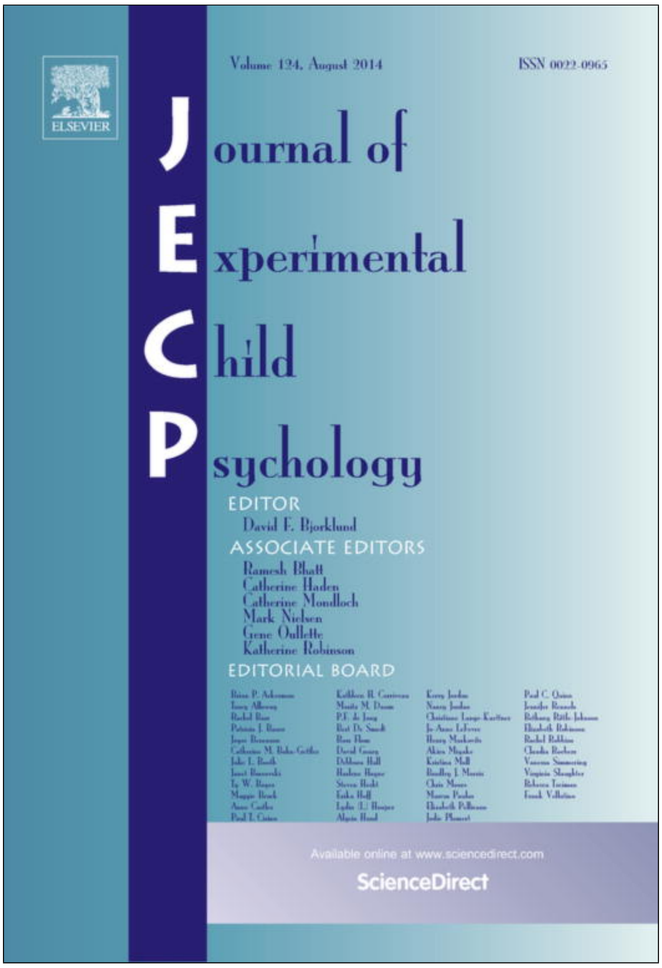
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Children's skepticism: Developmental and individual differences in children's ability to detect and explain distorted claims

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ABSTRACT

The current study examined some key developmental and individual differences in how elementary school-aged children evaluate sources of information. A sample of 130 children ages 6 to 9 years participated in a task designed to measure children's understanding of ways that claims can be distorted (i.e., biased decisions, skewed self-reports, and misleading persuasive claims). Children also completed several individual difference measures, including a brief intelligence task and an advanced social cognition measure (interpretive theory of mind). Overall, older children were less trusting and better than younger children at explaining the reasons to doubt sources that might provide distorted claims. Crucially, the results also suggest that beyond age, both general intelligence and advanced social cognitive skills play roles in children's ability to understand when and why they must doubt sources of distortion.

"The most dangerous of all falsehoods is a slightly distorted truth."
—Georg Christoph Lichtenberg, *The Waste Books*

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Distortion is everywhere. A politician may claim that a policy will have long-lasting ill effects, purposefully exaggerating one minor weakness of that policy while ignoring the abundant strengths. A salesperson desiring to earn a commission may focus on emphasizing and exaggerating the strengths of his product while ignoring the weaknesses. A mother may insist that her son is the best soccer player on the field, ignoring the fact that a couple of other children are indeed a little bit faster and a little bit more talented. In each of these claims, the information provided is distorted from the truth, and although trusting distorted claims is sometimes harmless, it can also lead to a host of negative outcomes.

Unfortunately, distortions can be incredibly challenging to detect because recognizing them often requires reflecting on the intentions and motivations of the source. Yet the ability to recognize that someone is likely to provide a distorted claim should protect that person against manipulation or misinformation. For instance, understanding the goals and methods of advertisers may arm consumers—both children and adults—against misleading claims (e.g., Moses & Baldwin, 2005).

Despite the importance of this issue, there is a relative paucity of research examining the development of the ability to evaluate social sources of information (e.g., Heyman, 2008; Mills, 2013). The majority of the research focuses on preschool-aged children completing straightforward source evaluation tasks; for instance, children's trust in new claims by someone who has been clearly inaccurate or accurate in the past is assessed (e.g., Koenig & Harris, 2005). Certainly, preschool-aged children can recognize that information from social sources may be inaccurate due to deception (e.g., Mascaro & Sperber, 2009), the source's false belief (Flavell, 1999), or a history of past inaccuracy (e.g., Koenig & Harris, 2005; for reviews, see Clément, 2010; Mills, 2013). But much less is known about developments after the preschool years and involving more complex kinds of social sources such as ones that might provide distorted information. Moreover, evidence suggests that some children are better than others at recognizing when a source may provide distorted claims (e.g., Mills & Keil, 2008), yet even less is known about the factors that help children to more successfully evaluate social sources of information. Thus, the current study examined developmental and individual differences in understanding distortion.

There are countless ways that claims can be distorted, but research with children has focused primarily on three different types of distortion in separate lines of research: biased decisions, skewed self-reports, and persuasive claims (Grant & Mills, 2011; Heyman, Fu, & Lee, 2007; Heyman & Legare, 2005; Mills, Al-Jabari, & Archacki, 2012; Mills & Grant, 2009; Mills & Keil, 2005). With biased decisions, someone may make a decision based on extraneous factors, such as personal relationships, instead of the ones that should be considered when making that decision, such as accuracy. By 6 years of age, children understand that it is possible for someone to have been biased in favor or against someone based on preexisting relationships (e.g., someone might choose his undeserving best friend as the winner of a contest), but they do not think that it happens very often (Mills et al., 2012) and they struggle to recognize when someone has made or is likely to make a biased claim (Mills & Grant, 2009; Mills & Keil, 2008). By 8 years of age, children are more capable of detecting when bias may have skewed decisions (Mills & Grant, 2009), particularly if the bias involves negative relationships (e.g., a judge does not choose his enemy as the winner of a contest despite the enemy's excellent performance; Mills & Keil, 2008).

A second type of distortion examined in prior research relates to skewed self-reports. With skewed self-reports, people's claims are skewed by a desire to appear in a positive light. For instance, someone who wants to win a prize may provide a skewed claim about her performance in a contest, or someone who wants to be seen as intelligent may claim to be smarter than average, even if that is not actually true. By 8 years of age, children recognize that claims about one's achievements may be distorted; for instance, 8-year-olds, but not 6-year-olds, recognize that claims made with someone's self-interest are less likely to be trustworthy than claims made against someone's self-interest (Mills & Keil, 2005). Moreover, by 10 years of age (8-year-olds were not tested), children recognize that self-reports about highly evaluative traits (i.e., value-laden traits such as being smart or honest) might not be reliable (Heyman & Legare, 2005). Notably, 10-year-olds are not unilaterally skeptical toward self-reports; they are more accepting regarding self-reports about less value-laden traits such as being nervous or outgoing (also labeled comparison traits) because any degree of those traits is generally acceptable and thus not biased.

