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Question, Explanation, Follow-Up: A Mechanism for Learning From Others?

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This study explored differences in caregiver–child interactions following children's information-seeking questions. Naturalistic speech from thirty-seven 4-year-olds and their caregivers was used to explore children's information-seeking questions, the caregiver's response, and children's subsequent follow-up. Half of the families were low-socioeconomic status (SES) and the other half were mid-SES. Although children across socioeconomic groups asked a similar proportion of questions, mid-SES caregivers offered significantly more explanatory responses to causal questions as well as more noncircular explanations than low-SES caregivers. No differences were found in children's follow-up to responses given to fact-based questions; however, after hearing unsatisfactory responses to causal questions, mid-SES children were significantly more likely to provide their own explanation. Such variability in caregiver–child interaction may have implications for subsequent learning.

Children's early learning experiences are largely shaped by their interactions with the social world (Vygotsky, 1978). Some of these learning experiences involve the child using their own, first-hand experience, whereas others depend on the child's ability to actively seek information from external sources. Indeed, solitary real-world exploration often does not provide full access to abstract concepts, absent or invisible referents, scientific phenomena, or future events. To fully learn about such concepts, children must rely on information provided by others (Bruner, 2009; Harris, 2012; Mills & Landrum, 2014).

Because such information is not always spontaneously provided, children often ask questions (Callanan & Oakes, 1992; Hickling & Wellman, 2001). By the time they enter preschool, children ask an average of 76 information-seeking questions per hour (Chouinard, 2007), and by the age of 5, they are able to formulate effective questions to acquire the knowledge they need to learn a new concept (Chouinard, 2007; Greif, Nelson, Keil, & Gutierrez, 2006; Kemler Nelson & O'Neil, 2005; Mills, Legare, Bills, & Mejias, 2010), although the quality of their questions develops through adolescence (Ruggeri & Lombrozo, 2014). Many of these questions require simple one-word answers (e.g., object names), whereas others require more complex explanations. (e.g., "how" and "why" questions; Callanan, 1990, 1991; Jipson & Callanan, 2003; Callanan, Shrager, & Moore, 1995; Crowley et al., 2001). Arguably, both the questions themselves as well as the content and the quality of the explanations play a critical role in shaping early learning. On the one hand, explanations can provide children with vocabulary-rich interactions that contribute to school readiness (Hart & Risley, 1995). On the other hand, explanations provide crucial information for understanding new concepts that cannot be acquired through first-hand observations (Frazier, Gelman, & Wellman, 2009).

Despite the critical role explanations play in providing young children with the necessary information to acquire new concepts, adults do not always provide high-quality explanations. Indeed, some caregivers simply do not have the necessary knowledge or the time needed to formulate a high-quality explanation and do not always feel it is necessary or appropriate to provide children with complex responses to their inquiries (Crowley et al., 2001; Shtulman & Checa, 2012; Valle, 2009). In these situations, caregivers may ignore their child's question, or offer an ineffective response with circular logic, such as "it is because it is." In contrast, high-quality explanations are often elaborate, complex, and avoid circular logic. Moreover, such high-quality explanations provide children with more opportunities to ask questions (Frazier et al., 2009) and to

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make inferences about the credibility of the caregiver (Corriveau & Kurkul, 2014; Mercier, Bernard, & Clément, 2014).

In the current article, we explore one factor that might contribute to differences in the types of questions children ask and the quality of explanations to which children are exposed. Specifically, different patterns of talk—such as children's use of questions to elicit explanations from caregivers—may differ across socioeconomic status (SES) groups, providing more or less opportunities for high-quality explanations (Blum-Kulka, 1997; Heath, 1983). We focus specifically on family SES because recent research has highlighted that by the time children enter formal schooling, children from low-SES families are at a significant academic disadvantage compared to children from mid- and high-SES families (Fernald, Marchman, & Weisleder, 2013; Hart & Risley, 1992, 1995). Mothers from families of low-SES have consistently been found to talk less, to use a smaller vocabulary, to be more directive, to use prohibitory language (e.g., "be quiet," "not now"), and to ask fewer questions of their children than higher SES mothers (Hoff, Laursen, & Tardif, 2002). Family income has also been associated with discrepancies in language development in early childhood (Bornstein, Haynes, & Painter, 1998; Hart & Risley, 1995; Hoff & Tian, 2005; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991; Weizman & Snow, 2001). For example, individual differences in early exposure to complex language are related to differences in the complexity of children's language production (Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002; Huttenlocher, Vasilyeva, & Shimpi, 2004) as well as differences in syntactic comprehension and verbal growth by the child (Huttenlocher et al., 2002).

Previous research exploring children's questions and adult explanations as a mechanism for knowledge acquisition has either employed a diary method of children's questions (Callanan & Jipson, 2001; Callanan & Oakes, 1992) or examined questions through naturalistic conversations (Chouinard, 2007; Crowley et al., 2001). Although several studies have explored children's behavioral responses to adult explanations (Crowley & Siegler, 1999; Krascum & Andrews, 1998), few studies have explored children's verbal follow-up to the responses they hear. One study systematically explored children's reactions to responses given to the child's "What is it?" questions about a novel artifact (Kemler Nelson, Chan, & Holt, 2004). Children were more likely to ask follow-up questions when they received an object label than when given the object's function. Taken together, these findings suggest that children engage in the question, response, and follow-up pattern of interaction as a way to acquire new knowledge.

To our knowledge, only one article has explored the entire question, adult response, child follow-up pattern of interaction in the same study (Frazier et al., 2009). Frazier et al. (2009) explored naturalistic interactions between children and their caregivers, finding that when children did not receive an explanatory response to a causal question, they were likely to repeat their original question or to provide their own explanation. These findings were replicated using an experimental paradigm and provide compelling evidence that children use specific conversational strategies to obtain the information they desire.

