

Why Things Happen: Teleological Explanation in Parent–Child Conversations

Deborah Kelemen
Boston University

Maureen A. Callanan
University of California, Santa Cruz

Krista Casler
Boston University

Deanne R. Pérez-Granados
Stanford University

Research indicates that young children, unlike adults, have a generalized tendency to view not only artifacts but also living and nonliving natural phenomena as existing for a purpose. To further understand this tendency's origin, the authors explored parents' propensity to invoke teleological explanation during explanatory conversations with their children. Over 2 weeks, Mexican-descent mothers were interviewed about question–answer exchanges with their preschool children. Analyses revealed that children asked more about biological and social phenomena than about artifacts or nonliving natural phenomena, with most questions ambiguous as to whether they were requests for causal or teleological explanations. In responding to these ambiguous questions, parents generally invoked causal rather than teleological explanations. The tendency to favor causal explanation was confirmed by analyses of transcripts from a longitudinal study of spontaneous speech in a father–son dyad. These results suggest that children's bias toward teleological explanation does not straightforwardly derive from parent explanation.

The tendency to explain objects and events in terms of their functions, designs, or purposes—to adopt a teleological mode of explanation—is a significant aspect of adults' explanatory repertoire. The bias to reason in teleological terms gives cohesion to notions of artifacts, such as chairs (objects viewed as “for” sitting on), body parts, such as feet (objects viewed as “for” walking), and

activities, such as breathing or working (behaviors viewed as “for” sustaining life either biologically or materially). It helps to constrain our reasoning about unfamiliar objects and events, allowing us to figure out, for example, how an unfamiliar gadget or body part works, why it has the properties it does, and how it relates to other things. In short, teleological reasoning plays a substantial role in adults' theory building about everyday phenomena, prompting a profoundly human compulsion to ask questions, such as “Why?” and “What is it for?” (e.g., Dawkins, 1995; Kelemen, 1999a, 1999c, 1999d).

Deborah Kelemen and Krista Casler, Department of Psychology, Boston University; Maureen A. Callanan, Department of Psychology, University of California, Santa Cruz; Deanne R. Pérez-Granados, Department of Psychology, Stanford University.

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Correspondence concerning this article should be addressed to Deborah Kelemen, Department of Psychology, Boston University, 64 Cummington Street, Boston, MA 02215. E-mail: dkelemen@bu.edu

Because teleological thought is such an important feature of adult cognition, research has recently begun to explore how it develops (Keil, 1992, 1995; Kelemen, 1999c; for related research, see also Evans, 2000; Gergely, Nádasdy, Csibra, & Bíró, 1995; Opfer & Gelman, 2001; Poling & Evans, 2002). These studies have indicated that young children's teleological intuitions are, in many ways, like those of adults. For instance, it has been found that, like Western-educated adults, preschool children presume that biological parts and artifacts are designed to fulfill specific functions rather than perform incidental activities (Kelemen, 1999c, 2004; see also German & Johnson, 2002; Matan & Carey, 2001). Furthermore, like adults, preschoolers use teleological assumptions about biological properties to constrain inferences about unfamiliar animals. They therefore conclude that physically dissimilar animals (e.g., otter and booby bird) that share the same functional body part (e.g., webbed feet) are more likely to have a similar behavioral property (e.g., aquatic living) than two overall similar animals (e.g., otter and weasel) who do not share such a body part (Kelemen, 1999b; Kelemen, Widdowson, Posner, Brown, & Casler, 2003; also McCarrell & Callanan, 1995).

However, in addition to these similarities, research has revealed some striking developmental differences. Specifically, preschool children assign purpose to a broader array of objects and events than adults do. In addition to artifacts, biological properties, and behaviors, they also view nonliving natural objects, such as clouds, and their properties as existing “for” something (Kelemen, 1999c; see also Piaget, 1929; but see Keil, 1992). This finding has now been established in several studies using various methods and with samples of diverse ethnicity. For example, in one experiment, 4- and 5-year-old children were shown photographs of artifacts, animals, and nonliving natural objects. They were then asked what each of the objects was “for” in a game in which they were also asked to identify when they had been posed a “silly” unanswerable question. The study found that adults were selective in their responses. They responded that biological properties (e.g., feet) and artifacts and their parts (e.g., clocks and clock hands) are “for” something but that, in general, it is “silly” to ask what whole living things (e.g., tigers) and nonliving natural objects and their properties (e.g., mountains, mountain peaks) are “for” because they have no function. In contrast, children assigned functions to all kinds of objects, stating them not only for artifacts and body parts but also for whole living things (e.g., “tigers are for walking around and going in the zoo”) and nonliving natural objects and their parts (e.g., “mountains and their peaks are for climbing”). A follow-up study used a forced-choice method to evaluate whether children really thought that the objects were “made for” these activities or whether the activities were just activities the objects “do” or can be “used to do.” This study also found that preschool children differed from adults by asserting that entities of all kinds—clocks, feet, lions, and icebergs—were “made for something” (Kelemen, 1999c), and further work indicated that they viewed natural and artificial objects that could not perform their designated functions as broken and hence in need of being “fixed or replaced” (DiYanni & Kelemen, in press).

This general bias in favor of purpose (labeled “promiscuous teleology;” Kelemen, 1999c, 1999d) has also been found to persist beyond the preschool years. For example, in a further set of experiments, adults and 7- to 10-year-old children were asked about the properties of prehistoric animals (e.g., “Why did *Cryptoclidus* have long necks?”) and nonliving natural kinds (e.g., “Why were the rocks pointy?”). For each property, they were then asked to choose between two answers: a physical-causal explanation based on antecedent conditions (e.g., “The rocks were pointy because bits of stuff piled up for a long time”) and a teleological explanation based on a consequent purpose (e.g., “They were pointy so that animals wouldn’t sit on them and smash them”). In contrast to adults, who selectively applied teleological explanations only to biological properties (eschewing it for nonliving natural properties), 7- and 8-year-old children strongly preferred teleological explanations for both biological and nonliving natural properties. This tendency toward teleological explanation was found to persist until at least 10 years of age, even after children were given a short tutorial indicating that from an adult “scientific” perspective, physical-causal explanations are highly appropriate to the nonliving natural domain (Kelemen, 1999d; but see Keil, 1992, 1994, for different results; Kelemen, 1999c, 1999d, for discussion). The pattern of results has now been established in both Britain and America, despite cultural differences in the public

availability and acceptance of religiously based teleological explanation (Kelemen, 2003).

An obvious question raised by these differences in children’s and adults’ attribution of purpose is why they occur. Piaget (1929), who first noted children’s general orientation toward teleological ideas, argued that the developmental contrast occurred because children have a profoundly different conception of the natural world than adults. He suggested that young children reason teleologically because they are unable to think in nonintentional physical-causal terms and, in consequence, develop “childhood artificialism” or the fundamental misconception that all things occur through human causation. Subsequent research has since challenged Piaget’s assertion that young children cannot entertain physical causality (e.g., Baillargeon, 1993; Chandler & Lalonde, 1994; Shultz, 1982) or that children indiscriminately attribute human origins to all phenomena (Gelman & Kremer, 1991; Gelman & Markman, 1987; Keil, 1989; Petrovich, 1997; but see Evans, 2000, 2001). Nevertheless, the idea that children’s teleological explanatory tendencies primarily derive from an intrinsic cognitive source still motivates most contemporary accounts (e.g., Atran, 1994, 1995; Carey, 1995; Keil, 1992, 1994; Kelemen, 1999a, 1999b, 1999c; also Evans, 2000, 2001).