A third type of distortion examined in prior research relates to persuasive claims. With persuasive claims, someone may make skewed statements in order to convince another person to do something. For instance, an advertiser may present exaggerated information about a product (e.g., an anti-aging product claims to make someone look 10 years younger) in order to make the product appear more attractive. Although preschool-aged children have some sense that advertisements differ from programming (Gunter, Oates, & Blades, 2005), it is not until 6 to 8 years of age that children recognize that advertisements may present misleading information to convince others to buy the product (e.g., Grant & Mills, 2011). Even then, children do not appear to consistently apply their knowledge about persuasion techniques when confronted with actual advertising claims (e.g., Brucks, Armstrong, & Goldberg, 1988; Livingstone & Helsper, 2006).

Crucially, across all of these studies examining children's understanding of different kinds of distorted claims, two issues are apparent. First, although we know that children's recognition of distorted claims develops drastically between 6 and 9 or 10 years of age, with evidence across studies suggesting that 8- to 10-year-olds are significantly more sophisticated than 6- and 7-year-olds, there are still no studies that have examined all three types of distorted claims simultaneously using the same paradigm. This makes it especially difficult to compare across the different kinds of claims to characterize what is changing across development. Second, along with the developmental differences, it is possible that there are some strong individual differences; some children are better at evaluating the information they encounter than others in their age group. For instance, research examining children's understanding that judges can make biased decisions found both developmental improvements and individual differences. Two distinct patterns of responses were found with 7- and 8-year-olds; approximately half performed like older children, with greater trust for objective judges, whereas half performed like younger children, with greater trust toward biased judges (Mills & Keil, 2008).

What factors could possibly account for these differences in recognizing distortion beyond age? The current study focused on three possibilities: social cognitive skills (particularly interpretive theory of mind), intelligence, and need for cognition (i.e., the degree to which children and adults desire to engage in effortful thinking). Beginning with the first possibility, to detect distortion it is likely useful to have a good understanding about how the mind can skew information (either intentionally or accidentally). Some researchers argue that before 7 or 8 years of age, children may overlook the importance of interpretation in psychological processes, thinking that reality basically copies itself onto whoever is in the path of that knowledge (Carpendale & Chandler, 1996; Chandler & Lalonde, 1996). For instance, 5-year-olds cannot explain why it is acceptable for two people to interpret the same ambiguous figure (e.g., the iconic "duck–rabbit" image) differently; in fact, they often reject this possibility altogether, concluding that there is only one right answer. This is despite the fact that they can succeed at other social cognitive tasks (e.g., the false belief task). In contrast, 7- and 8-year-olds seem to recognize both that information can be ambiguous and that ambiguous information can be interpreted in various ways.

Chandler and his colleagues have said that children develop this "interpretive theory of mind" (ITOM) at around 7 years of age; children pay much more attention to how things inside the mind, such as thought processing and previously held beliefs, might influence how people interpret information. When children at this age hear about an observer who has a stable preference for interpreting drawings (e.g., likes houses and likes to think that most drawings are houses), they recognize that such a belief may influence how the observer interprets an additional drawing (Barquero, Robinson, & Thomas, 2003). They also understand that two people could have different trains of thought about the same item (Eisbach, 2004), and they understand more about unconscious mental processes (Choe, Keil, & Bloom, 2005; Flavell, Green, Flavell, & Lin, 1999). In other words, this line of research suggests that children might not understand how people's claims can be distorted until around 7 years of age because they lack an awareness of the processes underlying the formation of beliefs.

Although there is little research examining how ITOM relates to children's recognition of distortion, there is evidence that basic social cognitive skills are related to performance on basic source evaluation tasks in preschool-aged children. For instance, children with higher scores on theory of mind tasks are better at recognizing that someone who has provided inaccurate labels for familiar objects in the past is likely to provide inaccurate labels in the future (e.g., DiYanni & Kelemen, 2008; DiYanni, Nini, Rheel, & Livelli, 2012; Fusaro & Harris, 2008; Vanderbilt, Liu, & Heyman, 2011; but see also Pasquini, Corriveau, Koenig, & Harris, 2007). Moreover, with elementary school-aged children, there is evidence of individual differences in ITOM performance that are meaningful. For instance, Ross, Recchia, and Carpendale (2005) found that although ITOM correlated with age, children with higher ITOM scores were better at understanding divergent interpretations of conflicts between characters above and beyond the effects of age. Other recent research has found that although ITOM correlated with age, ITOM significantly predicted performance on a persuasive claim evaluation task above and beyond the effects of age (Grant & Mills, 2011). Thus, it is likely that advanced social cognitive skills, such as ones measured by the ITOM task, play a role in children's success at recognizing and evaluating distorted claims.

A second possible contributor to children's ability to recognize reasons to doubt distorted claims is intelligence. Logically, it seems reasonable that children who are more intelligent are better at understanding and evaluating the claims that they encounter. Surprisingly, however, little research has examined the role of intelligence in how children evaluate claims. The closest related research focused on verbal skills; Koenig and Woodward (2010) found that 2-year-olds with higher vocabularies are sometimes more sensitive to how reliable a source is likely to be when learning labels for objects. There is also some preliminary evidence that preschool-aged children with higher IQs are slightly more likely to reject claims made from speakers with ambiguous histories of inaccuracy (thereby showing more skepticism; Tagar, Federico, Lyons, Ludeke, & Koenig, in press). Moreover, although intelligence and social cognitive skills are related in some cases (e.g., Cutting & Dunn, 1999), there is evidence that these are different constructs and that the relationship between the two decreases between the preschool and elementary school years (e.g., Choe, Lane, Grabell, & Olson, 2013). Thus, it seems reasonable to examine both constructs to see how they relate to how children evaluate potentially distorted claims.

A third possible contributor to individual differences in how children evaluate sources of distorted claims relates to an individual difference in adults that has rarely been studied in children—need for cognition. Need for cognition relates to how deeply individuals choose to think about subject matters and the degree to which they enjoy thinking (Cacioppo, Petty, Feinstein, & Jarvis, 1996). Adults high in need for cognition tend to think more complexly about decisions (Fletcher, Danilovics, Fernandez, Peterson, & Reeder, 1986; Verplanken, Hazenberg, & Palenéwen, 1992) and are better at coping with persuasive testimony (e.g., Cacioppo et al., 1996). Importantly, need for cognition is not merely an intellectual ability but also a motivational one; thus, although it relates modestly to intelligence in some studies, it is a separate construct (e.g., Cacioppo & Berntson, 1994). In other words, even if a person is not particularly intelligent, if he or she has a strong drive to think deeply and reports enjoying thinking, that person may perform better on tasks that involve critical thinking.

