humans' perspectives, this strategy is often mistaken. As with the false-belief tasks, however, this strategy

² To examine the relationship between children's beliefs about God seeing the box and their beliefs about God's knowledge of its contents, a χ^2 analysis was performed. The analysis gave no evidence that the two sets of belief were at all related among children who passed the false belief task, $\chi^2(1, N = 23) = .65$, $p = .42$. The corresponding correlation was also calculated and yielded a probability of .44. Because of the similarity of outcomes, the coefficients are reported for easier interpretation.

yields the child's best possible approximation of God's actual (infallible) perspective, granting that God sees things in some sense. Childhood realism would also support young children's being able to understand and use knowledge about animals who might see things that they themselves cannot. Experiment 3 explores these possibilities by examining 3- to 8-year-old children's performance in a modified perspective-taking task.

Whereas traditional level 2 perspective-taking tasks involve an object viewed from various angles and participants are asked to appreciate that the same object may appear differently depending on line of sight, in this task, the lighting conditions of the object were manipulated. Children reported on their own and other agents' perception of the dark interior of a box before and after knowing that a red block was in the box. Do children understand that light level affects the ability to see an object differentially depending on the type of agent doing the viewing? The difficulty with asking children to reason about God's visual perspective by using an angular rotation manipulation is that God's location cannot be specified. In Experiment 3, the two possible perspectives of the same visual field are detection of a block in a box versus not seeing anything. The task also resembles an appearance-reality task (Flavell, 1986) in that children must understand that even though in reality a block is in the box, it may appear to others that there is no object in the box.

If children anthropomorphize God and animals with regard to visual perception, then when an object cannot be seen because of darkness, no one can see it. Alternatively, if God possesses infallible perception as well as beliefs, darkness should not matter. Further, another special agent, a kitty cat who can see well in the dark, was included.

Method

Participants. Recruited from various Protestant churches and preschools in Michigan, 45 children, ages 3,2 to 8,5, participated. Participants included thirteen 3-year-olds, ten 4-year-olds, eleven 5-year-olds, and eleven 6- through 8-year-olds.

Materials. A shoe box with a small slit in the top, a hole in the side, and a red block inside, were used as stimuli. A standard flashlight served as the light source for the inside of the box. Three puppets represented a monkey, a kitty cat, and a girl named Maggie.

Procedure. Each child participated individually. All children looked through the slit in the top of the darkened box and were asked, "What do you see inside the box?" After the children agreed that they

could see nothing, the experimenter then shined the flashlight through the small hole, thereby revealing the block inside to the child. The experimenter then turned off the light and allowed the child to look again. To see if children could be taught about special properties of animal perception, the experimenter told the child that kitty cats have special eyes and can see in the dark. Then, in random order, the child was asked about what each agent saw in the darkened box.

Note that the experimenter did not instruct children about God at all but only asked at the beginning of the task if God could see. All children who reported knowing who God is also said that God can see.

Results

Answers to the second set of questions (i.e., after the child knew there was a block in the box but could no longer see it) were simply coded 1 if the agent in question was reported as seeing the block and 0 for not seeing. Results were analyzed by using simple linear regression analyses for relationships with age and Wilcoxon Signed-Ranks Tests for matched pairs. On the basis of the previous two experiments, it was predicted that children at all ages would tend to report that God and the kitty would see the block but that across ages children would show a standard developmental shift from failing the task at age 3 to passing the task by age 5 when reasoning about Maggie and the monkey.

Consistent with previous appearance–reality and level 2 perspective-taking tasks, older children were more likely to report that Maggie could not see the block in the darkened box; they appreciated that just because the block was present did not mean it would be perceived, $r(44) = -.52$, $t(44) = 4.01$, $p < .001$. Whereas 76.9% of 3-year-olds reported that Maggie could see the block, only 36.3% of 5-year-olds did so, $z = 1.97$, $p = .049$.

As in Experiments 1 and 2, children treated the monkey similarly to Maggie. A negative relationship between answers to monkey questions and age was detected, $r(44) = -.47$, $t(44) = 3.49$, $p = .001$. At no age, nor collapsing across age, was Maggie significantly different from the monkey. Overall, 46.7% of children reported that Maggie would see the block versus 51.1% for the monkey, $z = .58$, *ns*.