One limitation of Frazier et al. (2009) is that only mid-SES families were included in the sample, yet patterns of talk differ across ethnic and socioeconomic groups (e.g., Heath, 1983; Hoff, 2006; Rogoff et al., 1993). Children from diverse socioeconomic groups may have different strategies for acquiring new knowledge that do not include question asking, evaluations of explanations, and follow-up. Indeed, as we mention above, there is compelling evidence to suggest that SES is related to differences in the speech of both caregivers and children (Hart & Risley, 1992; Hoff-Ginsberg, 1991; Huttenlocher et al., 2002; Huttenlocher, Vasilyeva, Waterfall, Vevea, & Hedges, 2007; Huttenlocher, Waterfall, Vasilyeva, Vevea, & Hedges, 2010), and that such differences in parental language are associated with children's language growth (Huttenlocher et al., 2010).

The study presented here aims to explore differences in responses offered by caregivers to children's information-seeking questions and children's reactions to these responses. We explore naturalistic conversations between 4-year-old children and their caregivers from the Hall, Nagy, and Linn's (1984) CHILDES database (MacWhinney & Snow, 2000). Half of the 37 families were characterized as low-SES, whereas the other half were characterized as mid-SES, allowing us to explore socioeconomic variability in children's questions, the quality of caregivers' responses, and children's follow-up. Note that previous research using this corpus grouped families by both race (Black, White) and SES (low, mid), finding differences in children's word types and tokens by SES only (Hall & Tirre, 1979); thus, we chose to retain SES as the focus of our inquiry. Although our sample is from naturalistic conversations taken over 30 years ago, careful analysis of such conversations may still provide

important information. Indeed, the achievement gap between families of low and mid-SES has only widened since this corpus was recorded (Reardon, 2011).

We explored patterns of interaction following a child's fact-based question and causal question separately, given that the responses to these questions vary in complexity. Specifically, responses to most fact-based questions ("what," "where," and "who" questions) can be adequately addressed with a one-word reply. By contrast, causal questions ("how" and "why") most often require a longer explanation. We anticipated that families from both socioeconomic groups would have an easier time responding to fact-based questions, as opposed to causal questions.

Would we see differences in children's question asking by family SES? On the one hand, research has demonstrated differences in oral language by caregivers and children based on family SES (e.g., Hart & Risley, 1995; Hoff, 2006). On this hypothesis, we might anticipate that children from mid-SES families would ask a greater number of questions than children from low-SES families. By contrast, other research suggests that the overall content of these questions is similar across a range of family SES—at least for causal questions. In a sample comparing low- and mid-SES families, the types of causal questions were very similar (social questions vs. scientific questions; Callanan & Jipson, 2001). Thus, although the number of questions might vary by SES, the relative proportion of question types might be similar.

We anticipated that we would see differences in the explanations children received to the different types of questions they asked. Although studies have explored adult responses to children's questions (e.g., Callanan & Oakes, 1992; Chouinard, 2007), to our knowledge, no study has directly compared responses to fact-based questions to responses to causal questions. Previous research has explored adult responses to children's questions in general and found that mothers of 3-year-olds report responding less with causal explanations (32% of the time) than mothers of 5-year-olds (approximately 50%–60% of the time; Callanan & Oakes, 1992). Chouinard (2007, Studies 1 and 3) found similar results when collapsing across children's fact-seeking and causal questions. Caregivers offered an informative reply either immediately following the child's question or after the child reasked his original question approximately 64%–79% of the time depending on the child's age. This result was replicated in an experimental study, where adults offered informative responses 78%–86% of the time. Chouinard (2007) argued that the variability in responses due to children's age is likely due to caregivers' perceptions of their children's abilities and readiness to learn a new concept.

We also anticipated that we would see differences in the quality of the explanation by family SES. We focus on explanation circularity as a marker of explanation quality. Circular explanations refer to statements that reiterate the information from the original question without adding new information. By contrast, noncircular explanations provide more information than in the original question. Previous research indicates that by age 4, mid-SES children prefer noncircular explanations (Baum, Danovitch, & Keil, 2008; Mercier et al., 2014) and use such explanations to make inferences about the credibility of the informant (Corriveau & Kurkul, 2014).

Finally, we anticipated that we would see variability in children's follow-up depending on the type of adult explanation, and on family SES. Arguably, if children *are* using their questions as a tool for learning, then they would likely persist until they receive a satisfactory response (Chouinard, 2007; Frazier et al., 2009). Thus, the nature of children's responses (e.g., reasking their original question, dropping the topic, accepting what the adult says, etc.) provides critically important information about the purpose of the initial question that was asked. For example, if a child is using questions as a tool to engage an interlocutor, then he will likely be satisfied with any response. However, if a child is using his questions to learn new knowledge, then he will likely persist until he receives a satisfactory response. The results from Frazier et al. (2009) indicate that children's follow-up in response to a causal explanation varies across these dimensions. Here, we extend these findings to explore both causal and fact-based questions across low- and mid-SES families.

In summary, we explored children's spontaneous questions, caregiver's responses, and children's follow-up in naturalistic caregiver–child conversations. Specifically, we were interested in the exchange pattern following children's information-seeking questions. We focus on differences in these interaction patterns across children from diverse socioeconomic backgrounds. Our primary hypotheses concerned differences in adult explanations and children's follow-up between mid-SES and low-SES children. Indeed, previous work has found that children across diverse groups ask a similar proportion of

questions; therefore, we did not expect to see differences in the types of questions children ask. One additional hypothesis that we considered was that the quality of adult explanations would vary based on socioeconomic backgrounds. As previously noted, we used explanation circularity as a measure of explanation quality. Based on some early sociological work (Robinson & Rackstraw, 1967), we expected that caregivers from low-SES families would provide more circular explanations, whereas caregivers from mid-SES families would provide more noncircular explanations.