To date, there is little research using need for cognition with children under 10 years of age. The most closely related research is with 10- to 13-year-olds, finding that need for cognition scores related to children's ability to favor accurate, analytic-based responses over inaccurate, heuristic-based ones (Kokis, Macpherson, Toplak, West, & Stanovich, 2002). In other words, children with higher need for cognition were better at evaluating information. Although this is an interesting finding, it is difficult to say whether need for cognition is relevant earlier in childhood. That said, based on this research, it seems plausible that children with high need for cognition may be better at evaluating claims.

Understanding developmental and individual differences in children's recognition of distorted claims is an important issue given that evaluating social sources may help children to arm themselves against misleading information, yet little research has investigated this issue. Therefore, the current study tested 6- to 9-year-olds in a battery of tasks to examine the role of developmental and individual differences in children's recognition of distorted claims. We predicted developmental improvements in children's ability to recognize that someone might provide a distorted claim and to explain their reasoning. Moreover, we anticipated that there might be some differences between distortion types, although we did not have any specific expectations prior to conducting the study given that biased decisions, self-reports, and persuasive claims had not been examined simultaneously with the same paradigm. But beyond those developmental differences, we expected that social cognitive skills, intelligence, and need for cognition would significantly relate to children's ability to detect and explain reasons to be skeptical.

Method

Participants

Participants were 70 6- and 7- year-olds (M_{age} = 6.9 years, *SD* = 0.59, range = 6.0–7.9; 38 girls and 32 boys) and 60 8- and 9-year-olds (M_{age} = 9.0 years, *SD* = 0.58, range = 8.0–10.1; 20 girls and 40 boys) recruited from the greater north Dallas area of Texas in the southern United States. Demographically, 79% of the participants identified as Caucasian, 10% as Asian, 10% as Black or African American, and less than 1% as other races.

Procedure

Children were tested individually in a single 40- to 60-min audio-recorded laboratory session. Children received a certificate and small toy for participating, and their caregivers received either a $20 gift card or credit in an introductory psychology class.

Measures were presented in a fixed order, as is typical in individual difference research (see Carlson & Moses, 2001). The fixed order was as follows: Wechsler Abbreviated Scale of Intelligence (WASI) Matrix Reasoning, Distortion task, need for cognition (NFC), WASI Vocabulary, and a social cognition measure (ITOM task). Each measure is described in detail in the following section.

Measures

Wechsler Abbreviated Scale of Intelligence

IQ was measured with the WASI (Wechsler, 1999). For this study, the WASI was composed of two subtests (Matrix Reasoning and Vocabulary). These two subtests are recommended for estimating general cognitive functioning (full scale IQ, FSIQ) within 15 min or less when time is a major constraint (Wechsler, 1999), as it was in the current study. The Matrix Reasoning section required children to look at a matrix of drawings from which a section was missing and to complete the matrix from one of a set of options. The Vocabulary section required children to define words (e.g., what is a flashlight?). The raw scores of the two subtests were converted to standardized *T* scores, and these scores were added together and converted to an FSIQ score (*M* = 100, *SD* = 15) that had been normed from a large sample of children.

Distortion task

The Distortion task focused on children's understanding of four different kinds of claims: biased decisions, flawed self-reports, persuasive claims, and informative claims (included to determine whether children recognized that some claims were likely to be accurate). In total, there were six item types: two related to biased decisions (bias toward best friend, bias against worst enemy), two related to flawed self-reports (comparative self-report, evaluative self-report), one related to persuasive claims, and one related to informative claims. For each item type, two stories were included; thus, children heard 12 stories. Children received one of six pseudorandom orderings of these stories (i.e., the order in which the 12 stories were presented was determined using randomizing software).

The wording of the questions was modeled on a study by Heyman and Legare (2005). For each item type, children were told some background information (e.g., for evaluative self-report, "Honest people tell the truth and keep their promises.") and were then asked two follow-up questions. The first follow-up question focused on whether asking someone was a good way to find out information (e.g., "Is asking someone how honest they are a good way to find out how honest they are?"). Children could answer *yes, no,* or *maybe* for each story. Responses to these questions served as the Detection score. For the two stories focused on informative claims, children were given full credit (1 point) for saying that asking the informant would be a good way to find out that information, partial credit (0.5 points) for saying *maybe,* and no credit (0 points) for saying *no.* For the other 10 stories, children were given full credit (1 point) for saying that asking the informant would *not* be a good way to find out that information, partial credit (0.5 points) for saying *maybe,* and no credit (0 points) for saying *yes.* For each item type, we calculated the number of full credit, partial credit, and no credit responses (out of a maximum of 2 per item type overall). We also calculated an overall Detection score that consisted of adding up the scores for all 12 stories (with a possible range of 0–12 points).

The second follow-up question was, "Why do you think that?" Responses to this question served as the Explanation score. Children's explanations for their responses were transcribed and then coded in detail. The codes were then converted into scores based on the accuracy of the explanations regarding reasons to be skeptical (or, in the case of the informative claim, to be trusting) of that claim. As with the Detection score, children received full credit (1 point) for having an accurate explanation, partial credit (0.5 points) for having a partially accurate explanation missing some information, and no credit (0 points) for being off-track or otherwise inaccurate. Again, for each item type, we calculated the number of full credit, partial credit, and no credit responses (out of a maximum of 2 per item type overall). We also calculated an overall Explanation score that consisted of adding up the scores for all 12 scores (possible range of 0–12 points). Details on the item types and explanation codes are described below, and the full item set (along with all other measures except the WASI) are included in the Online supplementary material.

All explanations were transcribed and coded by two coders. To assess interrater reliability, 25% of the sessions were transcribed by both coders. Agreement was 98.7%. Disagreements were resolved through discussion.

Biased decisions. Children were asked questions about two types of biased decisions: bias toward a best friend and bias against a worst enemy (Mills & Grant, 2009; Mills & Keil, 2005). For instance, children were presented with a story about a character in a contest (e.g., "James is in an art contest. Whoever draws the best picture will win a prize.") and were asked about the validity of having a best friend or a worst enemy judge the contest (e.g., "Is having James's worst enemy judge the art contest a good way to decide who will win the art contest?").

Children received full credit for correctly explaining that the judge might make a biased decision and might not allow for equal opportunities for others (e.g., "No, because he'll pick his friend and that's not fair to other people."). Partial credit was given for a response that discussed that a judge might pick someone who matches his bias without mentioning fairness or anything about others (e.g., "She will pick her even if she did the baddest."). Irrelevant responses, or ones that showed that children thought the judge would be fair or that a biased decision is okay, received no credit (e.g., "Because the enemy will pick whoever draws best.").