For example, one recent proposal (Kelemen, 1999a; Kelemen & DiYanni, 2005) is that although young children are able to reason in physical-causal terms, in general, humans’ evolution as social animals has particularly oriented them to intentional explanation (e.g., Byrne & Whiten, 1988; Gallup, Marino, & Eddy, 1997; Heider & Simmel, 1944). This sensitivity is manifest from early in development (e.g., Gergely et al., 1995; Johnson, 2000; Tomasello, 1999) and is the basis of teleological notions about objects and events. In brief, the idea is that through their sensitivity to intentionality, children come to compensate for gaps in their knowledge using their early understanding of goal-directed behavior and resultant early insights into the intention-based domain of artifacts (Kelemen, 2004). This promotes the development of a promiscuous teleology wherein objects of all kinds are treated as quasi-artifacts—as objects that have been intentionally caused for a purpose (Kelemen, 1999b, 2004; Kelemen & DiYanni, 2005; see also Evans, 2000, 2001). This account therefore traces the origin of teleological thought about objects to early mind-reading capacities (but see Csibra & Gergely, 1998). However, other accounts are far more direct than this. Some scholars suggest that the teleological bias is, in itself, innate and likely to be a foundational, perhaps modular, component of infant cognition (e.g., Keil, 1992, 1994, 1995; also Atran, 1994, 1995).

Regardless of the differences in details, these contemporary accounts are like Piaget’s (1929) account in assuming an intrinsic cognitive source for children’s intuitions about purpose in nature. However, it is clearly the case that although this kind of emphasis has been popular in current approaches to the study of conceptual development, it may be misplaced. Children’s explanatory activities do not occur in a social vacuum (see, e.g., Gelman, Coley, Rosengren, Hartman, & Pappas, 1998; Pérez-Granados & Callanan, 1997; Rogoff, 1990). Children are social beings and, as such, ask their parents manifold questions about objects and events (Callanan & Jipson, 2000; Callanan & Oakes, 1992; Callanan, Shrager, & Moore, 1995). In answering these questions, parents are providing an explanatory database, and it is reasonable to presume that this database influences the development of chil-

dren's early theories. For example, there is certainly evidence indicating that children incorporate parents' descriptions of objects in their developing representations of different categories (Adams & Bullock, 1986; Callanan, 1985, 1991; Mervis, 1987; but see Gelman et al., 1998). According to this view, then, explanatory conversations are central to providing the context for preschool children's conceptual development and the revision of their understanding of the world (see, e.g., Callanan & Jipson, 2000; Callanan & Oakes, 1992; Ochs, 1987; Rogoff, 1990; Rogoff, Mistry, Göncü, & Mosier, 1993; Vygotsky, 1934/1986). From this perspective, young children's teleological ideas should owe as much, if not more, to conversations with parents as to any intrinsic explanatory predilection.

These perspectives are contrasted more by emphasis than incompatibility. Accounts focusing on inherent cognitive biases recognize the influence of adult modeling on children's ideas to varying degrees, and accounts that focus on sociocognitive mechanisms recognize that intrinsic properties of mind influence children's interactions and interpretation of socially derived information. Nevertheless, because cognitive developmental research has often tended to favor the former perspective's emphasis, the contribution of parent-child conversation to children's developing theoretical ideas is often acknowledged but left unexplored. Given the practical and theoretical significance of knowing whether conversations with parents are the primary source of children's teleological ideas about nature, the present study therefore investigated the following question: How and when do parents use teleological explanation in explanatory talk with their young children?

To study this question, we used an existing data set documenting explanatory conversations within Mexican-descent families residing in California (Callanan, Pérez-Granados, Barajas, & Goldberg, 2004). The data set was particularly appropriate to the current analysis for several reasons. First, although there was no reason to expect a distinctive conversational style in parents of Mexican descent (Vasquez, Pease-Alvarez, & Shannon, 1994; Villanueva, 1991), this parent sample was of interest because contemporary findings of children's broad bias toward teleological explanation have, in part, derived from studies conducted in the southwestern and western United States, in which Latino children and adults were well represented (Kelemen, 1999c, 1999d). Second, the data set was originally collected with a view to examining whether level of parent schooling bears on explanatory conversations. Because of this, it included two groups of parents: half who had completed high school and half who had not. For the purposes of the present study, this was beneficial because previous theoretical work (e.g., Kelemen, 1999a, 1999c, 2003) has speculated on the moderating effect of schooling on adults' use of teleological explanation and because there are already results from one cultural group (Romanian Roma) in which adults with limited schooling showed signs of a promiscuous teleological bias (Casler & Kelemen, 2003).

At a more specific level, the data set was also appropriate because its contents allowed us to address three central questions. First, what domains are young children interested in understanding, and are these domains in which adults find teleological explanation appropriate? Specifically, do children primarily ask about social behavior, artifacts, and biological phenomena—domains in which adults are likely to model teleological explana-

tion—or do they ask about nonliving natural phenomena—domains in which adults are unlikely to model its use?

Second, when children ask about these various domains, what form do their questions take and to what extent is the intent of their questions clear? Specifically, "why" questions are a typical feature of question asking at any age because they efficiently elicit information (Callanan & Oakes, 1992). However, such questions often possess a special property: Unlike "how" or "what for" questions, which unambiguously request causal or teleological answers, respectively, "why" questions are often indeterminate as to whether they are requests for information about causal antecedents or teleological purpose. For example, the question "Why do women have breasts?" could be interpreted as a request for information about cause (to which the answer "Because women's chests grow as they get older" is appropriate). Equally, it could be interpreted as a request for information about purpose (to which the answer "They have them so they can feed their babies" is also appropriate). Because of this ambiguity, it primarily falls to the respondent to interpret the question, and the respondent's decision as to an appropriate answer is likely to depend on his or her assumptions about the phenomenon under question and the question asker's intent. Children's ambiguous questions were therefore a particular focus in this study not only because they represent instances in which, potentially unbeknownst to an adult, a child may be asking a teleological question but also because parents' responses to these questions are informative as to how they scaffold their children's understanding in indeterminate contexts. If parents often answer ambiguous questions with teleological answers—particularly when children ask about the nonliving natural domain—then this lends supports to the idea of a causal relationship between children's promiscuous teleological ideas and their parents' explanations. This brings us to the third central question of this study.

How do parents respond to children's questions about different domains? Our prediction was that parents would answer unambiguously causal and teleological questions with unambiguously causal and teleological answers, respectively. Of particular interest, however, was how parents would respond to ambiguous questions. Because all varieties of phenomena can be accounted for by reference to causal antecedents and underlying properties, we expected that parents would offer a substantial proportion of causal explanations regardless of whether they were asked about biological or nonbiological natural phenomena, artifacts, or social behaviors. However, we expected that the balance between causal and other kinds of explanations would vary by domain. For the biological, social behavioral, and artifact domains, we predicted that parents might be as likely to offer teleological explanations as causal explanations because assumptions of purpose and function play an important role in adults' construal of these kinds of phenomena. In contrast, it was a more open question whether adults would offer significantly more causal than teleological explanations when explaining nonliving natural phenomena to their children. Callanan and Oakes's (1992) diary study on causal explanation included some data suggesting that, in general, consequence explanations might be offered only rarely, but because teleological explanation was not the central focus of their analysis, parents' tendency to invoke it in relation to different types of questions about different kinds of domains is unknown.

Method

Study Participants

The current study represents a secondary analysis of an existing data set. The data were collected as part of a project exploring the social, cognitive, and linguistic implications of explanatory conversations in families, particularly families of Mexican descent residing in the United States (Barajas & Goldberg, 1997; Callanan et al., 2004; Pérez-Granados & Callanan, 1997). Participants were 48 Mexican-descent families living on the central coast of California in two neighboring cities and adjacent rural areas. Families were recruited through local community agencies, centers, schools, and apartment complexes. Each family had at least one 3-, 4-, or 5-year-old child.