In contrast, participants treated God and the kitty as importantly different from either Maggie or the monkey. Neither God nor the kitty related to age negatively, $r(44) = .08$, *ns*, $r(44) = .26$, *ns*, respectively. Of the 3-year-olds, 91.7% answered that God would see the block, and 76.9% said the kitty would see the

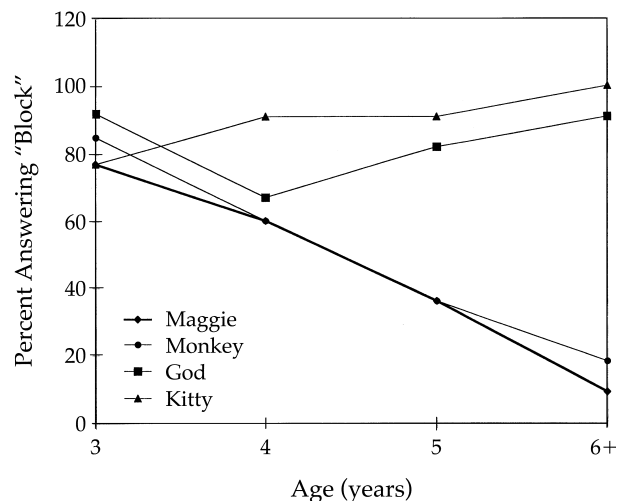


Figure 3 Experiment 3 results: Percent of children by age group reporting the agent in question would see the block in the darkened box by answering "block."

block. Similarly, 81.8% of 5-year-olds said God would see the block, whereas 90.9% said the kitty would. Across ages, children maintained that God would be more likely to see the block than Maggie, $z = 4.00$, $p < .001$; and the kitty would also be more likely to see the block, $z = 4.36$, $p < .001$. Inferential tests detected no significant differences between the kitty and God at any age.

Figure 3 illustrates Experiment 3 results.

Discussion

As in previous appearance–reality and level 2 perspective-taking experiments, 3-year-olds demonstrated difficulty in understanding that even though an object was present, other viewers might not be able to see the object; they often reported that Maggie would see the block even when it was completely invisible because of lack of illumination. By age 5 most children correctly reported that Maggie would not be able to see the block, thereby overriding their knowledge that the block was in the box.

Consistent with Experiments 1 and 2, children easily generalized the acquired ability to accurately represent other's representations of the display to a non-human agent, the monkey, but did not generalize to all other agents. Once again, children treated God as importantly different from the monkey or Maggie. Without receiving any training from the experimenter, children at all ages tended to report that God would see the block, thereby supporting the claim that children do not represent God as just another

person but rather understand God as a meaningfully different sort of agent with some nonhuman properties.

Apparently, children discern God as having nonhuman perceptual systems as well as beliefs, although the two may not be unrelated. Young children have been shown to understand that perception leads to beliefs (Baron-Cohen, 1995; O'Neill & Gopnik, 1991; Pratt & Bryant, 1990). In this case, acknowledging that God can see things that people cannot could entail that God also has accurate beliefs in situations when people do not (e.g., the cracker box task). Children may hold, however, that God has both infallible perception and infallible beliefs independently.

Experiment 3 also demonstrates that children can successfully apply knowledge about superhuman vision in animals. Children seemed to easily comprehend what it would mean for the kitty cat to see in the dark. At all ages children reported that the kitty would see the block. This result suggests that preschool children may already be making important distinctions between the sorts of agents that populate the natural world. Although in some cases they may exhibit overextension of human properties (Inagaki & Hatano, 1987), when differences with humans are salient, their agent concepts are flexible enough to accommodate nonhuman properties. Indeed, it would be unlikely for a young child who grows up with dogs as pets to not appreciate that dogs typically can smell and hear better than people.

GENERAL DISCUSSION

The results of the three experiments support two general conclusions. First, contrary to the line maintained by many in the Piagetian tradition and implicitly assumed by others, young children need not treat all agents the same as humans with regard to nonsuperficial agent properties. That is, the human agency hypothesis is false. Second, children may be better prepared to conceptualize the properties in some nonhuman agent concepts (e.g., God) than for understanding humans.

Flexibility in Agent Concepts

As predicted, the data presented here support the strong tendency for children to understand most agents much in the same way as humans. Children attributed to bears, elephants, snakes, ants, and even trees false beliefs (i.e., representational agency) simultaneous with this attribution to humans. No developmental lag was detected. The attribution of human-like beliefs to the tree and the animals is unsurprising in light of previous research demonstrating the ease

with which young children personify nonhumans (Eddy, Gallup, & Povinelli, 1993).

Although the tight correspondence between human and animal treatment in the false-belief task is evidence that children may apply their theory of human minds and action to other things, their performance on the God items casts doubt on the thesis that human agency is the only form of agency available to young children. Children who had an understanding of false beliefs in humans did not automatically transfer this knowledge to all other agents. Rather, they seemed to be selective about the agents to which they would apply this knowledge. Similarly, when given new information about the perceptual abilities of kitties being different from those of humans', children incorporated this information into their judgments of the kitty's differing perspective.