Method

Participants

Thirty-seven transcripts of native English-speaking caregiver–child conversations were used. Children ranged in age from 4;7 to 5;0. Transcripts were selected from the Hall et al. (1984) corpus in the CHILDES database (MacWhinney & Snow, 2000). Eighteen of the transcripts were from families of low-SES (50% White families, 50% Black families), the remaining 19 transcripts were from families of mid-SES (42% White families, 58% Black families). The designation of families as low-SES and mid-SES was determined through the use of income and education scales from the Index of Status Characteristics (Warner, Meeker, & Ells, 1949). In addition, families of low-SES all qualified for vouchers for their children to attend federally funded preschools. Overall, 43% of the transcripts came from White families, and the remaining 57% were from Black families (for additional descriptions, see Hall & Tirre, 1979; Hall et al., 1984).

All speech samples were collected over 2 consecutive days, with about 300 min of conversation for each child. Samples were recorded over 2.5 hr during the day in "one dose" via vests with wireless microphones worn by the target child, as well as a microphone clipped to the tie of the field experimenter (experimenter's race was matched to the target child). Field experimenters were always present and were trained to be as unobtrusive as possible, rarely initiating questions and responding naturally if spoken to. Samples came from children's everyday conversations with caregivers including parents and grandparents, and were recorded at home, at school, and during transition time. Here, we focus exclusively on samples from the home and transition settings, which include prior to school in the morning, drop-off at school, arriving home from school, before dinner, during dinner, and before bed. There were no differences in the number of questions children asked across these contexts, $\chi^2(2, N = 1{,}072) = 0.34$, *ns*. Moreover, the proportion of the overall conversation spoken by the target child did not vary by race or SES. Similarly, no significant effects of race or SES were found when considering the total number of turns spoken by the target child (Hall et al., 1984).

Search Materials and Procedure

We began by searching for child utterances that included question words ("how," "what," "why," "where," "can/could," "did/do," "when," "who," "should," as well as phrases associated with yes/no questions) across all 37 transcripts. We then eliminated utterances that were not initiated by the child, yielding 1,072 child-initiated questions. Child-initiated questions were marked as the beginning of a new exchange. An exchange consisted of three components: the child's question, the caregiver's response, and the child's follow-up reaction. An exchange was marked as complete when a child asked a new question pertaining to a new topic. This pattern of discourse has been documented as an exchange pattern that is used for acquiring new knowledge (e.g., Chouinard, 2007; Frazier et al., 2009).

CHILD (question): *Why is it wrapped up?* (P #25, L: 3792)

CAREGIVIER (response): *That's the way it came from Florida. Sometimes when they ship fruit they put it in tissue paper.* (P #25, L: 3793)

CHILD (reaction): *Oh* (P #25, L: 3794)

Coding was conducted by examining exchanges in the context of the entire transcript, allowing coders to read as much of the interaction as needed to appropriately situate each utterance.

Coding

Children's Questions

Questions were first assigned to one of two mutually exclusive categories: information-seeking or noninformation-seeking. Consistent with the categories defined by Chouinard (2007),

information-seeking questions included *fact-based* questions and *causal* questions. A question was coded as fact-based when a child asked a question that could typically be answered with a one-word factual response (e.g., most "what," "when," or "where" questions; see example below). A question was coded as causal when a child asked a question where a more extensive response was required (e.g., most "how" or "why" questions; see example below).

Fact-based: "Are there elephants in the circus?" (P #1, L: 3652)

Causal: "How do you talk through this?" (P #24, L: 173)

Noninformation-seeking questions included two distinct types: *permission seeking* and *action seeking*. Questions were coded as permission seeking when a child asked for approval to complete an action. Questions were coded as action seeking when the child's question ("can," "want to") required the caregiver to respond with an action.

Permission seeking: "Ma, can I go in the hallway and play football?" (P #17, L: 130)

Action seeking: "Can you get my slipper?" (P #36, L: 5079).

Given that the purpose of the current study was to explore the role of question–explanation interactions as a mechanism for knowledge acquisition, all additional analyses (caregiver's response, children's follow-up reactions) were conducted with respect to responses to *information-seeking* questions only ($N = 916$).

Caregivers' Responses

Of the 916 information-seeking questions, caregivers responded with 1,611 utterances (in some instances, a caregiver provided multiple utterances in response to a single question). Caregiver's responses were coded across six categories. Categories included (a) response on topic, no explanation needed; (b) response on topic with explanation; (c) response on topic, no explanation; (d) response unrelated; (e) turns the question back (Chouinard, 2007); and (f) no response. Each of these categories is described in more detail next.

Response on topic, no explanation needed. This code was used when the caregiver provided an on-topic response that did not require an explanation. Note that because causal questions typically require explanations, this category was removed from analysis when looking specifically at responses to causal questions.

CHILD: "What's in here?" (P #22, L: 278)

CAREGIVER RESPONSE: "Coffee" (P #22, L: 279)

Response on topic with explanation. This code was used when a caregiver gave an appropriate response that included an explanation.

CHILD: "Why do we always take the car on Monday?" (P #31, L: 153)

CAREGIVER RESPONSE: "Because I have nine o'clock class." (P #31, L: 154)

We also coded for the quality of the caregiver's explanation. An explanation was coded as *circular* if it repeated the question as an explanation.