Parent information. The participant families represented a broad range in terms of the level of the mother's formal schooling. Half of the mothers had a relatively high level of schooling (high schooling mothers); 15 had completed high school and/or were currently enrolled in college, and 9 had completed their bachelor's degree or above (mean years of schooling = 14, range = 12–20 years). The other half of the mothers had some basic schooling but had not completed high school (basic schooling mothers); 12 had completed the 6th grade or lower, 10 had completed the 9th grade, 1 had completed the 10th grade, and 1 had completed the 11th grade (mean years of schooling = 6.5, range = 2–11 years).

Most of the parents in this study were born in Mexico and had then immigrated to the United States. However, in six of the families, the parents were first-generation Mexican Americans who had been born in the United States. Mothers' occupations varied. Twenty-seven were homemakers. The occupations of the remaining mothers included administrative analyst, bookkeeper, cashier–receptionist, college student, counselor, farm–factory worker, housekeeper, medical assistant, physician, restaurant manager, and teacher–educator. Fathers' occupations varied and included such jobs as accountant, cannery worker, cook, engineer, field worker, janitor, physician, truck driver, and welder.

Parents' annual income levels were varied within and across schooling level groups. Most of the parents in the basic schooling group (18 of 24) reported that they earned \$20,000 or less per year (3 families did not report their income). Twelve of the parents in the high schooling group reported that they earned \$20,000 or less per year, and 11 reported earning over \$20,000 per year (1 family did not report their income).

Child information. Each family had an average of two children, but the data for this study focused on only one target child per family who fell between the desired ages of 3 to 5 years. Of the 48 children, half belonged to the younger preschool age group (mean age = 3 years 10 months, range = 3 years 4 months to 4 years 5 months; 11 girls and 13 boys) and half belonged to the older preschool group (mean age = 5 years 2 months, range = 4 years 7 months to 5 years 11 months; 12 girls and 12 boys). Twenty-four of the children were firstborn (13 from the high schooling group, 11 from the basic schooling group), 14 were the youngest in the family (5 from the high schooling group, 9 from the basic schooling group), 1 child was a middle-born child (1 from the basic schooling group), and 9 were only children (6 from the high schooling group, 3 from the basic schooling group).

Procedure

Families in this study participated in an initial home interview, approximately five follow-up phone calls, and a final home interview, which spanned approximately 2 weeks in duration. If fathers were present during the home interviews or answered the phone, they were also invited to participate and provide information; however, mothers, as primary caretakers, were the primary source of data in this study. In consequence, a variable relating to maternal rather than paternal schooling level was entered into all analyses.

Initial interview. Two researchers conducted an audiotaped interview with families in their homes in which demographic data about family members' places of birth and schooling levels were gathered. At the time of the initial interview, researchers also told mothers that they would be interviewed every 2 to 3 days over the next 2 weeks and that the study concerned children's questions about "why things happen" and "how things work" and what explanations parents give to those questions. Parents were asked to track what questions their children asked and how they responded to them. They were also asked to provide a general description of where and when these conversations took place. To ensure that parents understood what they were being asked to report, researchers gave them some examples of questions about "why things happen" and "how things work" and asked whether they could remember some examples of those kinds of questions that their children had recently asked.

Follow-up phone calls. Parents were asked to report on the questions children asked over the 2-week duration of the study to the researchers who called approximately every 2 to 3 days to gain a verbal report. For a few parents who had no phone service, visits were made instead of phone calls. There was some variation in the number of phone calls (or visits) completed because of parents' schedules, but an average of 5.1 phone calls or visits were made (high schooling families, $M = 5.2$, range = 3–7; basic schooling families, $M = 5.0$, range = 3–6). Researchers kept a written log of all information provided by mothers during the phone calls or contacts. Mothers were also asked to report information about the context of the question and the conversation that followed by answering the following questions: (a) "Who asked the question?" (b) "Where and when was the question asked?" and (c) "Was an explanation offered in response to the question? If so, what was the explanation?" This information was recorded for every question reported in each phone call or visit.

Final interview. There was a final home visit within a week of the final phone call. In this visit, parents were asked to report any additional questions that their children had asked since the final follow-up call. Families were paid \$25 during the final home visit to compensate them for their participation in the study.

Coding

The interviews and follow-up phone calls yielded a database of 590 reported questions (mean number of questions per child = 12, range = 2 to 60 questions). Preliminary analysis indicated no differences in the number of questions reported by parents as a function of their schooling level or as a function of the age of the target child (high schooling mothers, older child, $M = 11.42$, $SD = 5.38$; high schooling mothers, younger child, $M = 15.08$, $SD = 11.97$; basic schooling mothers, older child, $M = 9.08$, $SD = 4.70$; basic schooling mothers, younger child, $M = 13.58$, $SD = 15.00$). The questions were coded using three different coding schemes concerned with (a) the (adult) content domain of children's questions, (b) the form of children's questions, and (c) the type of parent response. Because many of the parent–child interactions took place in Spanish, these were transcribed in Spanish and later translated into English by four Spanish–English bilingual researchers. Each question was independently translated by two bilingual translators; disagreements regarding Spanish to English translation were resolved through discussion. The English transcripts were then coded by two additional researchers. Inter-coder agreement was determined for at least 30% of the data for all coding schemes. Inter-coder reliability was 86% agreement (Cohen's $\kappa = .81$; see Bakeman & Gottman, 1987) for the coding of the content of children's questions, 97% agreement (Cohen's $\kappa = .93$) for the coding of the form of children's questions, and 87% agreement (Cohen's $\kappa = .81$) for the coding of the type of parental response. Coding disagreements were resolved by a third coder. The three separate coding schemes are described below.

Content of children's questions. To explore what kinds of phenomena children are interested in understanding, children's questions were coded into five content domains: biological, nonliving natural kind, artifact,

others' mental states and behavior, and own behavior. The domain of the question was judged from the adult perspective of the three coders because although it is unclear whether, for example, a preschool child construes "bleeding" and "eating" as biological activities, adults' responses are likely to be based on that assumption. When the domain of the child's question was indeterminate, it was coded as "indeterminate." Coding identified 560 questions with clearly identifiable content and 30 questions with indeterminate content.

Often parents reported several related questions in one descriptive episode of their children's questions. Thus, for coding purposes, all questions were first divided into separate codeable segments. For example, an episode that included the reported question "Why was grandpa sick and why did he die?" was separated into two different codeable questions ("Why was grandpa sick?" and "Why did he [grandpa] die?").

Biological questions included children's inquiries about biological organisms, properties, events, and activities (i.e., living things and their physical parts; events such as being born, growing, and dying; and animals' or people's natural behaviors related to biology). Actual examples are (a) "Why do women have breasts?" (b) "Why are there Black kids?" (c) "Why do trees have leaves?" (d) "How do babies grow?" (e) "Why did the lady faint?" and (f) "Why can't I pee standing up?"

Nonliving natural kind questions included children's inquiries about inanimate natural objects, such as clouds and planets, and nonliving natural phenomena, such as the weather, seasons, nighttime, and daytime. Actual examples are (a) "Why is the sun hot?" (b) "Why do the clouds follow us?" (c) "Why does it get dark?" (d) "Why doesn't the moon look at me when it's dark?" and (e) "Why does it rain?"

Artifact questions included children's inquiries about human-designed objects, their properties, mechanisms, and activities. Examples are (a) "What are seatbelts for?" (b) "Why are there lights on the shoes?" (c) "How do you open the mailbox?" (d) "Why doesn't the (video) tape run out?" and (e) "Why is my daddy's car white?"

Questions on others' behavior included children's queries about others' motivations, mental states, and social behavior; others' social, cultural, and religious norms and conventions; and others' beliefs and desires. Actual examples are (a) "Why do you give my mother a kiss?" (b) "Why do we have birthday parties?" (c) "Why is my brother bad?" (d) "Why do you put lipstick on?" (e) "Why does my uncle work?" and (f) "Why do we dream?"