Self-reports. Children were asked questions about two types of self-reports: evaluative and comparison (Heyman & Legare, 2005). As noted earlier, people tend to want to be seen positively for traits that might be considered as highly evaluative (e.g., intelligence), and they may be more comfortable seen anywhere along the spectrum for traits that are more comparative (e.g., outgoing). By 10 years of age (if not earlier), children tend to be skeptical toward evaluative self-reports (which they believe are likely to be skewed) and more accepting of comparison self-reports (which are more likely to be accurate). The current study used items from prior research (Heyman & Legare, 2005): the evaluative self-reports focused on the characteristics *smart* and *honest*, and the comparative self-reports focused on the characteristics *outgoing* and *nervous*. Children were presented with personal characteristics and their definitions. Then they were asked whether or not they would endorse someone's self-report on that quality. For instance, children were told, "Honest people tell the truth and keep their promises. Is asking someone how smart they are a good way to find out how smart they are? Why do you think that?"

Children received full credit (1 point) for correctly explaining that people may distort information about their own characteristics (e.g., "Because they might tell you the truth and they might not."). For comparison traits, children also received full credit (1 point) for noting that it may be helpful to ask the person because doing so is more likely to gather accurate information regarding comparative nonevaluative traits (e.g., "Because they know how outgoing they are."). To receive partial credit (0.5 points), children's responses indicated that it would be inappropriate to ask someone about his or her own qualities (e.g., "Because it's not really your business to ask. So maybe there's a different way that you can do it, like by watching their body language."). This kind of response received partial credit because children were demonstrating some recognition that it is inappropriate to ask a question that someone might not be able or willing to honestly answer but did not explicitly state that information. Responses that showed no understanding of distortion or inappropriateness of the question did not receive any credit (0 points) (e.g., "Because you can tell if their shirt is really sweaty.").

Persuasive claims. Children were presented with a story about a character looking for information about which type of product to buy (e.g., guitar, computer; Moses & Baldwin, 2005). They were then told that another character sold only one type of product in his or her store and that this character needed to sell a lot of his or her product that week in order to make money. Then they were asked whether that salesperson would be an appropriate person to ask for information when deciding which product to buy.

Children received full credit for explaining that the salesman might make biased or deceptive claims about his product (e.g., "Probably because one costs $5 and the rest cost $4 and she wants a lot of money so she'll give her the one that costs $5."). Partial credit was given for responses that showed children understood the informant's qualities but did not connect these qualities to the accuracy of the information (e.g., "Because he only has one kind of guitar."). Responses that showed children would expect accurate information or that were not relevant received no credit (e.g., "Because he knows a lot about guitars.").

Informative claims. The informative claims were modeled similarly to the persuasive claims in that a character who wanted to buy something was introduced. However, children were told that the second character knew about many different types of the product and that he or she taught lessons on how to use that product (e.g., "Linda teaches a computer class and knows a lot about a lot of different kinds of computers."). Informant accuracy could be inferred from the description provided given that previous research suggests that children trust claims made by someone described as being knowledgeable about a topic (e.g., Landrum, Mills, & Johnston, 2013).

Children received full credit for explaining that the character had expertise and would provide helpful information about the products (e.g., "Because she knows a lot about computers, and if she knows one kind of computer freezes a lot when online . . . you can ask her about that and she will probably answer."). Partial credit was given if children understood that the informant had knowledge but did not indicate that this knowledge would be helpful (e.g., "Because she knows a lot about them."). Irrelevant responses or responses where children explicitly stated that the informant would not be helpful received no credit (e.g., "Because there are only two kinds: Mac and PC. They basically have the same functioning but not the same programming.").

Need for cognition

To examine NFC, participants were presented with a nine-item scale adapted for middle to upper elementary school-aged children by Kokis and colleagues (2002) (the 18-item adult scale was described by Cacioppo et al., 1996). Items focused on interest in thinking and learning (e.g., "I like to spend a lot of time and energy thinking about something," "It's really cool to figure out a new way to do something."). Children indicated whether they *really agreed, sort of agreed, sort of disagreed,* or *really disagreed* with each item. Items were scored on a 4-point scale where higher scores indicated a greater need for cognition. Questions 3, 5, 7, and 9 were reverse scored, and total scores could range from 9 to 36 points.

Interpretive theory of mind

The ITOM task is an advanced social cognition measure based on research by Carpendale and Chandler (1996; for other research using this task, see Brown, 2006; Ross et al., 2005). It was designed to measure children's understanding that ambiguous information can be interpreted in different ways. Children were presented with nondescript line drawings of three characters who had different opinions about the meaning of three different types of ambiguous claims: an ambiguous figure, lexical ambiguity, and ambiguous referential communication. For example, for the *ambiguous figure*, after ensuring that children could see that a picture looked like both a rabbit and a duck, children were told that two people were trying to decide what the drawing depicted. One person reported that the drawing was of a duck, and the other person reported that the drawing was of a rabbit.

Each ambiguous claim was followed by three types of questions. *Explanation questions* assessed children's understanding that it is okay for two people to interpret the ambiguous information differently (e.g., "Why does one person say it's a duck and the other person say it's a rabbit? Does it make sense for one person to say it's a duck and the other person to say it's a rabbit? Why does [doesn't] it make sense?"). *Prediction questions* assessed children's understanding that it is impossible to anticipate how a third party, a new person, will interpret the stimuli because it is ambiguous (e.g., "Will a new person think it's a rabbit, or are you not sure what they will think? How can you tell what they will think? [or] Why is it hard to tell what they will think?"). *Deviant interpretation questions* assessed children's understanding that there are limits to the manner in which ambiguous stimuli can be interpreted. Children were introduced to a third character and informed about the new character's unrealistic interpretation (e.g., the picture is an elephant). Then children were asked, "Does it make sense for [the new person] to say that [deviant interpretation], or does it not make sense? Why? (or) Why not?"

The three characters were rotated among the three types of ambiguous claims so that the character with the deviant interpretation did not earn a bad reputation.

Children's responses were scored according to criteria adapted from Carpendale and Chandler (1996). For explanation questions, children received 1 point only if they endorsed that the two interpretations were acceptable and explained that differences in interpretation were due to the stimuli being ambiguous (e.g., "Because it can be both a duck and rabbit."). For prediction questions, children received 1 point if they explained why it was difficult to make a prediction or why people might disagree about the best prediction to make (e.g., "You can't tell because it can be both."). For the deviant interpretation questions, children received 1 point if they endorsed that the interpretation did not make sense given the stimuli (e.g., "It doesn't make sense because there is not an elephant.").

Children received 1 point for each correct answer for each of the three ambiguous claims. Thus, children could earn between 0 and 9 points on the ITOM task. Children's responses were scored during the interview by two interviewers. To assess interrater reliability, 25% of the sessions were transcribed and coded independently by one author. Agreement was 99.2%. Disagreements were resolved through discussion.

Results

We first describe the results for the individual measures before turning to the analyses describing the relations among them. Note that no effects of gender were found in any analyses, and so that variable is not discussed further.