CHILD: "Why didn't you like them?" (P #24, L: 4995)

CAREGIVER RESPONSE: "Because I decided I didn't like them when I go home" (P #24, L: 4997)

An explanation was coded as *noncircular* if it provided additional information.

CHILD: "What kind of tickets are these?" (P #1, L: 2034)

CAREGIVER RESPONSE: "Well when you go to the circus you have to buy tickets, you know, so you can get inside." (P #1, L: 2047)

Response on topic, no explanation. This code was assigned when a caregiver gave an appropriate response; however, an explanation was not included. This category differs from *on topic, no explanation needed* category because many causal questions needed explanations, but the caregiver only provided a brief responses without an explanation.

CHILD: "How do you talk through this?" (P #24, L: 173)

CAREGIVER RESPONSE: "Oh, you don't have to worry about it" (P #24, L: 174)

Unrelated. This code was assigned when caregivers responded with information that was not related to the question the child asked.

CHILD: "What? Did you say it's a chair?" (P #24, L: 3556)

CAREGIVER RESPONSE: "No, it's good" (P #24, L: 3557)

Turns the question back. This code was assigned when a caregiver attempted to get the child to answer his own question.

CHILD: "How come you keep coughing?" (P #22, L: 402)

CAREGIVER RESPONSE: "What happens when water goes down your throat the wrong way?" (P #22, L: 403)

Child's Follow-Up Reactions

The child's follow-up reactions were initially coded into one of seven categories, including (a) agrees with caregiver response, (b) asks a follow-up question, (c) reasks original question, (d) provides own explanation, (e) disagrees with caregiver response, (f) provides additional on-topic details, and (g) no response.

Agrees with caregiver response. This code was used when the child responded by agreeing with the caregiver (e.g., saying "yes/yeah," "oh,") or repeating the caregiver's response.

CAREGIVER RESPONSE: "I don't want to ask her in front of the others kids, so we will ask her quietly" (P #25, L: 851)

CHILD REACTION: "Okay, quietly" (P #25, L: 852)

Asks a follow-up question. This code was used when the child responded by asking a question that was on the same general topic as the original question.

CHILD QUESTION: "Giving him seeds?" (P #25, L: 125)

CAREGIVER RESPONSE: "Yes, Daddy is feeding him gerbil seeds." (P #25, L: 127)

CHILD REACTION: "What kind of seeds?" (P #25, L: 128)

Reasks the original question. This code was used when a child repeated their original question or some variation requesting the same information.

CHILD QUESTION: "What's cooking in there?" (P #29, L: 2770)

CAREGIVER RESPONSE: "Todd, listen, do you want your burger?" (P #29, L: 2771)

CHILD REACTION: "What's cooking in there?" (P #29, L: 2772)

Provides own explanation. This code was assigned when a child offered an alternative explanation or when the child provided his own explanation.

CHILD QUESTION: "How come?" (P #8, L: 4301)

CAREGIVER RESPONSE: No response (P #8, no line)

CHILD REACTION: "It's because he didn't want to get it dirty" (P #8, L: 4302)

Disagrees with caregiver's response. This code was assigned when the child responded by saying "no," or "that's not right."

CHILD QUESTION: "How come we are walking down Madison St.?" (P #32, L: 1233)

CAREGIVER RESONSE: "We're not walking Madison" (P #32, L: 1234)

CHILD REACTION: "Well we are. That is Madison St." (P #32, L: 1263)

Provides additional on-topic details. This code was assigned when a child provided additional details in reaction to the caregiver's response or about the original question.

> CHILD QUESTION: "Is he coming over by bus?" (P #11, L: 392)
>
> CAREGIVER RESPONSE: "He's goin(g) on the bus with us an(d) he's gonna walk to school with us." (P #11, L: 393)
>
> CHILD REACTION: "And he is gonna go into our class." (P #11, L: 394)

Reliability

Interrater reliability was established using a randomly selected sample of 20% of the transcripts. The first author (KK) and a research assistant independently coded the transcripts. Coders were blind to the SES of the family. Overall agreement was 90% (Cohen's kappa = .84). Discrepancies were resolved through discussion.

Results

In keeping with child language data analytic techniques, the data were pooled across children in each group, making the utterance instead of the child the basic unit of analysis. This strategy has been used across multiple studies (e.g., Bartsch, Horvath, & Estes, 2003; Frazier et al., 2009; Brandy, Frazier, Gelman, & Wellman 2016) and meets the requirement of independence needed to conduct statistical analyses as defined by Bakeman and Gottman (1997) who suggest that consecutive events (e.g., multiple utterances from the same child) measured in naturalistic settings are considered independent as long as separate coding decisions are made for each individual event, and the coding system consists of "mutually exclusive and exhaustive categories" (Bakeman & Gottman, 1997). Both of these conditions applied to the coding scheme that was used. Moreover, to ensure that the results were not driven by one child, we followed a multistep analytic plan. We began by conducting omnibus chi-square. When significance was found, we compared the proportions of each individual category by group using a *z* test (Beasley & Schumacker, 1995; see also Hickling & Wellman, 2001; Lagattuta & Wellman, 2002). Finally, as suggested by Bakeman and Gottman (1997), we report the number of subjects in each group that reflect the particular pattern highlighted in the analysis.

Children's Questions

Table 1 displays the total number of questions by socioeconomic background (mid-SES, low-SES) and question type. Inspection of Table 1 indicates that the most frequently asked questions were fact-based, followed by causal questions, highlighting children's use of questions for knowledge acquisition (Chouinard, 2007; Frazier et al., 2009). Overall, children from mid-SES families asked more questions than children from low-SES families (684 vs. 388, binomial test, $p < .001$). However, the overall pattern of questions asked was similar across the two groups, $\chi^2(1, N = 1{,}072) = 0.892$, *ns.* Indeed, 18 of the 19 mid-SES and all 18 low-SES children followed the same question-asking pattern (the majority of their questions were fact based).