Questions on own behavior comprised self-relevant questions that the child asked concerning their own activities. Initially, these questions were separated out from more general queries about social-cultural norms and others' motivations because they were primarily focused on parental restrictions on the child's personal behavior rather than on understanding others' activity in general. Nevertheless, parents' responses certainly provided insights into general norms of behavior. Examples are (a) "Why are you going to take Jenny to the neighbor's house and not me?" (b) "Why can't I sleep with you guys?" (c) "Why are we going out?" and (d) "Why can't I have a cat?"

Form of children's questions. To know what kinds of questions children ask about different domains, researchers coded children's requests for information into four categories: causal, teleological, ambiguous, and other. Causal questions were queries about causal antecedents (prior states and events) and causal processes and mechanisms that could not be interpreted as requests for information about purpose. Questions were categorized in this manner if the question could not be sensibly answered by a purpose-based response. Actual examples are (a) "How can I get boo boos?" (b) "What makes someone bad?" (c) "How does the radio work?" and (d) "How do you make money?"

Teleological questions were queries about the function, purpose, or consequences of objects or events that could not be interpreted as requests for information about causal antecedents or mechanisms. Questions were categorized in this manner if the question could not be seen as sensibly answered by a causal response in terms of underlying mechanisms or prior states. They were almost exclusively of the "What is X for?" variety.

Actual examples are (a) "What are there stars for?" (b) "What is that deodorant for?" and (c) "What is that (cemetery) for?"

Questions were coded as ambiguous if they could be reasonably interpreted as requests for information about cause or purpose. As discussed above, this was particularly relevant to "why" questions. Because the nature of an answer is shaped by the respondent's assumptions concerning the inquiry (i.e., their personal interpretation both of the phenomenon asked about and the inquirer's intent in asking) rather than its possible or actual nature, coding decisions were made without taking into account the domain of the question or the adult response to it. For example, a Western adult may assume that when another adult asks "Why did she die?" the questioner is interested in the cause of the fatality, and an appropriate answer takes this into account (e.g., "She died because she had cancer"). Because less is known about the nature of children's view of death, the same assumption cannot be made when a similar inquiry is made by a child, particularly as the question can be logically understood and treated as an inquiry about the purpose of the death (e.g., "She died to end her suffering," "She died so she could join her sister in heaven," "She died so her husband could collect on the insurance"). Other examples of actual ambiguous questions are (a) "Why did the rocks fall?" (b) "Why is there smoke coming out of the house?" (c) "Why does it get dark?" and (d) "Why are they putting up Christmas trees?"

Questions coded as "other" were those that did not require explanation but were simple requests for descriptive information or definition (e.g., "What color is this?" "What does pushy mean?" "When are we leaving?"). Because the focus of this study was on explanatory exchanges, questions that were coded as other were excluded from all analyses except those concerned with the content of children's questions.

As noted earlier, coders identified 560 child questions as having a clearly determinable content. Of these questions, 431 questions were coded as causal, teleological, or ambiguous and 129 questions were coded as other.

Type of parental response. Parents' responses were coded into three categories: causal, teleological, and nonexplanatory. For coding purposes, all parents' responses were first parsed into separate codeable explanations. For example, in one episode, a child asked her parent, "Why do you work?" and her parent responded, "I work so that I can make money and because I like to work." The mother's responses were divided into two separate codeable explanations ("I work so that I can make money" and "[I work] because I like to work"). In response to children's 431 causal, teleological, and ambiguous questions, there were 454 codeable parent responses. Of these 454 responses, 377 (83%) involved causal or teleological explanations and 77 (17%) were nonexplanatory responses.

Causal explanations involved a causal antecedent, state, or mechanism. Actual examples are (a) "Why did the milk turn that color?" "Because the cereal has chocolate." (b) "Why did the rocks fall?" "It rained and the rain caused the rocks to slide down." (c) "Why did she die?" "Because a car hit her and she got hurt." and (d) "Why do babies grow?" "Because people grow."

Teleological explanations involved reference to a consequence, purpose, or function. For example, (a) "Why do you put (the cream) on?" "So my face won't be dry." (b) "Why is the sun hot?" "Because it is cold and we need the sun." (c) "Why does it get dark?" "Because we have to go to sleep." and (d) "Why isn't there lights on the road?" "So that cars can see."

Nonexplanatory responses included "I don't know," failures to respond, nonsequiturs to children's specific questions, and answers that did not state a reason, cause, or purpose. For example, (a) "Why do people kiss?" "Only big people kiss." (b) "Why are they arguing?" "No, they are just talking." and (c) "How do stomachs grow on women?" "The stork brings children."

A methodological note: As already described, the data set analyzed in the current study was originally collected over a 2-week period using a phone interview method in which mothers spoke to researchers every 2–3 days to verbally report question-answer interactions that they had with their preschool son or daughter. Before we turn to the actual data, it is important to note that there were various significant factors that led the original data

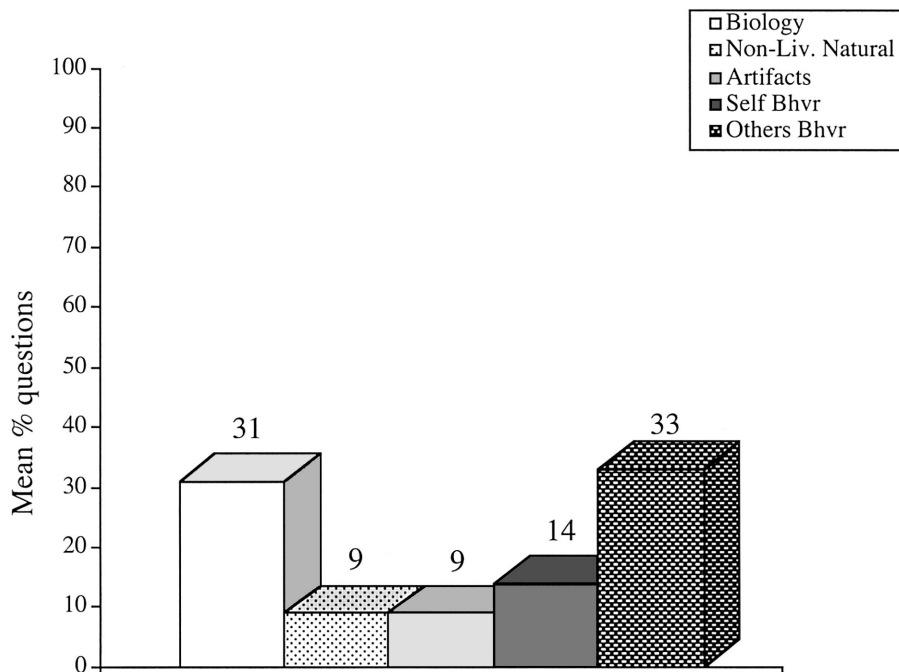


Figure 1. Mean percentage of questions in each domain. Non-Liv. = nonliving; Bhvr = behavior.

collection to be based on a phone interview and retrospective parent verbal report method rather than either an audiotape recording of spontaneous speech (e.g., Child Language Data Exchange System [CHILDES; MacWhinney & Snow, 1990]) or the keeping of a written parent diary (e.g., Ashmead & Perlmutter, 1980; Callanan & Oakes, 1992; Nelson & Ross, 1980).