A small but growing number of recent studies support the notion that young children can and do treat other agents as importantly different from humans. Children are not doomed to be strictly anthropomorphic when it comes to central properties of mind or causal powers. For example, contrary to Piagetian artificialism (Piaget, 1969), Petrovich (1997) found that although 4-year-olds know that humans make machines and God doesn't, when asked to account for the origins of natural objects such as large rocks or mountains, they gave God the credit and not people. Similarly, several studies have uncovered evidence that 4-year-old (and in some cases, older) children believe magicians are a special type of agent able to perform actions that apparently violate natural causation. It seems children believe this ability is not merely learned but either an inborn or endowed power (Chandler & Lalonde, 1994; Rosengren & Hickling, 1994; Rosengren, Kalish, Hickling, & Gelman, 1994). Further, recent research suggests that 4- and 5-year-olds appreciate differences in perceptual abilities of different agents across sensory modalities (Richert & Barrett, 1999) and appreciate that whereas God is more likely than humans to possess various forms of knowledge, animals are less likely (Barrett & Newman, 1999).

That God was treated differently from the other "agents" in the false-belief experiments is strong evidence that children do not have to treat all agents the same; but why was God treated differently? Perhaps the reason is that already by the age of 4, children of the Protestant populations sampled have been thoroughly taught that "God knows everything" or "God is never wrong" and fluently applied this abstract rule to the crackerbox task. Similarly, children may have been taught that "God sees everything" and used this rule to reason that God would even see in

the dark; however, Sunday school teachers from the participating churches did not report that teaching on God's properties such as infallibility or seeing in the dark was a focus of their instruction.

The fluidity with which children applied their training to (presumably) override the tendency to anthropomorphize suggests that other factors might have cued children to treat God as a different sort of agent. Through the Bible stories that make up most church teaching for young children, children are taught that God has extraordinary powers and physical properties but is clearly an agent. The knowledge that God is a different sort of agent than humans probably makes children who have just begun to "pass" the false-belief task hesitant to transfer this newly discovered insight about most agents to God. Both being taught that God is infallible and knowing that God is a different sort of agent than humans probably contribute to God not being treated like a bear or a tree.

That children truly understand God as a different sort of agent and not just a human with a few strange properties (e.g., infallible beliefs, ability to make mountains) that have been overlearned is difficult to disambiguate. Few agents that young children know about are presented either as radically different from humans but having fallible beliefs (like a fallible god) or similar to humans but having infallible beliefs (like a supersmart person). Possible test cases such as Santa Claus or angels do not quite fit. Santa Claus is not perfectly infallible because really he only knows if you are naughty or nice but requires letters to tell him what gift to bring. Angels are not radically different from humans because they are often depicted as humans with wings and are often described as just being humans who have died and gone into God's service. Information about precisely which properties an agent must possess to be treated differently from humans on the false-belief task will wait for future studies.

By no means do the data here support the claim that children's concepts of God are independent of their understanding of people or parents. Christian theology teaches about a God who practiced self-anthropomorphization by becoming human in the form of Jesus of Nazareth. Not surprisingly then, Christian children often conflate God and Jesus's properties. The present studies do, however, clearly demonstrate that young children need not treat God or other agents possessing salient special properties (such as the cat) as merely human.

Not only do the data presented here support the claim that children can adequately represent and generate inferences by using concepts of agents importantly different from humans, but they also suggest

that children find it as easy or easier to represent at least some properties of nonhuman agents than human properties. In Experiment 3, children more accurately predicted what a cat would see better than what other people would see. Further, children at all ages sampled in both false-belief experiments more accurately predicted God's knowledge than their parents', theologically speaking. For children to "get God right" all they had to do is keep answering like a young 3-year-old. God's beliefs are much like the pre-representational child's understanding of beliefs: They always match what is in the world. This pre-representational foundation apparently facilitates slightly older children's ease at continuing to understand God's infallible beliefs.