Caregivers' Responses to Fact-Based Questions

Table 2 displays the type of response to fact-based questions by family SES. Inspection of Table 2 indicates that, although caregivers from mid-SES families provide more responses than caregivers from low-SES families, the relative proportion of response types is similar across family SES, with the majority of caregiver responses categorized as on topic, no explanation needed (50.5% and 49.3%). This is likely because fact-based questions (e.g., "what is that?") do not require extensive explanations and therefore on topic responses with no explanation are the most appropriate type of response for these questions. To confirm the similarity across the two groups, we conducted an omnibus chi-square, $\chi^2(4, N = 862) = 6.63$, *ns*.

Table 1
Frequency of Questions Asked (Percentage) by Question Type and Family Socioeconomic Status (Mid-SES, Low-SES)

	Mid-SES	Low-SES	Total
Information seeking			
Fact based	503 (73.5%)	283 (72.9%)	786
Causal	84 (12.6%)	46 (12.4%)	130
Noninformation seeking			
Permission seeking	29 (3.9%)	27 (6.4%)	56
Action seeking	68 (9.9%)	32 (8.2%)	100
Total	684	388	1,072

Next, we explored the quality of caregivers' response by creating four categories: (a) exemplary, (b) satisfactory, (c) unsatisfactory, and (d) turns question back. *Exemplary* comprised on topic with explanation responses; *satisfactory* consisted of on topic, no explanation needed; and *unsatisfactory* consisted of unrelated and no response. *Turns question back* was retained as a distinct category because these responses may be interpreted as unsatisfactory or satisfactory.

Figure 1 displays the proportion of response types offered by caregivers from mid-SES and low-SES families. Inspection of Figure 1 indicates little difference across family SES, with the majority of mid-SES and low-SES caregivers providing satisfactory responses (52% and 50%, respectively), $\chi^2(4, N = 862) = 6.63$, *ns*. When examined separately, 13 of the 19 mid-SES and 14 of the 18 low-SES caregivers followed the same response pattern (the majority of responses were on topic with no explanation needed).

Caregivers' Responses to Causal Questions

Table 3 displays caregivers' responses to causal questions by response type and family SES. Inspection of Table 3 indicates some differences in response type by family SES—especially with regard to the *on topic with an explanation* and *on topic, no explanation given* categories. To confirm these differences, an omnibus chi-square test was conducted, revealing significant differences in the types of caregiver responses by family SES, $\chi^2(4, N = 155) = 11.34$, $p = .02$.

To better understand the difference in responses to causal questions, post hoc analyses were conducted. These analyses revealed statistically significant differences in the proportion of *on topic with an explanation given* (39.8% vs. 21.67%; $z = 2.28$, $p = .029$) as well as in the proportion of on topic, no explanation given (14.56% vs. 34.62%; $z = 2.99$, $p = .004$). All other post hoc tests were not significant.

To explore the quality of the caregivers' response, we recoded the response types using the same categories used for fact-based questions with one exception: We removed the *satisfactory* category, which had consisted of on topic, no explanation needed responses. Given that causal questions, by nature, require an explanatory response, this category was removed. Thus, response quality consisted of three categories: *exemplary* (on topic with explanation), *unsatisfactory* (on topic no explanation given, unrelated, no response), and *turns question back*.

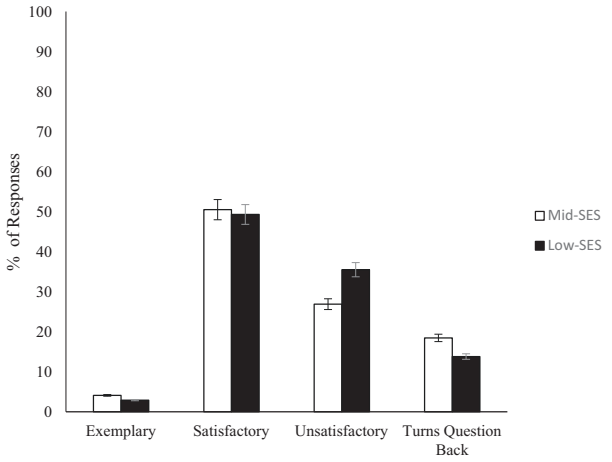

Figure 1. Percentage (standard error, *SE*) of caregivers' responses to fact-based questions by quality of response and family socioeconomic status (mid-SES, low-SES).

Table 2
Caregivers' Responses to Fact-Based Questions

	Mid-SES	Low-SES	Total
Response to fact questions			
On topic with explanation	23 (4.1%)	9 (2.9%)	32
On topic, no explanation needed	282 (50.5%)	150 (49.3%)	432
Unrelated	56 (10%)	37 (12.2%)	93
No response	94 (16.8%)	66 (21.7%)	160
Turns question back	103 (18.46%)	42 (13.8%)	145
Total	558	304	862

Note. SES = socioeconomic status.

Table 3
Caregivers' Responses to Causal Questions by Response Type and Family Socioeconomic Status (SES)

	Mid-SES	Low-SES	Total	*z* scores
Response to causal questions				
On topic with explanation	41 (39.8%)	11 (21.6%)	52	2.28*
On topic, no explanation given	15 (14.56%)	18 (34.623%)	33	2.99**
Unrelated	16 (15.5%)	6 (11.54%)	22	0.67
No response	16 (15.5%)	11 (21.15%)	27	−0.94
Turns question back	15 (14.5%)	6 (11.53%)	21	0.5
Total	103	52	155	

*$p < .05$. **$p < .01$.