First, in contrast to random audio recording, parental report was a far more effective way of targeting the phenomenon of interest, which was everyday child-initiated explanatory conversation occurring in a nonartificial setting. This is because, in contrast to basic social interaction and parent-child information exchange (e.g., “Where’s my hat?” “It’s in the closet”), explanatory conversation is a relatively rare portion of ordinary parent-child interaction and thus one that is hard to capture without continuous observation or extensive recording of families over substantial periods of time.¹ Such observation would have been intrusive and unfeasible in a multifamily (48 families) study, given the dynamic nature of most home environments. Second, written parent diary methods have many benefits—they are low on intrusiveness, yield a focused corpus, and allow for a broader and more ecologically valid sampling of natural interaction than snapshot audio recording or structured lab tasks. The phone recall method used in the original data collection maintained these benefits but also circumvented an issue that would have made the keeping of a written diary record problematic. Specifically, some of the mothers in the basic schooling group had sufficiently low literacy levels that a written record would have been unobtainable. Requiring such a record would have led to the exclusion of such parents from the study even though their parent-child conversations were of as much interest as those among families with higher parental literacy. Finally, the adoption of the phone interview was further justified by research suggesting that parents can be relatively good informants about child behavior, especially regarding events that are rare or unlikely to occur in, for example, a lab setting (e.g., Ashmead & Perlmutter, 1980; Dale, Bates, Reznick, & Morrisset, 1989; Nelson & Ross, 1980).

Having stated all of the benefits of this phone interview method, it is also important to note that there are, of course, limitations to the kind of data collected: The data are limited by what parents remembered or chose to

report during the interviews, and like the more typical written diary method, the phone recall method has no independent assessment of accuracy, relying on the report of only one informant—the parent. Before even turning to a description of the data, we acknowledge these shortcomings along with the need for converging evidence from data based on other methods. The issue of validity is therefore one we consider again in some detail in the Discussion section.

Results

What Is the Content of Children’s Questions?

What kinds of phenomena are 3- to 5-year-old children interested in understanding? To answer this question, we conducted a 2 (mother’s schooling level: high, basic) \times 2 (child age: younger, older) \times 5 (question domain: biology, nonliving natural kind, artifact, own behavior, others’ behavior) analysis of variance (ANOVA) on children’s questions. To control for differences between children in their overall tendency to ask questions, for each child, we expressed questions about each domain as an arcsined proportion of the total number of questions that the child asked, including indeterminate questions. For ease of description, the data are described and shown in the figures in terms of mean percentages. Results of the analysis of question content are presented in Figure 1.

The analysis revealed a significant main effect of question domain, $F(4, 176) = 14.34, p < .01$. Post hoc *t* tests indicated that

¹ For example, even in a museum environment that would seem likely to prompt explanatory talk, Crowley, Callanan, Tenenbaum, and Allen (2002) found that only 37% of parent-child museum conversation comprised explanatory talk, of which only 11% was child initiated.

the main effect occurred because, regardless of their parents' schooling background, the major focus of young children's questions was others' behavior ($M = 33\%$) and biological phenomena ($M = 31\%$). They were far more interested in both of these domains than any other domain (own behavior, $M = 14\%$; nonliving natural kinds, $M = 9\%$; artifacts, $M = 9\%$). Patterns at the individual level confirmed the overall pattern just described. As Table 1 indicates, in both age groups, there were more children demonstrating at least some curiosity (i.e., they asked at least one question) about biological phenomena and others' behavior than there were children demonstrating curiosity about artifacts, nonliving natural phenomena, or their own behavior.

What Form Do Children's Questions Take?

To simplify these analyses, we collapsed questions about children's own behavior and others' behavior into one category labeled "social behavior." Also as Table 1 indicates, each child did not ask about every domain. In consequence, an omnibus analysis of all domains together was precluded,² and analyses were therefore conducted by performing four separate 2 (mother's schooling level: high, basic) \times 2 (child age: younger, older) \times 3 (question type: causal, teleological, ambiguous) ANOVAs on the kinds of questions children asked about the biological, nonliving natural kind, artifact, and social behavioral domains, respectively. Differences in the overall frequency of each child's question asking behavior were controlled for by expressing each child's use of a question type (causal, teleological, ambiguous) as an arcsined proportion of the total number of questions the child asked about the domain (including other simple requests for factual information). The results in mean percentages are shown in Figure 2.

In each domain, the analysis revealed a main effect of question type: biology, $F(2, 76) = 73.61, p < .05$; nonliving natural kinds, $F(2, 36) = 41.94, p < .05$; artifacts, $F(2, 44) = 4.69, p < .05$; and social behavior, $F(2, 80) = 115.65, p < .05$. However, there were no effects of child age or maternal schooling level and no interactions, with one exception. Within the social behavioral domain, there was a Maternal Schooling Level \times Question Type interaction, $F(2, 80) = 4.33, p < .05$.

Table 1
Number of Children Asking At Least One Question About a Domain and Mean Number of Questions Asked About Each Domain per Child

Domain	No. of children asking questions			Mean no. of questions asked
	Young ($n = 24$)	Older ($n = 24$)	Total ($N = 48$)	
Biological	19	23	42	3.70 (3.2)
Nonliving natural kind	13	9	22	1.13 (1.7)
Artifacts	16	10	26	1.29 (2.1)
Own behavior	14	11	25	1.97 (3.1)
Others' behavior	21	21	42	3.56 (3.4)
Social behavior (own or others')	23	21	44	5.54 (5.6)
Indeterminate	8	5	13	0.63 (1.2)

Note. Numbers in parentheses are standard deviations.

With respect to the four main effects of question type, post hoc t tests revealed that the pattern was the same for all domains except the artifact domain. When children asked about the social behavioral, biological, or nonliving natural kind domain, ambiguous questions (e.g., "Why does X occur?") substantially exceeded unambiguous causal queries (e.g., "How does X occur?") and unambiguous teleological questions (e.g., "What is X for?"). Thus, in all three of these domains, unambiguous questions about cause or purpose were relatively rare (or never occurred), and it is therefore unclear whether the greater proportion of children's queries were motivated by causal or teleological assumptions. The pattern in the artifact domain differed slightly because children asked a number of causal questions about objects such as cars, fans, and lighters, and their tendency to ask causal questions about human-made objects ($M = 26\%$) did not differ from their tendency to ask ambiguous questions ($M = 41\%$), $t(25) = 0.9, p > .10$. Despite the particular relevance of function to artifacts, children here again made very few unambiguous requests for purpose or function information ($M = 5\%$). It is likely, though, that many of their ambiguous questions were, in fact, requests for teleological information (Kemler Nelson, Chan Egan, & Holt, 2004).³

Finally, the Maternal Schooling Level \times Question Type interaction in the domain of social behavioral questions occurred because children of mothers in the basic schooling group tended to ask more ambiguous questions about social behavior ($M = 85\%$) than did children of mothers in the high maternal schooling group ($M = 67\%$).

How Do Parents Respond to Ambiguous Questions?

As Figure 2 indicates, the majority of children's questions were ambiguous. What kinds of explanations did parents give to such questions? For example, did they respond to ambiguous questions about nonliving natural phenomena with causal rather than teleological information but ambiguous questions about artifact, biological, or behavioral phenomena with teleological rather than causal information? This would be a predicted pattern if parents' use of teleological explanation in parent-child conversation is consistent with that generally endorsed by Western-educated adults.

² An omnibus ANOVA was precluded because of the missing data generated, as most children did not ask about every domain. Even aside from this issue, independent analyses of each domain were more appropriate than an omnibus analysis. Specifically, because parent-child conversations are often, in practice, time-constrained interactions, children's tendency to spend time asking about one kind of phenomena (e.g., biological) has direct implications for the likelihood that they will ask (and receive explanations) about another (e.g., artifacts). Separate analyses therefore helped to circumvent concerns about dependence between variables. Despite the separate analyses, overall patterns in children's question asking are easily inferred from the individual domain analyses.

³ Although it is possible that the infrequency of parental reports of explicit teleological (e.g., "What's X for?") questions may have been related to parents' interpretation of the study guidelines, the tendency of most parents (approximately 75%) to report a variety of question forms (e.g., "What...for?" "What is...?" "What do...?" "Is X ...?" "Do X ...?") mitigates against this explanation, as does the analysis of Abe presented in the Discussion section.