Naturalness of God Concepts

Theorists commonly suggest that understanding goal-directedness and making mentalistic attributions may be hardwired but understanding representational agency is learned through experience (e.g., Gopnik & Wellman, 1992). As Zaitchik (1990) suggests, a plausible account for how children come to understand that mental representations do not always match reality is that they experience an enormous amount of evidence that does not support a one-to-one correspondence. They know when their own beliefs are not confirmed and witness others acting in ways that are incongruent with reality. This account is consistent with recent research demonstrating that environmental factors such as number of siblings may profoundly influence when false beliefs are understood (Dunn, Brown, Slomkowski, & Tesla, 1991; Jenkins & Astington, 1996; Perner, Ruffman, & Leekam, 1994; Ruffman, Perner, Naito, Parkin, & Clements, 1998). Following this line of reasoning, it is a form of agency at the core of many God and other supernatural concepts that is "native," whereas a more appropriately human form of agency must be learned. In some respects, God concepts (and some other nonhuman agent concepts) may be more conceptually primitive, in part accounting for why such God concepts are so widespread.

These observations corroborate the arguments of several scholars applying insights of cognitive science to the study of religion. Each in their own ways, these scholars have maintained that religious beliefs and practices are "natural" or "intuitive" in the sense that they primarily enlist ordinary cognitive resources. Lawson and McCauley (1990) have shown how religious rituals are undergirded by garden-variety action and agent representations. Boyer (1994, 1995) has argued that religious concepts satisfy the bulk of intu-

itive assumptions generated by their ontological category membership (e.g., living things, artifacts, persons) but gain their unusual qualities by minor violations of these assumptions. Guthrie (1993, 1997) maintains that gods are explained by an overactive agent detector that cares little if a postulated agent has some nonhuman qualities such as invisibility because being able to reason about unseen agents would have had great survival value in our evolutionary past. Likewise, assuming agents may be infallible with regard to beliefs would be a good survival bet: If wrong, little is lost; but gambling that a predator or prey knows less than it does could be disastrous. The relative ease humans have at representing an agent with properties such as infallible beliefs and invisibility could help explain why concepts of gods are so widespread and contagious (Sperber, 1996). Not all of the properties attributed to gods, however, are easily understood. Many properties are quite counterintuitive and cognitively cumbersome, especially in real-time inference generation (Barrett, 1998; Barrett & Keil, 1996).

Simulation-Theory and Theory-Theory of Nonhuman Agents

That children treat God differently from humans in the false-belief task and God and the kitty cat differently than Maggie in the perspective-taking task is more easily explained by a theory theory of mind than a pure simulation theory of mind. Simulation theories argue that children solve theory of mind problems such as the false-belief task and the perspective-taking task by imagining themselves in the position of the agent in question and “simulating” what that agent would believe or see in the task by comparison with their own beliefs or perceptions. Because omnipresence and omniscience cannot be simulated, it is difficult to see why a simulation of a bear’s or ant’s beliefs would yield different conclusions than simulating God’s beliefs about the contents of the cracker box. That children’s simulation of God and the bear differed in visual access to the box (different inputs), thus accounting for the difference in God’s beliefs, received no support from the data gathered. Similarly, to successfully simulate the kitty’s visual perception as different from the monkey’s or Maggie’s, children would have to be able to simulate what it would mean to see in the dark—an unlikely feat.

Versions of the theory theory, including those that use some simulation (e.g., Perner, 1996), argue that children have access to some general rules about how minds behave in certain situations and use these rules, rather than simulation, to solve theory of mind

problems. In the case of God’s inability to have false beliefs, the child simply imports this theoretical knowledge when addressing the problem, thus producing the observed differences with other agents. To judge what the cat would see, children would use their theoretical knowledge about vision to generate inferences about what it might mean for a cat to see better in the dark. Although these data certainly fall short of a convincing blow against simulation theory, they do add to the growing case against it (Ruffman, 1996).

Reframing the Development of Agent Concepts

As suggested earlier, research concerning the development of understanding agency typically focuses on how children better and better approximate adult understandings of human agency. Consequently, even the earliest evidence of children appreciating purposeful movement is regarded as a primitive representation of *human* agency. But in what sense are these early agent concepts only *human* agent concepts? Although individual humans are certainly the most important agents for developing children to understand, successful survival (at least in our human past) also requires reasonably accurate prediction of the behaviors of animals and organized groups of humans. Early agent concepts must be refined not only into human agent concepts but also into these other agent concepts.

Given the need for flexible application of early agent concepts across the lifespan, not surprisingly, evidence exists that infants do not require a human substrate to apply agent expectations. For example, already at 3 months old, children appear sensitive to the difference between something like teleological causation and similar independent movement in geometric shapes. Rochat, Morgan, and Carpenter (1997) found that infants preferentially look at two colored circles “chasing” each other on a computer monitor over a control display with two independent moving circles matched for speed, changes in direction, and average distance. By 9 months infants significantly dishabituate when the roles (who is chasing whom) are reversed in a display of “chasing” colored circles, which again suggests some rudimentary understanding of the causal relationship being illustrated (Morgan & Rochat, 1998). Likewise, Gergely and colleagues found that 12-month-olds seemed to anticipate teleological agency from circles that exhibited self-propelledness (Gergely, Nadasdy, Csibra, & Biro, 1995). Note that these are circles, not people, which suggests that concepts of teleological agency might not be tied to humans even in infancy.