Wechsler Abbreviated Scale of Intelligence

Of the 130 total participants, 109 completed the IQ measure.[1] Raw scores for the Vocabulary subsection and the Matrix Reasoning subsection were converted into a standardized FSIQ score for analysis. The mean FSIQ was 111.36 ($SD = 16.04$), and younger children's scores were not significantly different from older children's scores, $t(107) = 0.95$, $p = .34$, $d = 0.18$ (younger children: $M = 109.91$, $SD = 14.73$; older children: $M = 112.83$, $SD = 17.29$).

Distortion task

There were two types of scores obtained in the Distortion task: Detection scores and Explanation scores. The first set of analyses focused on the Detection scores, which involved answers to the

[1] There were no significant differences between children who completed the IQ measure and children who did not on Detection scores, $t(128) = 0.43$, $p = .67$, $d = 0.08$, or Explanation scores, $t(128) = 1.14$, $p = .26$, $d = 0.05$. Thus, we felt comfortable that the children who completed the IQ measure were not different from those who did not.

question, ‘‘Is asking [person] a good way to find out [answer to question]?’’ For each item type, we calculated the number of full credit, partial credit, and no credit responses (out of a maximum of 2; see Fig. 1).

We used generalized estimating equations to assess the effects of stage and item type on children’s Detection scores (see Hardin & Hilbe, 2012, for more information). Because participants’ responses were ordinal, we specified the distribution to be multinomial with a cumulative logit link function. Item type was treated as a within-participants factor; moreover, we specified the working covariance matrix to possess an exchangeable structure. The initial analysis revealed a main effect of age, Wald $\chi^2(1) = 34.53$, $p < .001$, and a main effect of item type, Wald $\chi^2(5) = 249.98$, $p < .001$). There was a trend toward a significant interaction between age and item type, Wald $\chi^2(5) = 9.01$, $p = .11$.

To break down the interaction between age and item type, we performed simple slope analyses for the effect of age (effects coded such that 1 = younger and 1 = older) at different levels of item type. Older children were more likely than younger children to respond correctly for the best friend bias item type ($b = .72$, $SE = .16$, $p < .001$, odds ratio [OR] = .49, confidence interval [CI] = 0.36–0.66), the comparative self-report item type ($b = .63$, $SE = .14$, $p < .001$, OR = 0.53, CI = 0.41–0.69), the evaluative self-report item type ($b = .64$, $SE = .14$, $p < .001$, OR = 0.53, CI = 0.40–0.70), and the persuasive self-report item type ($b = .65$, $SE = .15$, $p < .001$, OR = 0.52, CI = 0.39–0.70). In contrast, older children and younger children performed similarly for the worst enemy bias item type ($b = .28$, $SE = .26$, $p = .18$, OR = 0.76, CI = 0.51–1.13) and for the informative claim item type ($b = .21$, $SE = .18$, $p = .26$, OR = 0.82, CI = 0.57–1.16).

One potentially helpful way to examine the Detection scores is by making comparisons with scores that would be expected from chance responding. Summing across the two stories for each item type led to a possible maximum score of 2 (with scores potentially ranging from 0 to 2), where higher numbers indicated better explanations of reasons to doubt. A total of 1 for an item type would suggest that children were unsure regarding whether or not the person would be a good source of information (i.e., either answered *maybe* for both items or answered *yes* for one item and *no* for the other). For each age group, then, we compared the scores for each item type with the test value of 1. Younger children were

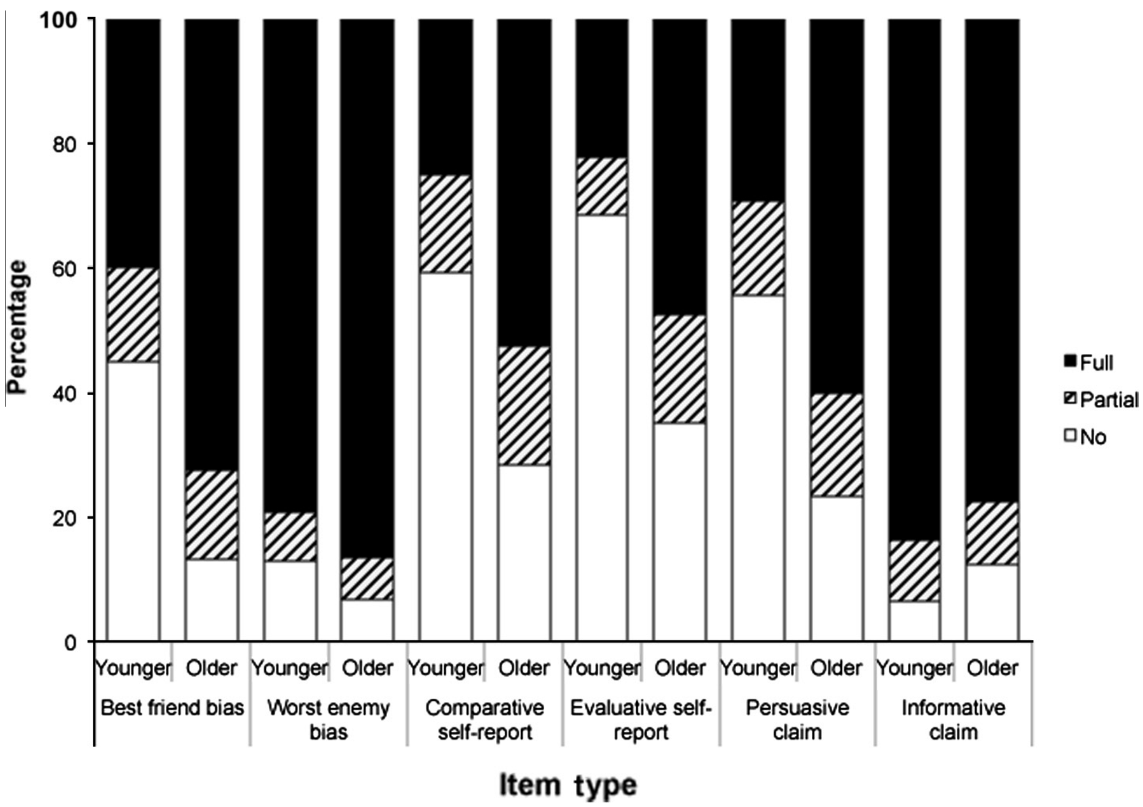

Fig. 1. Percentages of responses receiving full, partial, and no credit for the Detection score for each item type for younger and older children.

more accurate than chance for the informative claim and worst enemy bias items (both $ts > 9.00$, $ps < .01$) and at chance for the best friend bias item, $t(69) = 0.512$, $p = .61$. For the other three items (comparative self-report, evaluative self-report, and persuasive), they performed *below* chance (all $ts > 2.64$, all $ps < .01$). Older children were much more accurate overall, providing accurate responses significantly above chance levels for five of the items (all $ts > 2.72$, $ps < .009$) and at chance only for evaluative self-report claims ($p = .20$).