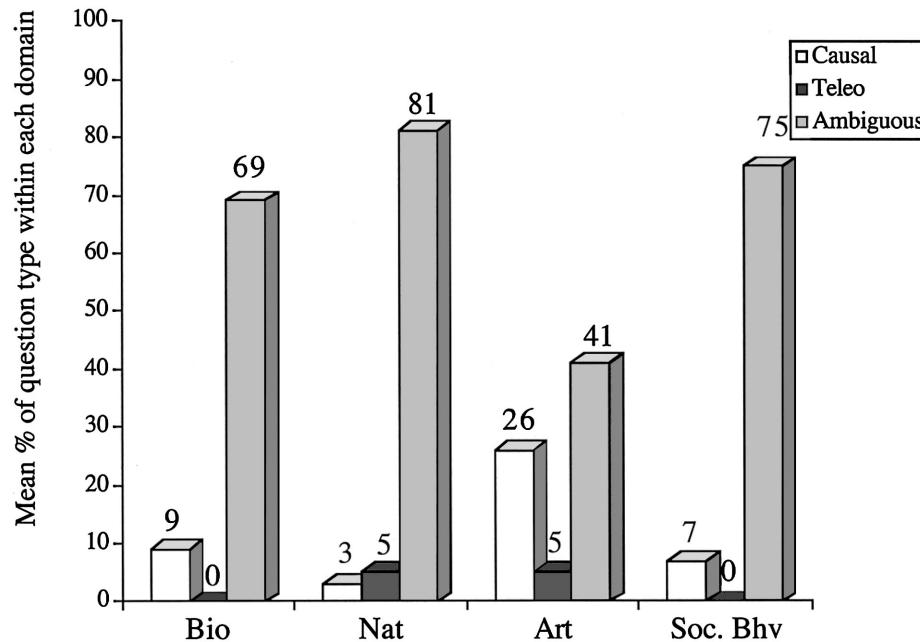


Figure 2. Mean percentage of questions within each domain that were causal, teleological (Teleo), or ambiguous. Bio = biological; Nat = nonliving natural kind; Art = artifact; Soc. Bhv = social behavior.

These questions were explored with four separate 2 (mother's schooling level: high, basic) \times 2 (child age: younger, older) \times 2 (explanation type: causal, teleological) ANOVAs on the biological, nonliving natural kind, artifact, and social behavioral domains, respectively.⁴ Even though many parents offered multiple kinds of explanations to one question, differences in children's tendency to ask questions about each domain meant that there was variation between parents in their opportunities to offer explanations. To control for these differences, we expressed each mother's causal and teleological explanations in each domain as an arcsined proportion of the total number of responses that she gave about that domain (including nonexplanatory responses). The results in mean percentages are shown in Figure 3.

Each of the four ANOVAs revealed the same pattern of effects: In every domain, there was a main effect of explanation type, with no effect of maternal schooling level, no effect of child age, and no interactions. The main effect occurred in each domain because parents had a greater tendency to offer causal rather than teleological explanations to their children's ambiguous questions. This was not only true for the nonbiological natural kind domain—a domain in which Western adults usually eschew teleological explanation but in which young children have been found to actively demonstrate teleological intuitions, $F(1, 17) = 3.28, p < .09$ —but also in those domains in which adults usually consider teleological purpose-based explanation highly appropriate, that is, the social behavioral, $F(1, 39) = 14.98, p < .01$; biological, $F(1, 34) = 35.00, p < .01$; and artifact, $F(1, 10) = 3.84, p < .08$, domains. Although differences between causal and teleological explanations in both the artifact and nonliving natural phenomena were statistically more marginal, in both of those domains, parents' mean tendency to offer causal explanations was, as indicated in Figure 3, twice as great as their tendency to offer teleological explanations

(artifacts: 64% vs. 28%; nonliving natural kinds: 60% vs. 24%). The smaller effect size was due to the relative infrequency of children asking about, and thus receiving explanations for, both of these domains.

To further understand the way parents in this sample used teleological explanation, in follow-up analyses we focused on exploring individual mothers' patterns of explanation to ambiguous questions. Two issues were of interest. First, although parents tended to offer causal rather than teleological explanations of nonliving natural kinds, purpose-based explanations were still offered on average 28% of the time—a figure that is not inconsequential. To better understand why young children might be prone to teleological explanations of nonliving natural phenomena, we needed to know whether most of the parents who explained nonliving natural phenomena appealed to teleological explanation at least occasionally or whether the use of teleological explanation was concentrated in only a small subset of parents. Second, despite the fact that adults usually consider teleological explanation appropriate to artifact, social behavioral, and biological phenomena, parents showed an overall bias to favor causal explanation for each of these domains. To what extent, then, did most parents model the

⁴ Responses to the relatively few unambiguously causal and teleological questions were also examined. These analyses, which collapsed domains because of the infrequency of these kinds of questions, found that, as expected, parents of both schooling backgrounds tended to give causal (63%) rather than teleological answers (6%) to causal questions, $F(1, 21) = 18.07, p < .01$, with the marginal finding that parents of younger rather than older children were more likely to offer causal answers to causal questions (78% vs. 56%), $F(1, 21) = 4.30, p = .05$. Of the seven purely teleological questions in this study, seven (100%) received teleological answers.

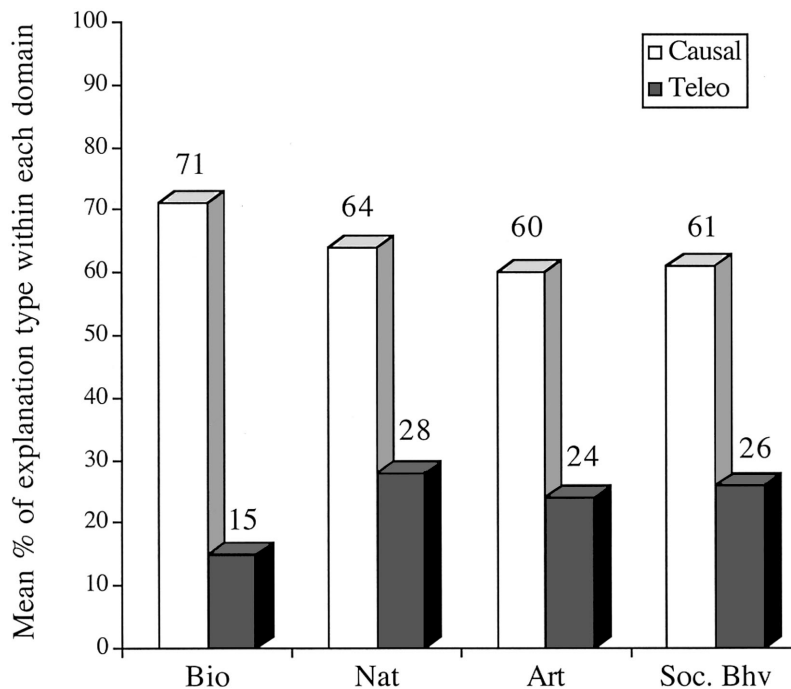


Figure 3. Mean percentage of parental responses to ambiguous questions within each domain that were causal or teleological (Teleo) explanations. Bio = biological; Nat = nonliving natural kind; Art = artifact; Soc. Bhv = social behavior.

use of teleological explanation for these domains at all? Was it used at least occasionally by the majority of mothers or frequently by only a few?