That infants attribute teleological agency to circles should not be confused with the claim that infants an-

thropomorphize the circles. Clearly these infants do not expect circles on a computer screen to converse with them or get them a bottle. Many human properties that infants recognize in people are not generalized to other agents. The development of agent concepts is not only a matter of figuring out which properties apply to humans but which ones do not.

Given a less anthropocentric perspective on the development of agent concepts, little reason remains to suppose that young children have only one concept of agents—human agency—that is uniformly and indiscriminately applied to all other agents. At each important step in the development of human concepts, children must also determine to which objects the newly discovered properties of humans apply. The present experiments demonstrate that children need not extend the discovery of fallible, representational beliefs to all agents, nor humanlike visual perspectives. Development of agent concepts is a story not just of how representations of human agency become increasingly accurate but also of how general concepts of agency become specialized and selectively applied to represent various agents.

ACKNOWLEDGMENTS

The authors thank Ithaca (NY) Women's Bible Study, Bay Area Community Church (Severna Park, MD), Young Life's Lake Champion (New York), Sunshine Community Church (Grand Rapids, MI), Lutheran Church of the Redeemer (Birmingham, MI), Hillcrest Christian Reformed Church (Hudsonville, MI), John Knox Presbyterian Preschool (Kentwood, MI), and Fairhaven Reformed Church (Jenison, MI) for their assistance in recruiting participants.

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REFERENCES

- Astington, J. W., Harris, P. L., & Olson, D. R. (Eds.). (1988). *Developing theories of mind*. New York: Cambridge University Press.
- Avis, J., & Harris, P. L. (1991). Belief-desire reasoning among Baka children: Evidence for a universal conception of mind. *Child Development, 62*, 460–467.
- Baron-Cohen, S. (1995). *Mindblindness: An essay on autism and theory of mind*. Cambridge, MA: MIT Press.
- Barrett, J. L. (1998). Cognitive constraints on Hindu concepts of the divine. *Journal for the Scientific Study of Religion, 37*, 608–619.
- Barrett, J. L., & Keil, F. C. (1996). Conceptualizing a non-natural entity: Anthropomorphism in God concepts. *Cognitive Psychology, 31*, 219–247.
- Barrett, J. L., & Newman, R. (1999, October). *Knowing what God Knows: Understanding the importance of background knowledge for interpreting static and active visual displays*. Poster session presented at the Cognitive Development Society meeting, Chapel Hill, North Carolina.
- Bartsch, K., & Wellman, H. M. (1989). Young children's attribution of action to beliefs and desires. *Child Development, 60*, 946–964.
- Boyer, P. (1994). *The naturalness of religious ideas: A cognitive theory of religion*. Berkeley: University of California Press.
- Boyer, P. (1995). Causal understandings in cultural representations: Cognitive constraints on inferences from cultural input. In D. Sperber, D. Premack, & A. J. Premack (Eds.), *Causal cognition: A multidisciplinary debate* (pp. 615–644). Oxford, U.K.: Oxford University Press.
- Caporael, L. A. (1986). Anthropomorphism and mechanomorphism: Two faces of the human machine. *Computers in Human Behavior, 2*(3), 215–234.
- Carruthers, P. (1996). Simulation and self-knowledge: a defence of theory-theory. In P. Carruthers & P. K. Smith (Eds.), *Theories of theories of mind* (pp. 22–38). Cambridge, U.K.: Cambridge University Press.
- Carruthers, P., & Smith, P. K. (1996). *Theories of theories of mind*. Cambridge, U.K.: Cambridge University Press.
- Chandler, M., Fritz, A. S., & Hala, S. (1989). Small-scale deceit: Deception as a marker of two-, three-, and four-year-olds' early theories of mind. *Child Development, 60*, 1263–1277.
- Chandler, M. J., & Lalonde, C. E. (1994). Surprising, magical and miraculous turns of events: Children's reactions to violations of their early theories of mind and matter. *British Journal of Developmental Psychology, 12*, 83–95.
- Coley, J. D. (1995). Emerging differentiation of folkbiology and folkpsychology: Attributions of biological and psychological properties to living things. *Child Development, 66*, 1856–1874.
- Dennett, D. C. (1978). *Brainstorms: Philosophical essays on mind and psychology*. Cambridge, MA: MIT Press.
- Dunn, J., Brown, J., Slomkowski, C., & Tesla, C. (1991). Young children's understanding of other people's feelings and beliefs: Individual differences and their antecedents. *Child Development, 62*, 1352–1366.
- Eddy, T. J., Gallup, G. G., & Povinelli, D. J. (1993). Attribution of cognitive states to animals: Anthropomorphism in comparative perspective. *Journal of Social Issues, 49*(1), 87–107.
- Elkind, D. (1970). The origins of religion in the child. *Review of Religious Research, 12*, 35–42.
- Estes, D., Wellman, H. M., & Wooley, J. D. (1989). Children's understanding of mental phenomena. In H. Reese (Ed.), *Advances in child development and behavior*. New York: Academic Press.
- Flavell, J. H. (1974). The development of inferences about others. In T. Miscel (Ed.), *Understanding other persons*, 66–116, Oxford, U.K.: Basil Blackwell.