Our next set of analyses focused on the Explanation score (i.e., answers to the prompt, "Why do you think that?"). Again, for each item type, we calculated the number of full credit, partial credit, and no credit responses (out of a maximum of 2; see Fig. 1). See Fig. 2.

Again, we used generalized estimating equations to assess the effects of age and item type on the accuracy of children's responses. The setup for this analysis mirrored the one for the Detection scores. The initial analysis revealed a main effect of age, Wald $\chi^2(1) = 37.65$, $p < .001$, and a main effect of item type, Wald $\chi^2(5) = 41.52$, $p < .001$. There was also evidence for an interaction between age and item type, Wald $\chi^2(5) = 20.52$, $p = .001$.

To break down the interaction between age and item type, we performed simple slope analyses for the effect of age (effects coded such that –1 = younger and 1 = older) at different levels of item type. Older children were more likely than younger children to provide accurate explanations to the best friend bias item type ($b = .58$, $SE = .15$, $p < .001$, OR = 1.78, CI = 1.32–2.40), the worst enemy bias item type ($b = .35$, $SE = .11$, $p = .002$, OR = 1.42, CI = 1.13–1.78), the comparative self-report item type ($b = .29$, $SE = .15$, $p = .045$, OR = 1.34, CI = 1.00–1.78), the evaluative self-report item type ($b = .91$, $SE = .18$, $p < .001$, OR = 2.48, CI = 1.74–3.53), the persuasive claim item type ($b = .89$, $SE = .18$, $p < .001$, OR = 2.43, CI = 1.71–3.46), and the informative claim item type ($b = .32$, $SE = .15$, $p = .029$, OR = 1.38, CI = 1.03–1.83). The odds ratios were highest in the evaluative claim and persuasive claim conditions, indicating the greatest differences in performance between younger and older children.

Again, another way to examine these data is by comparing with chance levels, with a score of 1 of 2 points for an item type being set as chance (i.e., scoring somewhere equivalent to partial credit on both questions or full credit on one question and no credit on the other question for an item type). Children

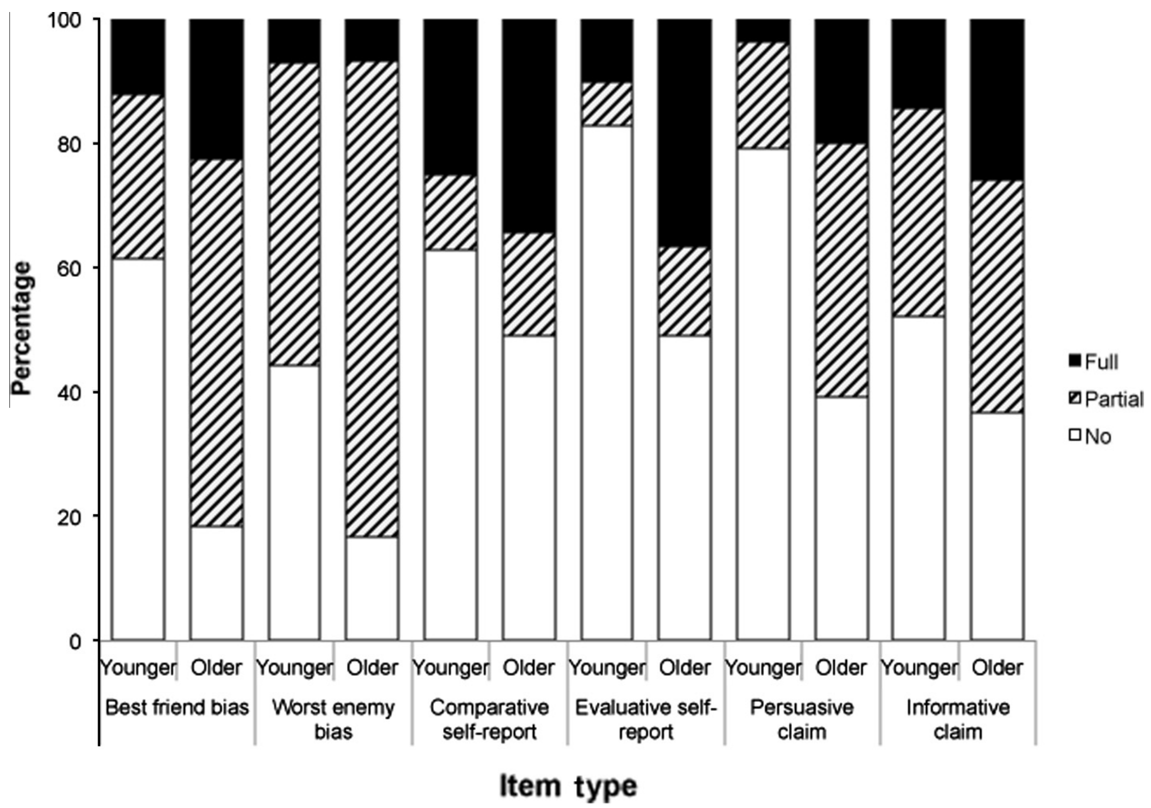

Fig. 2. Percentages of responses receiving full, partial, and no credit for the Explanation score for each item type for younger and older children.

Table 1
Correlations and partial correlations between primary study measures.

	Descriptive statistics						
	M	*SD*	1	2	3	4	5
1. Age	7.88	1.17	–	–	–	–	–
2. NFC	24.69	4.87	.17[†]	–	–	–	–
3. ITOM	6.07	2.16	.36[**]	.20[*](.15)	–	–	–
4. FSIQ	111.36	16.04	.01	.02(.02)	.26[**](.29)[**]	–	–
5. Detection scores	7.45	2.26	.62[**]	.26[**](.17)[†]	.38[**](.21)[*]	.16(.23)[*]	–
6. Explanation scores	3.99	2.46	.54[**]	.26[*](.13)	.38[**](.26)[**]	.37[**](.50)[**]	.60[**](.45)[**]

Note. Partial correlations controlling for age are shown in parentheses.
[†] $p < .10$.
[*] $p < .05$.
[**] $p < .01$.

were not providing strong explanations overall; younger children were performing lower than chance levels (i.e., 1) on all of the items (*ts* > 4.90, *ps* < .001), and older children were performing at chance levels for all items except persuasive claims, for which they performed lower than chance, $t(59) = 2.19$, $p = .03$, $d = 0.57$. In other words, younger children were earning between no credit and partial credit for their explanations for each item type on average, and older children were earning approximately partial credit for each item type on average (except for persuasive claims, where they performed worse).

In sum, there were clear developmental improvements; older children outperformed younger children for nearly all claims at recognizing that a claim may be distorted (i.e., the Distortion score) and for all claims at explaining how that claim may be distorted (i.e., the Explanation score). But there were also some interesting item type differences. For the Explanation scores, the largest differences between younger and older children were for the evaluative self-report and persuasive claim item types. Moreover, performance between children varied drastically. For the Detection score (Cronbach's alpha = .64), scores ranged from 2 to 12 (the maximum possible), with a mean of 7.45 and a standard deviation of 2.30. For the Explanation score (Cronbach's alpha = .71), scores ranged from 0 to 9, with a mean of 3.99 and a large standard deviation of 2.46. No children performed at ceiling (12). The next sets of analyses examine the individual difference variables in turn before examining the relationship between these different measures.