Figure 2 displays the percentage of caregivers' response by quality and family SES. An omnibus chi-square revealed differences in the proportion of caregiver responses, $\chi^2(2, N = 155) = 6.89$, $p = .03$. Post hoc analyses revealed that mid-SES caregivers provided a significantly higher proportion of exemplary responses to causal questions (39.8% vs. 21.2%; $z = 2.5$, $p = .018$), whereas low-SES caregivers provided a significantly greater proportion of unsatisfactory responses (67.3% vs. 45.6%; $z = 2.6$, $p = .014$). No other significant differences were found. When examined separately, 14 of the 19 mid-SES caregivers followed the same response pattern (the majority of responses contained explanations). Fourteen of the 18 low-SES children followed a similar, opposite pattern (the majority of low-SES responses did not include explanations).

Circularity of Caregivers' Responses

We also explored the quality of caregivers' explanatory responses by coding for whether the explanation was circular or noncircular. We considered the entire exemplary category, which included responses that were greater than one word and included a causal connective. Collapsing across responses to both fact-based and causal questions, this category consisted of 84 total explanations. Of the 65 explanations from mid-SES caregivers, 51 (78.5%) were classified as noncircular and 14 (21.5%) as circular. Indeed, 17 of the 19 mid-SES children followed this pattern. In contrast, of the 20 explanations from low-SES caregivers, about half (47.6%) were classified as noncircular. Only 7 of the 18 low-SES children followed this pattern (note that in several of the low-SES dyads no explanations were provided). A chi-square test confirmed that caregivers from mid-SES families provided a significantly greater proportion of noncircular explanations, $\chi^2(1, N = 85) = 6.93$, $p = .008$.

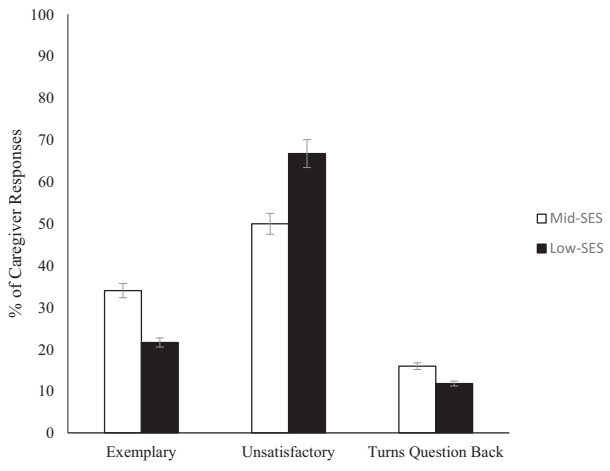

Figure 2. Percentage (standard error, *SE*) of caregivers' responses to causal questions by response quality and family socioeconomic status (SES).

Children's Follow-Up Reactions

Arguably, if children use their questions for learning, they will not be satisfied with an inadequate response and will persist until they receive a satisfactory answer. Indeed, Frazier et al. (2009) found that when children receive a nonexplanatory response to a causal question, they are likely to reask their original question or to provide their own explanation. In contrast, when children receive an explanatory response, they are more likely to agree with the adult or to ask a different follow-up questions. Here, we explored differences in patterns of children's reactions to adult responses separately for both types of information-seeking questions (fact-based, causal). We collapsed across the seven follow-up categories to create four new categories: (a) agrees, (b) persists, (c) provides own explanation, and (d) no reaction. The *agrees* category collapsed "child agrees," "child asks a follow-up question for elaboration," and "child provides additional on-topic details." The *persists* category collapsed "disagrees" with "repeats original question." Note that these results should be interpreted with caution as the small sample size associated with each follow-up category do not allow for meaningful comparison at the child level.

Children's Follow-Up Reactions to Fact-Based Responses

Table 4 displays children's follow-up reactions to fact-based question by caregiver response (exemplary, satisfactory, unsatisfactory, turns question back). Inspection of Table 4 indicates that children from both mid-SES families and low-SES families reacted to the adult responses in similar ways. The most common child follow-up reaction across all of the adult response types was no reaction at all. To confirm these observations, we conducted four omnibus chi-square tests for each of the adult response types (exemplary, satisfactory, unsatisfactory, and turns question back). The only significant difference emerged for children's follow-up reactions to adult exemplary responses, $\chi^2(2, N = 33) = 11.04$, $p = .004$. No other differences were significant across adult response types.

Table 4
Frequency and Within-Group Percentage of Types of Child Reactions Following Adult Responses to Fact-Based Questions

	Exemplary		Satisfactory		Unsatisfactory		Turns question back	
	Mid-SES	Low-SES	Mid-SES	Low-SES	Mid-SES	Low-SES	Mid-SES	Low-SES
Agrees	19 (79.2%)	2 (22.2%)	72 (25.5%)	35 (23.3%)	38 (25.3%)	26 (25.2%)	29 (28.2%)	12 (28.6%)
Persists	1 (4.2%)	0 (0%)	15 (5.3%)	3 (2%)	42 (28%)	21 (20.4%)	12 (11.65%)	3 (7.1%)
Own explanation	0 (0%)	0 (0%)	2 (< 1%)	1 (< 1%)	13 (8.7%)	12 (11.65%)	4 (3.4%)	1 (2.4%)
No reaction	4 (16.67%)	7 (77.8%)	193 (68.5%)	111 (74%)	57 (38%)	44 (42.7%)	62 (60.2%)	26 (61.9%)

Note. SES = socioeconomic status.