- Flavell, J. H. (1986). The development of children's knowledge about the appearance-reality distinction. *American Psychologist*, 41, 418–451.
- Flavell, J. H. (1993). The development of children's understanding of false belief and the appearance-reality distinction. *International Journal of Psychology*, 28, 595–604.
- Flavell, J. H., Flavell, E. R., Green, F. L., & Moses, L. J. (1990). Young children's understanding of fact beliefs versus value beliefs. *Child Development*, 61, 915–928.
- Freud, S. (1961). *The future of an illusion* (J. Strachey, Trans.). New York: Norton. (Original work published 1927)
- Gergely, G., Nadasdy, Z., Csibra, G., & Biro, S. (1995). Taking the intentional stand at 12 months of age. *Cognition*, 56, 165–193.
- Goldman, R. G. (1964). *Religious thinking from childhood to adolescence*. London: Routledge and Kegan Paul.
- Goldman, R. G. (1965). *Readiness for religion*. London: Routledge and Kegan Paul.
- Gopnik, A., & Slaughter, V. (1991). Young children's understanding of changes in their mental states. *Child Development*, 62, 98–110.
- Gopnik, A., & Wellman, H. M. (1992). Why the child's theory of mind really is a theory. *Mind and Language*, 7, 145–171.
- Gordon, R. M. (1996). 'Radical' simulationism. In P. Carruthers & P. K. Smith (Eds.), *Theories of theories of mind* (pp. 11–21). Cambridge, U.K.: Cambridge University Press.
- Gorsuch, R. L. (1988). Psychology of religion. *Annual Review of Psychology*, 39, 201–221.
- Guthrie, S. E. (1993). *Faces in the clouds: A new theory of religion*. New York: Oxford University Press.
- Guthrie, S. E. (1997, November). *Cognitive approaches to religion: Natural selection, strategic interests, and cognitive bias*. Paper presented at the meeting of the Society for the Scientific Study of Religion, San Diego, CA.
- Hadwin, J., & Perner, J. (1991). Pleased and surprised: Children's cognitive theory of emotion. *British Journal of Developmental Psychology*, 9, 215–234.
- Hala, S., Chandler, M., & Fritz, A. S. (1991). Fledgling theories or mind: deception as a marker of 3-year-olds' understanding of false belief. *Child Development*, 62, 83–97.
- Harris, P. L. (1989). *Children and emotion*. Oxford, U.K.: Basil Blackwell.
- Harris, P. L. (1992). From simulation to folk psychology: The case for development. *Mind and Language*, 7, 120–144.
- Harris, P. L., Brown, E., Marriot, C., Whithall, S., & Harmer, S. (1991). Monsters, ghosts and witches: Testing the limits of fantasy-reality distinction in young children. *British Journal of Developmental Psychology*, 9, 105–123.
- Heller, D. I. (1986). *The Children's God*. Chicago: University of Chicago Press.
- Inagaki, K., & Hatano, G. (1987). Young children's spontaneous personification as analogy. *Child Development*, 58, 1013–1020.
- Jenkins, J. M., & Astington, J. W. (1996). Cognitive factors and family structure associated with theory of mind development in young children. *Developmental Psychology*, 32, 70–78.