Need for cognition

Of the 130 total participants, 125 completed the NFC scale (Cronbach's alpha = .54). There were no differences between older children ($M = 25.25$, $SD = 4.78$) and younger children ($M = 24.21$, $SD = 4.93$), $t(123) = 1.19$, $p = .24$, $d = 0.21$. Overall, the mean was 24.69 ($SD = 4.87$), with a range from 12 to 36 (maximum possible range of 9–12), demonstrating some variability on this measure in this sample.

Interpretive theory of mind

Of the 130 total participants, 125 completed the ITOM measure. Scores on the composite ITOM measure ranged from 0 to 9 (the full range of the scale), with a mean of 6.07 ($SD = 2.16$). Older children performed better than younger children, as expected ($M_{younger} = 5.50$, $SD = 2.23$; $M_{older} = 6.75$, $SD = 1.88$), $t(123) = 3.36$, $p = .001$, $d = 0.61$.[2]

[2] In the coding scheme developed by Carpendale and Chandler (1996), children received points only for being able to provide an accurate explanation. In our sample, the correlation between scores focusing only on scores based on correct answers to the yes/no questions and scores based on the regular coding scheme was extremely high ($r = .885$, $p < .001$). This suggests that performing well on the ITOM task is not due solely to the ability to provide detailed explanations.

Specifying the relation between the variables

Our next step was to examine the relationship between each of our measures of interest: FSIQ, Detection and Explanation scores, NFC, and ITOM (see Table 1 for correlations). For the Detection and Explanation scores, we used the sum of the scores across the six item types instead of the ordinal data (scores could then range from 0 to 12). Not surprisingly, Detection and Explanation scores were significantly correlated with one another ($r = .60$, $p < .01$). Age was significantly correlated with most measures (marginally with NFC) except the FSIQ.

After controlling for age, partial correlations revealed the following findings. First, Detection scores were significantly correlated with FSIQ ($r = .23$, $p = .02$) and ITOM ($r = .21$, $p = .03$) and were marginally correlated with NFC ($r = .17$, $p = .07$). Second, Explanation scores were significantly correlated with FSIQ ($r = .50$, $p < .001$) and ITOM ($r = .26$, $p = .01$). In other words, the higher children's FSIQ and social cognition scores, the better they were at indicating whether it is a good idea to trust a potentially misleading source and to provide a good explanation for their reasoning.

With that in mind, we also examined what related most strongly to performance on the two Distortion task measures. Thus, we carried out a series of multiple regressions. For both Detection and Explanation scores, age, FSIQ, ITOM, and NFC were entered in one block. For Detection scores, the overall model was significant, $F(4, 100) = 22.95$, $p < .001$. Age was a significant predictor ($\beta = .59$, $t = 7.43$, $p < .001$), and FSIQ was marginally significant ($\beta = .15$, $t = 1.95$, $p = .05$). For Explanation scores, the overall model was also significant, $F(4, 100) = 29.27$, $p < .001$, and both age ($\beta = .55$, $t = 7.41$, $p < .001$) and FSIQ ($\beta = .37$, $t = 5.17$, $p < .001$) were significant predictors. In other words, although ITOM correlates with both Distortion task measures when controlling for age, it does not account for significant variance in scores above and beyond age and FSIQ.[3]

Discussion

This study examined developmental and individual differences in children's ability to recognize and evaluate sources of potentially distorted claims. Our first focus was on developmental similarities and differences on our Distortion task. One aspect of our Distortion task, the Detection measure, asked children simply whether someone would be a good source of information, and we examined the accuracy of their responses. Overall, both younger and older children were accurate on the informative claim items, trusting that someone who was informed about a topic and did not have any vested interest in convincing others to respond in a specific way would be a good source of information. Both younger and older children were also accurate on the worst enemy bias questions, recognizing that someone who is worst enemy of a person competing in a contest might not be a fair judge for that contest. But there were developmental differences on the rest of the items; whereas older children only struggled to detect the possible distortion in evaluative self-reports, younger children struggled to detect the possible distortion in comparison self-reports, evaluative self-reports, and persuasive claims.

That said, we recognize that the yes/no/maybe response that children could give does not provide a complete picture of what children think about those sources. Indeed, it should be much easier to recognize that a claim might be distorted than to explain how that distortion might occur. Thus, we had a second measure of interest in this study—the explanations children provided for whether or not someone would be a good source of information. In general, although children often had some sense that certain individuals might not be a good source of information, they struggled to provide clearly articulated explanations for the reasons to be concerned about those very same sources of information. Older children provided better explanations than younger children on all items, with particularly strong differences observed for the persuasive claim and evaluative self-report item types. But they received, on average, partial credit for five of the six items (performing poorly only on the persuasive claim item). Younger children performed worse, receiving less than partial credit for their

[3] Similar results were found when the Explanation scores were recoded so that children received either full or no credit (i.e., children received no credit for the explanations that had previously received partial credit).

explanations. Importantly, no one did well on this task, but older children were at least closer to receiving full credit for the items than younger children.

Reflecting on the three broader kinds of distorted claims of interest here—biased decisions, skewed self-reports, and persuasive claims—we see several patterns of note. Related to detecting bias, overall, children seemed to find it easiest to detect the possibility of biased decisions (particularly ones made against a worst enemy) and most challenging to detect the possibility of inaccurate self-reports made about evaluative characteristics (e.g., how smart someone is). Related to explaining bias, overall, children seemed to struggle to provide accurate explanations, and inspection of the figures reveals particularly poor performance by younger children for the evaluative self-report and persuasive claim items (for both items, more than 79% of younger children received no credit whatsoever for their explanations).

At least two questions arise from these findings. First, why do children show these particular differences in how they respond to the different types of potential distortions? We believe that examining the characteristics of these distortions provides insight into why some potential distortions are easier to detect than others. For instance, to understand that a judge might not be the best source of decisions about a competition involving his or her worst enemy, children need to recognize that the judge may be motivated to keep the enemy from winning. Plenty of evidence from past research suggests that negative motives like this are apparent to elementary school-aged children (e.g., Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001). In contrast, to understand that a person might not be the best source of information about his or her own level of intelligence or honesty, for instance, children need to understand that people sometimes present partially inaccurate information about themselves to make themselves appear in a positive light, and that is something that children younger than 8 years struggle to understand (e.g., Banerjee & Yuill, 1999).