To better understand this between-group differences in children's follow-up reactions to adult exemplary responses, post hoc analyses were performed using *z* scores. Children from mid-SES families were more likely to agree with these responses than children from low-SES families (79.2% vs. 22.2%; $z = 3.05$, $p = .004$). In contrast, children from mid-SES families were less likely to have no reaction to the adult exemplary response than children from low-SES families (16.67% vs. 77.8%; $z = 3.33$, $p = .002$). No other differences were significant.

Children's Follow-Up Reactions to Causal Responses

Children's reactions to causal responses were coded using the same categories (agrees, persists, own explanation, no reaction) for each of the three adult response types (exemplary, unsatisfactory, and turns question back).

Inspection of Table 5 reveals that, as in their follow-up reactions to fact-based responses, it was most common for children to have no reaction at all. To explore differences in child reaction by family SES, we conducted three omnibus chi-square tests. Reactions to unsatisfactory responses were significantly different, $\chi^2(2, N = 97) = 11.26$, $p = .01$. No other significant differences in children's reactions emerged when adults provided exemplary responses or turned the question back to the child.

To further explore differences in children's reactions to adult unsatisfactory responses, we conducted post hoc *z*-score tests. Children from mid-SES families provided their own explanations significantly more than children from low-SES families (39.1% vs. 0%; $z = 3.13$, $p = .004$). In contrast, children from mid-SES families were less likely than children from low-SES families to have no reaction after hearing an unsatisfactory response (21% vs. 40%; $z = 2.11$, $p = .043$). One plausible explanation for this difference is that children from mid-SES families have a more advanced understanding of causality and are therefore able to provide explanations. We explore this explanation further in the discussion.

One additional finding warrants discussion. Specifically, when adults turned the original question back to the child, the most typical response of both groups of children was to provide their own explanation to their original question (37.5% vs. 25%). In addition, low-SES children tend to persist more than mid-SES children when the caregiver turns the question back (50% vs. 12.5%). Note that these results should be interpreted with caution as there were only four follow-ups from low-SES children to turns question back responses.

Table 5
Frequency and Within-Group Percentage of Types of Child Reactions Following Adult Responses to Causal Questions

	Exemplary		Unsatisfactory		Turns question back	
	Mid-SES	Low-SES	Mid-SES	Low-SES	Mid-SES	Low-SES
Agrees	5 (16.67%)	1 (12.5%)	12 (21%)	8 (20%)	0 (0%)	0 (0%)
Persists	0 (0%)	1 (12.5%)	18 (31.5%)	15 (37.5%)	2 (12.5%)	2 (50%)
Own explanation	4 (13.33%)	0 (0%)	15 (26.3%)	1 (2.5%)	6 (37.5%)	1 (25%)
No reaction	21 (70%)	6 (75%)	12 (21%)	16 (40%)	8 (50%)	1 (25%)

Note. SES = socioeconomic status.

Discussion

We explored the types of questions children ask, the quality of the caregiver response, and children's follow-up reaction to the caregiver response in a sample of caregiver–child everyday conversation. We asked if this pattern of interaction varied by family SES, as previous research has indicated differences in caregiver talk (e.g., Heath, 1983). Although no differences in family SES were found in the proportion of children's questions, and caregiver response to fact-based questions, differences were found in caregiver response to causal questions, and children's follow-up reactions to their caregiver's response. Below, we briefly review these findings, before turning to the role of question asking as a mechanism for knowledge acquisition.

Consistent with previous research on children's questions as a mechanism for knowledge acquisition (Callanan & Oakes, 1992; Chouinard, 2007; Kelemen, Callanan, Casler, & Pérez-Granados, 2005), the majority of the questions children asked were information seeking. Regardless of family background, most of children's questions were fact based, with about 25% of their questions as causal (or explanatory; Frazier et al., 2009). Note that although the proportion of questions was similar across social class groups, the frequency was not. Children from mid-SES families asked almost double the number of questions than children from low-SES families (684 vs. 388), a finding that is consistent with some pioneering work in child language by McCarthy (1930) and Tizard and Hughes (1984). Taken together, these data suggest that the capacity to ask questions is largely universal and has an epistemic motive—although children from low-SES families may be less likely to pursue question asking as a strategy for knowledge acquisition.

Why might children from low-SES families be less likely to ask questions? One of the reasons might be that they are less likely to receive a response to their query that aids in knowledge acquisition. Although most research on children's questions and adult explanations focused specifically on causal questions only (Frazier et al., 2009; Kelemen et al., 2005) or collapse across fact-based and causal questions (Chouinard, 2007), we chose to retain the separation across these question types in order to explore individual differences in the quality of the adult response when an explanation is not explicitly required (fact-based questions) and when it is necessary (causal questions). No differences across family socioeconomic background emerge when we consider caregivers' responses to fact-based questions.

By contrast, we found differences in adult responses to children's causal questions by family background. Mid-SES caregivers provided significantly more exemplary responses (responses that were on topic and included an explanation) than low-SES caregivers. In contrast, low-SES caregivers provided more unsatisfactory responses than mid-SES caregivers. Such differences were also present in the quality of the adult's explanations. When collapsing across both fact-based and causal exemplary responses, caregivers from mid-SES families were much more likely to provide a noncircular explanation than caregivers from low-SES families. Taken together, these data suggest that caregivers from mid-SES are more likely to encourage children's questions by providing an appropriate explanation. By implication, perhaps children attend to such differences in the quality of the adult response, and over time, low-SES children become less likely to pursue question asking as a strategy for knowledge acquisition.