- Lawson, E. T., & McCauley, R. N. (1990). *Rethinking religion: Connecting cognition and culture*. Cambridge, U.K.: Cambridge University Press.
- Legerstee, M. (1994). Patterns of 4-month-old infant responses to hidden, silent, and sounding people and objects. *Early Development and Parenting*, 3, 71–80.
- Lempers, J. D., Flavell, E. R., & Flavell, J. H. (1977). The development in very young children of tacit knowledge concerning visual perception. *Genetic Psychology Monographs*, 95, 3–53.
- Leslie, A. M. (1995). A theory of agency. In D. Sperber, D. Premack, & A. J. Premack (Eds.), *Causal Cognition: A multidisciplinary debate*. New York: Oxford University Press.
- Lewis, C., & Osbourne, A. (1990). Three-year-olds' problems with false belief: conceptual deficit or linguistic artifact? *Child Development*, 61, 1514–1519.
- Liben, L. S. (1978). Performance on Piagetian spatial tasks as a function of sex, field dependence, and training. *Merrill-Palmer Quarterly*, 24, 97–110.
- Light, P., & Nix, C. (1983). "Own view" versus "good view" in a perspective-taking task. *Child Development*, 54, 480–488.
- Masangkay, Z. S., McCloskey, K.A., McIntyre, C. W., Sims-Knight, J., Vaughn, B. E., & Flavell, J. H. (1974). The early development of inferences about the visual percepts of others. *Child Development*, 45, 357–366.
- Masur, E. F. (1983). Gestural development, dual-directional signaling, and the transition to words. *Journal of Psycholinguistic Research*, 12, 93–109.
- Morgan, R., & Rochat, P. (1998, April). *The perception of social causality by 3- to 9-month-old infants*. Poster session presented at the Eleventh International Conference on Infant Studies, Atlanta, GA.
- Moses, L. J., & Flavell, J. H. (1990). Inferring false beliefs from actions and reactions. *Child Development*, 61, 929–945.
- O'Neill, D. K., & Gopnik, A. (1991). Young children's ability to identify the sources of beliefs. *Developmental Psychology*, 27, 390–399.
- Paloutzian, R. F. (1996). *Invitation to the psychology of religion* (2nd ed.). Boston: Allyn and Bacon.
- Pealting, J. H. (1974). Cognitive development in pupils in grades 4–12: The incidence of concrete and abstract religious thinking in American children. *Character Potential*, 7, 52–61.
- Perner, J. (1988). Developing semantics for theories of mind: From propositional attitudes to mental representations. In J. W. Astington, P. L. Harris, & D. R. Olson (Eds.), *Developing theories of mind* (pp. 271–294). New York: Cambridge University Press.
- Perner, J. (1989). Is "thinking" belief? Reply to Wellman and Bartsch. *Cognition*, 33, 315–319.
- Perner, J. (1991). *Understanding the representational mind*. Cambridge, MA: MIT Press.
- Perner, J. (1995). The many faces of belief: Reflections on Fodor's and the child's theory of mind. *Cognition*, 57, 241–269.
- Perner, J. (1996). Simulation as explicitation of predication-implicit knowledge about the mind: Arguments for a simulation-theory mix. In P. Carruthers & P. K. Smith (Eds.), *Theories of theories of mind* (pp. 90–104). Cambridge, U.K.: Cambridge University Press.