As Table 2 indicates, within the domains in which teleological explanation is considered appropriate, it was only with social behavior that a substantial proportion of children (27 of 43 children; 63%) heard a purpose-based explanation invoked at least once. For children asking ambiguous questions about artifacts and biological phenomena, only a third (36% and 37%, respectively) were ever given a teleological explanation, despite the relevance of function to both domains. Furthermore, as with biological phenomena and artifacts, it was only a subset of parents who ever offered any kind of teleological explanation to questions about nonliving natural phenomena: Of the 21 parents who were asked about phenomena such as rain and nighttime, only 9 (43%) ever gave a purpose-based explanation of the form “[The moon only comes out at night] so that we can see it.” Interestingly, although it seemed possible that this subset of parents might have a particular explanatory style and therefore be the same as those parents offering teleological explanations of biological and artifact phenomena, only weak evidence of an overlap was found. Of the 9 parents giving teleological explanations to nonliving natural phenomena, only 3 parents received ambiguous questions about artifacts. None offered a teleological response to those questions. The degree of overlap was higher among the 7 parents asked about both biological and nonbiological natural phenomena: 4 of them offered a teleological explanation about each domain.

Although relatively few parents invoked teleological explanation for anything other than social behavior, the same was not true in relation to parents’ use of causal explanation. As Table 2 also

shows, among parents who received ambiguous questions about social behavior, artifacts, and living and nonliving natural phenomena, the proportion who offered a causal explanation on at

Table 2
Number of Children Receiving At Least One Exposure to Each Kind of Response After Asking an Ambiguous Question About a Domain and Mean Number of Parental Responses (Including Nonexplanations)

Domain and response type	No. of children receiving response after asking an ambiguous question	Mean no. of responses received
Biological ($n = 38$)		3.37 (2.2)
Causal	34	
Teleological	14	
Nonexplanatory	13	
Nonliving natural ($n = 21$)		2.33 (1.9)
Causal	17	
Teleological	9	
Nonexplanatory	4	
Artifact ($n = 14$)		2.00 (1.2)
Causal	11	
Teleological	5	
Nonexplanatory	4	
Social behavior ($n = 43$)		4.50 (4.2)
Causal	39	
Teleological	27	
Nonexplanatory	15	

Note. Numbers in parentheses are standard deviations.

least one occasion was substantial in each case (social behavior = 91%; biology = 89%; nonliving natural phenomena = 81%; artifacts = 79%).

In short, most children who asked about a domain were likely to be exposed to a causal explanation but comparatively few children were likely to be exposed to teleological explanation. Those children who did hear teleological explanations did not seem to have parents with an explanatory style in which teleological explanations were offered about all domains in a manner that might lead children to view teleological explanation as appropriate to all domains.

Discussion

This study addressed three overarching questions: What domains are preschool children interested in understanding? What types of questions do they ask about different kinds of phenomena? What kinds of explanations do parents offer when their preschool children ask ambiguous questions about different domains?

In response to these questions, the present results reveal that the preschool children in this study were substantially more interested in understanding other people's behavior and the nature of biological phenomena than in understanding artifacts and nonliving natural phenomena or even restrictions on their own behavior. These patterns held true regardless of whether the children were younger or older preschoolers. In addition, analyses revealed that the clear majority of children's questions in all domains, except the artifact domain, were questions that were ambiguous as to whether they were requests for information about purpose or cause, so that parents had substantial opportunity to respond with either teleological or causal explanations. Question type revealed the only effect in the study relating to maternal schooling level, with children of mothers in the basic schooling group asking more ambiguous questions about social behavior. The reason for this difference between children is unclear, although the absence of any schooling effects in parent responses to ambiguous questions suggests that the answer does not lie with parent responses.

So, how did parents respond to these ambiguous questions, and did their pattern of responses seem to clearly promote promiscuous teleological intuitions in children? Interestingly, analyses revealed that mothers were generally disinclined to provide teleological explanations for any of the domains, even those in which it is not only licensed but preferred according to prior research on adult intuitions. Instead, regardless of child age or maternal schooling level, mothers showed a strong tendency to favor causal explanation, using it, on average, more than twice as often as teleological explanation within each domain. This overall bias to causal explanation, which echoes suggestive patterns reported by Callanan and Oakes (1992), was also revealed in analyses of individual parents' tendency to draw on each kind of explanation. For example, most parents drew on causal explanation when trying to make sense of nonliving natural phenomena, such as rain, with fewer than half ever appealing to a teleological notion of design and purpose on even one occasion. In short, the present data suggest that parents' tendency to explicitly scaffold children's use of teleological explanation in both appropriate and inappropriate domains is muted, particularly when compared with their tendency to adopt causal explanation. Thus, although a subgroup of parents did provide

children with data that could support the extension of teleological reasoning to nonliving natural phenomena, it was still the case that the popularity and frequency of teleological explanation among parents was low. These findings therefore suggest that any relationship between parental explanation and young children's broad teleological intuitions is unlikely to be simple or straightforward.

Immediately, these findings, of course, raise two questions. First, could the results be a spurious consequence of a fallible data set that was based on parental report? Second, if the data are not spurious, why would adults have a bias to causal explanation?

The first question needs to be addressed before anything else. As acknowledged earlier, despite its many strengths, a data set collected by asking parents to recall explanatory conversations with their children has its weaknesses. There is only one informant, there is no independent measure of validity, and it is perhaps possible that parents are particularly prone to remembering causal explanation. Furthermore, given this particular data set, it is also possible that the patterns of parent-child explanatory conversation discovered may not generalize beyond Mexican-descent families. The best way to establish the validity of the current results is to therefore explore whether similar patterns occur with children whose explanatory interactions have been recorded rather than recalled. Because the infrequency of spontaneous parent-to-child explanatory talk created substantial practical impediments to gaining a body of data by eavesdropping on preschoolers' families, we therefore explored whether there was any existing corpus that might provide a child of an equivalent age as a point of comparison. Fortunately, the CHILDES database of spontaneous child speech transcripts yielded one case who fit both the preschool age criteria and the requirement of having been recorded frequently and extensively enough that the snapshots of his conversation seemed likely to provide a substantial, relevant corpus: That case was a child named Abe.

Stanley Kuczaj (Kuczaj, 1976) recorded interactions with his son Abe from age 3 to age 5, for at least half an hour every week over a 2-year period during the early 1970s.⁵ Aside from the ethnicity difference—Abe was being raised in a European American home—there are some other differences regarding the context of Abe's conversations versus the context of the original 48 children's conversations that should be noted. First, although Abe's mother was often present, Abe was primarily recorded talking with his father. Second, Abe was recorded solely inside the home, often while eating or during collaborative activities potentially designed to elicit talk or to keep Abe in one place for practical purposes of tape recording. In consequence, although present in the original parent recall database, Abe was rarely sampled during passive behavior (e.g., watching television), and whereas the original 48 children's questions occurred across a variety of contexts, none of Abe's conversations seemed to occur while parent and child were, for example, outside directly observing natural phenomena.

⁵ Abe was recorded for two 30-min sessions (i.e., 1 hr) a week between the ages of 3 years 7 days and 4 years 1 month and once a week for 30 min from 4 years 1 month until 5 years. Because different amounts of speech were sampled at different ages, no developmental analysis is attempted here.

Despite these differences, explanatory talk was certainly present in Abe's conversations, and so, in analyzing his spontaneous speech, the only alteration we made to the earlier described method was that we identified Abe's causal, teleological, and ambiguous questions from a diverse body of spontaneous speech rather than from a body of parent-identified questions. We did this by searching for all occasions from just after Abe's 3rd birthday to just after his 5th birthday when Abe queried "How?" "What for?" or "Why?"⁶ This approach yielded a corpus of 454 causal, teleological, and ambiguous questions of determinable content—a data set comparable in size to the original 48-family data set reported over 2 weeks. The 1-child Abe data set was compared with the 48-child dataset (collapsed across individual children) by computing the percentage of questions and question types about each domain and the percentage of different parent responses to those questions. These percentage frequencies are presented in Table 3.