An alternative interpretation comes from Tizard and Hughes (1984) and Hart and Risley (1992), who found a relationship between the proportions of caregiver utterances that included a question and the number of the child's utterances including a question. On this hypothesis, question asking, although an important mechanism for cognitive development, can be seen as a general style of communication. Although we did not code for the caregiver's spontaneous questions in our analysis, we did code for the proportion of responses where the caregiver turned the original question back to the child. The overall proportion of child information-seeking questions (fact-based and causal) was not significantly associated with the adult's proportion of responses where they turned the question back to the child, $r(37) = .097$, *ns*. Moreover, the overall proportion of child information-seeking questions (fact-based and causal) was also not significantly associated with adult's proportion of overall satisfactory responses, $r(37) = .23$, *ns*. Thus, although we cannot rule out the dispositional hypothesis completely, we believe these findings support the notion that differences in children's question asking are a result of the quality of the adult's responses—not simply individual differences in communication style.

Finally, we asked if children simply accept the explanations they receive from adults or if they are more selective, given that some research has indicated that children are much more likely to repeat the question or ask a related question when the

adult response is unsatisfactory (Chouinard, 2007; Frazier et al., 2009; Kemler Nelson et al., 2004). Our data are consistent with that finding: When exploring the proportion of persists responses (which included repeating the original question), children were more likely to persist upon receiving an unsatisfactory response than when they received an exemplary response (34% vs. 2.6%; $z = 3.81$, $p = .00$). However, somewhat surprisingly, children's reactions to unsatisfactory adult responses varied by family background. Although children from low-SES families were most likely to have no reaction at all, children from mid-SES families frequently provided their own explanation.

Why might these differences exist between conversational style in mid-SES and low-SES families? Our findings are consistent with previous work that suggest that in general low-SES families engage in less elaborative discourse and are more directive in their speech patterns (Hart & Risley, 1992, 1995). In the current study, responses that included explanations were longer and less direct, whereas on-topic responses with no explanation (typically only several words) tended to be more direct. Mid-SES caregivers tended to provide explanations more frequently than low-SES caregivers. This difference is potentially problematic, especially if children are using the explanations as a tool for acquiring new knowledge. It is likely that longer explanations provide children with more information and, in turn, more knowledge.

Such differences in adult responses to causal questions might be related to differences in the culture of the learning and teaching process across learning communities. On this interpretation, such group-level differences might be subject to the "home-field disadvantage" where a deficit model is used to interpret a comparison group (here, families of low-SES) relative to a baseline (families of mid-SES; Medin, Bennis, & Chandler, 2010; see also Gutiérrez & Rogoff, 2003 for discussion of "deficit assumptions"). We are cautious to interpret a smaller proportion of caregiver causal explanations as a "deficit," given that children could acquire causal knowledge through other nonverbal means such as "listening in" (Rogoff, Paradise, Arauz, Correa-Chávez, & Angelillo, 2003). Yet, there are other learning situations, such as learning about events not in the immediate present or to comprehend counterintuitive claims, where verbal testimony is not only more efficient learning method but is sometimes necessary for knowledge acquisition (Harris, 2012; Harris & Corriveau, 2011). Thus, although differences in explanation might reflect important cultural values surrounding the learning and teaching process, linguistic explanations might be especially useful when acquiring causal knowledge.

A second plausible explanation for why low-SES caregivers may not provide explanations as frequently to their children's causal questions is the lack of knowledge needed to answer their children's questions. In the current study, mid-SES caregivers provided significantly more high-quality responses (noncircular) than low-SES caregivers. Low-SES caregivers may be more likely to provide circular explanations (those that reiterate the question) because they do not know the correct answer. Note, however, that we were unable to evaluate the accuracy of the caregiver explanations, given that some explanations referred to people or events beyond the scope of the transcripts. Thus, although we cannot say for certain that all of the noncircular explanations were accurate, we can be sure that none of the circular explanations allowed children access to new information.

A third explanation is that adults are appropriately providing speech based on the level of their child's understanding (Snow, 1983). On this hypothesis, because children from mid-SES families are exposed to more complex language that likely includes complex explanations (Snow & Uccelli, 2009), they may have a more developed understanding of causality. Indeed, studies looking at children from mid-SES families show that beginning around age 4, children begin to provide explanations that may help in their understanding of causal mechanisms (Kuhn & Katz, 2009; Rittle-Johnson, Saylor, & Swyget, 2008). Future research should explore differences in causal understanding by family SES to determine if children's understanding of causality is related to the quality of caregiver explanations.

Beyond exploring whether these findings hold in a more contemporary sample, our results raise a number of important questions for future research. First, why do differences exist in the types of explanations caregivers from diverse socioeconomic backgrounds provide? Can these differences be attributed to variability in the types of learning opportunities a family provides a child (Durkin, 1987; Heath, 1989)? Another open question is whether or not we might expect to see developmental changes in children's follow-up after repeated exposure to a caregiver's unsatisfactory responses. Given that children's earliest causal questions emerge around age 3 (Chouinard, 2007), it is likely that their understanding of what makes a response

satisfactory may also be emerging (but see Corriveau & Kurkul, 2014; Mercier et al., 2014). Consistent with this interpretation, repeated exposure to unsatisfactory responses from an interlocutor (e.g., prohibitions) is related to a decrease in children's direction of future questions toward that individual (Hart & Risley, 1995). Thus, exposure to unsatisfactory responses might have profound implications for children's use of questions as a tool for learning from others. In summary, these findings suggest that the question, explanation, and follow-up pattern of interaction that is often privileged in formal schooling might vary based on children's early interactions with caregivers. Thus, more attention might be needed in order to support different interaction patterns that promote learning across diverse socioeconomic backgrounds (Cazden & Beck, 2003). Future research should explore the mechanisms underlying such differences and the implications for children's use of questions as a tool for knowledge acquisition.

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