- Perner, J., Leekam, S. R., & Wimmer, H. (1987). Three-year-olds' difficulty with false belief. *British Journal of Developmental Psychology*, *5*, 125–137.
- Perner, J., Ruffman, T., & Leekam, S. R. (1994). Theory of mind is contagious: You catch it from your sibs. *Child Development*, *65*, 1228–1238.
- Petrovich, O. (1997). Understanding of non-natural causality in children and adults: A case against artificialism. *Psyche en Geloof*, *8*, 151–165.
- Piaget, J. (1969). *The psychology of the child*. New York: Basic Books.
- Pitts, V. P. (1976). Drawing the invisible: Children's conceptualization of God. *Character Potential*, *8*, 12–24.
- Poulin-Dubois, D., & Shultz, T. R. (1988). The development of the understanding of human behavior: From agency to intentionality. In J. W. Astington, P. L. Harris, & D. R. Olson (Eds.), *Developing theories of mind* (pp. 104–125). Cambridge, U.K.: Cambridge University Press.
- Pratt, C., & Bryant, P. E. (1990). Young children understand that looking leads to knowing (so long as they are looking into a single barrel). *Child Development*, *61*, 973–982.
- Premack, D. (1990). The infant's theory of self-propelled objects. *Cognition*, *36*, 1–16.
- Reddy, V. (1991). Playing with others' expectations: Teasing and mucking about in the first year. In A. Whiten (Ed.), *Natural theories of mind*. New York: Basil Blackwell.
- Richert, R. A., & Barrett, J. L. (1999). *Perspectives in a new sense: Children's understanding of various agents' perceptions of across modalities*. Unpublished manuscript.
- Rochat, P., Morgan, R., & Carpenter, M. (1997). Young infants' sensitivity to movement information specifying social causality. *Cognitive Development*, *12*, 537–561.
- Rosengren, K. S., & Hickling, A. K. (1994). Seeing is believing: Children's explanations of commonplace, magical, and extraordinary transformations. *Child Development*, *65*, 1605–1626.
- Rosengren, K. S., Kalish, C. W., Hickling, A. K., & Gelman, S. A. (1994). Exploring the relation between preschool children's magical beliefs and causal thinking. *British Journal of Developmental Psychology*, *12*, 69–82.
- Ruffman, T. (1996). Do children understand the mind by means of simulation or a theory? Evidence from their understanding of inference. *Mind and Language*, *11*, 388–414.
- Ruffman, T., Perner, J., Naito, M., Parkin, L., & Clements, W. A. (1998). Older (but not younger) siblings facilitate false belief understanding. *Developmental Psychology*, *34*, 161–174.
- Shatz, M., Wellman, H. M., & Sibling, S. (1983). The acquisition of mental verbs: A systematic investigation of first references to mental state. *Cognition*, *14*, 301–321.
- Siegal, M., & Beattie, K. (1991). Where to look first for children's knowledge of false beliefs. *Cognition*, *38*, 1–12.
- Sodian, B., Taylor, C., Harris, P. L., & Perner, J. (1991). Early deception and the child's theory of mind: False trails and genuine markers. *Child Development*, *62*, 468–483.
- Spelke, E. S., Phillips, A., & Woodward, A. L. (1995). Infant's knowledge of object motion and human action. In D. Sperber, D. Premack, & A. J. Premack (Eds.), *Causal Cognition: A multidisciplinary debate*. New York: Oxford University Press.
- Sperber, D. (1996). *Explaining culture: A naturalistic approach*. Oxford, U.K.: Blackwell.
- Stein, N. L., & Levine, L. J. (1989). The causal organization of emotional knowledge: a developmental study. *Cognition and Emotion*, *3*, 343–378.
- Tager-Flusberg, H. (1993). What language reveals about the understanding of minds in children with autism. In S. Baron-Cohen, H. Tager-Flusberg, & D. J. Cohen (Eds.), *Understanding other minds: Perspectives from autism* (pp. 138–157). Oxford, U.K.: Oxford University Press.
- Tamminen, K. (1991). *Religious development in childhood and youth: An empirical study*. Helsinki, Finland: Suomen Tiedeakatemia. (Finnish Academy of Science and Letters, Tiedekirja, Kirkkokatu 14, 00170, Helsinki, Finland)
- Taylor, M., Esbensen, B. M., & Bennett, R. T. (1994). Children's understanding of knowledge acquisition: The tendency for children to report that they have always known what they have just learned. *Child Development*, *65*, 1581–1604.
- Wellman, H. M. (1990). *The child's theory of mind*. Cambridge, MA: MIT Press.
- Wellman, H. M. (1993). Early understanding of mind. In S. Baron-Cohen, H. Tager-Flusberg, H., & D. J. Cohen (Eds.), *Understanding other minds: Perspectives from autism* (pp. 10–39). Oxford, U.K.: Oxford University Press.
- Wellman, H. M., & Banerjee, M. (1991). Mind and emotions: children's understanding of the emotional consequences of beliefs and desires. *British Journal of Developmental Psychology*, *9*, 191–214.
- Wellman, H. M., & Bartsch, K. (1988). Young children's reasoning about beliefs. *Cognition*, *30*, 239–77.
- Wellman, H. M., & Wooley, J. D. (1990). From simple desires to ordinary beliefs: The early development of everyday psychology. *Cognition*, *35*, 245–275.
- Whiten, A. (Ed.). (1991). *Natural theories of mind*. New York: Basil Blackwell.
- Wimmer, H., Hogrefe J., & Perner, J. (1988). Children's understanding of informational access as source of knowledge. *Child Development*, *59*, 386–396.
- Wimmer, H., & Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition*, *13*, 103–128.
- Zaitchik, D. (1990). When representations conflict with reality: The preschooler's problem with false beliefs and "false" photographs. *Cognition*, *35*, 41–68.
- Zinober, B., & Martlew, M. (1985). Developmental changes in four types of gesture in relation to acts and vocalizations from 10 to 21 months. *British Journal of Developmental Psychology*, *3*(3), 293–306.