The data can be summarized quite easily. With respect to content, as with the original 48 children, a substantial proportion of Abe's questions were about social behavior (64%), especially other people's behavior (Abe: 50%; original children: 31%). However, in contrast to the original data set, Abe asked much more rarely about living things and much more frequently about artifacts. This difference in emphasis is readily explained by the fact that Abe's conversations were sampled inside the home and often while he was engaged in goal-directed activities that involved artifacts—a context that would also explain why, although queries about nonliving natural phenomena were rare among the original

48 children (11%), they were almost nonexistent among Abe's queries: Across 150 half-hour recording sessions, Abe only ever asked four questions about natural entities (one about a fire, one about rock, one about quartz crystal, and one about static electricity). Concerning the types of questions asked about each domain, as with the original 48 children, Abe rarely asked purely teleological questions (5% of all questions), even when referring to artifacts—about which he asked relatively frequently. Instead, although there were more causal questions in Abe's corpus overall (Abe: 27%; original data: 11%), Abe's questions were, like the original children's, primarily ambiguous as to their intent, with ambiguous questions comprising 68% of Abe's questions (87% in the original data set).

In general, what kinds of responses did Abe receive to his questions? As Table 3 indicates, a significant proportion of Abe's questions met with nonexplanations, and this is where the recall corpus and the recorded corpus—which captured all spontaneous speech—differ most. Although parents in the original data set often reported nonexplanatory responses (73% of families reported at least one), the request to track responses to their child's questions clearly led the original parents to focus on reporting explanation rather than failures to respond. Given that the focus of this study was on what kinds of explanations parents provide when they do offer an explanation, this contrast between the data sets would only be a concern if it signaled broader differences between reported versus recorded conversations that would bring the validity of the former data into question. In consequence, the central question was whether the patterns of explanation offered to Abe resembled those found in the original data set. Because, not surprisingly, Abe's parents, like the original parents, answered causal questions with causal rather than teleological explanations and teleological questions with more teleological explanations, it is the preponderance of Abe's questions—ambiguous questions—that are of most interest. Specifically, when Abe's parents offered explanations to ambiguous questions, did they show any bias to favor causal explanation? Is a bias to causal explanation limited to parents reporting explanatory exchanges by phone?

As Table 3 indicates, the answer to the latter question is clearly no. Within every domain in which teleological explanation is considered appropriate, Abe's parents had a tendency to favor causal explanation. As in the original data set, for the biological and artifact domains, the proportion of causal explanations was two and three times greater than the proportion of teleological explanations. Although causal and teleological explanations were more evenly matched for the social behavioral domain, causal explanation was slightly more frequent for this domain as well. Finally, and importantly, Abe's rare questions about nonliving natural phenomena all received nonexplanations. There was no overt evidence of his parents scaffolding the idea that entities, such as rocks and crystals, exist for a purpose.

It should be noted that Abe's transcripts were never prescreened for content. They were selected on the purely practical grounds that his age was equivalent to that of children in the original data

Table 3
Comparison of Corpora in Terms of Percentage Frequency of Questions and Question Types About Each Domain and Percentage of Causal or Teleological Explanations to Ambiguous Questions Within Each Domain

Variable and data set	Biological	Nonliving natural	Artifacts	Social behavior
Questions in each domain				
Abe	12	1	22	64
Original data set	32	11	11	47
Question type in each domain				
Causal				
Abe	36	40	34	23
Original data set	11	4	30	8
Teleological				
Abe	2	0	13	7
Original data set	0	2	13	0
Ambiguous				
Abe	63	60	53	74
Original data set	89	94	57	92
Response to ambiguous questions				
Causal				
Abe	49	0	52	37
Original data set	68	55	57	59
Teleological				
Abe	8	0	21	24
Original data set	20	31	18	26
Nonexplanatory				
Abe	43	100	27	38
Original data set	13	14	25	15

⁶ These data were coded by one researcher, with an additional researcher coding over 50% of the data. Inter-coder agreement was as follows: content coding, 94% (Cohen's $\kappa = .90$); question form, 93% (Cohen's $\kappa = .71$); and parent response, 91% (Cohen's $\kappa = .85$).

set and that his conversation had been extensively sampled. Despite a selection that was otherwise essentially random, analysis of his conversation reveals that the patterns found in the parent-reported original data set are generalizable. Considered together, they support the conclusion that preschool children rarely ask purely teleological questions about any kind of phenomena and, instead, primarily ask ambiguous questions. When offering an explanation to these questions, parents are inclined to offer causal explanations, even when purpose-based explanation would be highly appropriate to the child's apparent domain of inquiry. What might explain parents' general tendency to favor causal explanation?

There seem to be several possibilities. One possibility is that parents' emphasis on causal explanation is a kind of indirect scaffolding: Perhaps parents intuit—rightly or wrongly—that information about underlying cause is less easily discovered than information about purpose and presume, furthermore, that once causal information has been provided, children are well situated to figure out the functional consequences of an object or event for themselves. For example, it is an empirical question whether understanding the cause of a social behavior (i.e., that someone yells because another person is too far away to hear normal speech) facilitates insights into the action's purpose (i.e., that someone yells to get another person's attention), but it is certainly possible. If parents are intuitively aware of this, then their tendency to provide causal explanation is extremely useful for children's theory building about several domains. Alternatively, parents may emphasize cause because they are implicitly sensitive to children's bias to teleological thought and are therefore unconsciously attempting to counteract the bias. If this was the case, however, why did 9 of the parents in the original data set occasionally offer teleological explanations to children's questions about the nonliving natural world when adults often consider such explanations inapplicable to these kinds of phenomena?

The data set indicates several probable answers to this question. First, supplementary parental comments suggested that several mothers adopted a teleological mode of explanation for pragmatic reasons when explaining phenomena such as rain and nighttime. In some instances, this was because they were seeking child compliance and ended up adopting purpose-based explanations because such explanations can authoritatively imply that there is a nonarbitrary natural order on how things are meant to be. For example, 3 parents noted that their children's questions about the reasons for nighttime or darkness occurred when the child did not want to go to bed or stop playing outside. This led to exchanges of the following kind: "Why does it get dark?" "Because we have to sleep." In other instances, the teleological explanation was used pragmatically when a parent did not know how to answer a question posed by their child and thought that a purpose-based response would suffice and potentially satisfy. At least 1 mother's response was of the latter kind, leading to the following exchange: "Why does it rain?" "The little birds want to bathe." In addition to these pragmatic uses, a significant proportion of parents' explanations seemed to reflect teleological beliefs held by parents themselves as a result of implicit or explicit religious convictions, Panglossian idealism, anthropocentrism, or assumptions concerning a natural order or chain of being. Specifically, religious reference underpinned responses by at least 3 parents, and responses from 5 parents seemed derived from nonreligious teleological

theories about nature (e.g., "Why does it rain?" "So that there are trees and grass"). Such answers provide subtle indications that the kinds of promiscuous teleological intuitions found in children may be maintained into Western adulthood but are only revealed in certain contexts or with certain audiences (Kelemen, 2003; Kelemen & DiYanni, 2005).

In conclusion, the present results provide a valuable basis for further research by suggesting that children's bias toward teleological explanation is not attributable, in any direct manner, to patterns of parental explanation. Instead, the results are consistent with the conclusion that children's generalized orientation to teleological ideas is the reflection of an intuitive cognitive bias that is intrinsic to the child. Having said this, we note that it is undoubtedly the case that the current analysis leaves open the possibility that more complex and dynamic patterns of influence may be occurring between parents and children than have been captured here. For example, parents' explanations may serve to signal to children that the forms of explanations they intuitively favor are also a valid part of an adult's explanatory repertoire, and this may help to support children's continued (overextended) use of them. Such a possibility does not, of course, undermine the conclusion supported by the current results, which is that the teleological explanatory bias has its primary origin within children themselves. It remains for future projects to build on the foundation provided by this study and to fully explore, using more exhaustive methods (e.g., a longitudinal multifamily observational study), how parent-child interaction relates to the development of individual differences in teleological thought. Such focus on teleological reasoning is warranted by the centrality of such thinking to human cognition.

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