In other words, to detect the possibility of distortion, it is important to have some sense of the conditions under which someone's claims may be distorted. Although some of this understanding may arise from a general improvement in social cognitive skills (discussed further below), other aspects of this understanding may arise from social experience. For instance, a child purchasing a product that turns out to be poor may lead to a conversation about the motivation of the salesperson, which might help the child to be more skeptical toward salespeople in the future. At least in advertising, there is evidence that specific negative product experience helps children to become more aware regarding the motives of advertisers (e.g., Moore & Lutz, 2000). Additional research needs to explore children's ability to detect different kinds of motivations that might lead to distortion.

Of course, just because a child can recognize that someone is not a good source of information does not mean that the child can articulate why not. Thus, a second open issue from these data is the following: Why are children struggling so much to provide accurate explanations for reasons to doubt these sources of information? Perhaps one reason is that our coding scheme was very conservative. Full credit was given only when children clearly explained the reasons to doubt, focusing not only on the idea that a source might provide inaccurate information but also on *how* that source might provide inaccurate information. In most cases, a majority of older children did not fully articulate reasons to doubt. Although we did not have access to children older than the oldest age group for this project, testing older children in future research would be useful to examine the full range of development on understanding the explanations for reasons to doubt these kinds of sources.

At some level, however, it is not surprising that children struggled to provide solid explanations for their intuitions regarding whether asking these sources was a good way to find out information. First, in many cases, younger children actually believed that asking the questionable sources was a good way to gather information, making it understandable that they would not provide good explanations of why the sources should be doubted. Second, the discrepancy between knowing when to doubt and explaining why someone should be doubted makes sense given some theories about how reasoning works. Indeed, research with adults suggests that there are two systems that we use to make reasoning decisions: a quick intuitive system and a slower reasoning system (e.g., Evans, 2003). Children may be tapping into their intuitive system when answering whether or not they should trust the source, and although those intuitions may be accurate, children might not be able to use their reasoning system to articulate why. Third, it may be quite difficult for children to recognize and/or articulate why these sources of information may be untrustworthy; the ability to do so may require advanced social cognitive skills to recognize the potential intentions of the speaker, advanced language skills to explain their perspective, and/or a strong desire to understand the world that makes them more appropriately skeptical.

Before exploring the skills that aid in the recognition of misinformation, we would be remiss to not point out the crucial role of development in children's understanding of distortion. For all of our item types, for instance, older children were more successful at providing accurate explanations for the distortions than younger children. *Something* is changing across development that tends to make it easier for older children to recognize and explain that someone might be providing a distorted claim. Perhaps older children have more experience with distortion in their lives; for instance, 9-year-olds are probably more likely than 6-year-olds to have experienced some sort of misinformation (e.g., a misleading advertisement), which may make them more likely than younger children to have had the opportunity to discuss misinformation with their parents. To examine this issue, some of our ongoing research examines how parents and children talk about distortion to determine how the input children receive may differ across development and how that input may relate to children's understanding of distortion.

Specific skills may also be changing across development, giving rise to improvements in recognizing and explaining distortion. For instance, older children tend to have more extensive vocabularies than younger children, and so older children may provide better explanations about distortion simply because they have the vocabularies to explain it. Improvements in language production skills might partially explain age differences in Explanation scores (which required full explanations produced out loud), but they would not necessarily explain developmental differences in Detection scores (which required simply saying *yes, maybe,* or *no* as to whether someone would be a good source of information).

To better understand what factors relate to children's ability to recognize and explain distortion, we selected three individual difference measures to investigate in this study: full scale IQ, need for cognition, and interpretive theory of mind. For our Detection measure, when age was held constant, FSIQ and ITOM (and, at marginal levels, NFC) correlated with whether children recognize when information should be doubted. In our regression model, however, age was the only significant predictor, although FSIQ marginally predicted children's accuracy. For our Explanation measure, when age was held constant, both FSIQ and ITOM correlated with the accuracy of children's explanations for reasons to doubt certain sources. In the regression model, age and FSIQ were the only predictors. In other words, although ITOM correlates with both Distortion task measures when controlling for age, it does not account for significant variance in scores above and beyond age and FSIQ.

So what does this all mean? First, NFC correlated marginally with Detection scores even after controlling for age. We believe that that this is a promising finding. Given that the current study is the first to explore NFC with this age group, and given that adults with higher NFC tend to perform better on a number of different aspects of critical thinking and source evaluation tasks than those with lower NFC (Cacioppo et al., 1996), we believe that this construct is worthy of further exploration. For instance, it is possible that NFC, or the interest in engaging in effortful cognitive activity, relates to the concept of *explanatory curiosity*—how much children desire to engage in exploratory behavior to learn about something new (Jirout & Klahr, 2012). Perhaps children with a greater desire to learn new things are also motivated to seek accurate information, which may relate to greater appropriate skepticism. That said, one weakness in the current study is that there were no NFC measures available designed intentionally for use with 6- to 10-year-olds, and so a version of the NFC scale meant for 10-year-olds was used here. Although this measure is a first pass at examining interest in engaging in deep thinking in this age group, further research is needed to examine how best to measure 6- to 10-year-olds' interest in thinking deeply. This study demonstrates that there is reason to examine this further.

Second, to our knowledge, this is the first research to demonstrate that intelligence plays a significant role in how children articulate reasons to doubt sources of information. Given how important intelligence is for other aspects of cognitive development, it is astonishing that so little research has examined the role it plays in how children evaluate information. Although the current study found a relationship between IQ and children's ability to know that a source might be worthy of skepticism, the specific reasons for this relationship are unknown. Perhaps children with higher IQs are better at attending to complex stories and/or articulating the reasoning behind their judgments. Another possibility is that children with higher IQs have a better understanding of the reasons to doubt claims that may be distorted. Although the former possibility focuses on verbal ability in particular, which is most primarily related to providing explanations for reasons to be skeptical, the latter possibility may be demonstrated more implicitly. Additional research on this issue using different kinds of explicit and implicit tasks is crucial.

Third, it is apparent that advanced social cognition also relates to children's ability to explain why someone may provide inaccurate information, although not above and beyond IQ, for these specific Distortion tasks. The ITOM measure used here focuses on one component of social cognitive skills—the ability to recognize that two people can interpret the same piece of information in different ways. It is clear that this ability to understand the role of different perspectives on interpretation is an important aspect of social cognitive development, and it makes sense that children might not understand how people's claims can be distorted until they understand that individuals can make different claims based on different perspectives. Still, there are other aspects of social cognition that change during the elementary school years that may also be relevant such as the ability to understand more complicated beliefs and intentions. At around 6 or 7 years of age, for example, children recognize second-order mental states (e.g., Courtney does not know that Sam knows his flight has been rescheduled; e.g., Miller, 2009). Although this clearly connects to ITOM, it is slightly different; ITOM focuses on recognizing that two people can think differently about the same thing, whereas second-order mental state reasoning focuses on understanding the thoughts one person may have about someone else's thoughts and beliefs. In fact, Miller (2009) suggested that understanding second-order mental states may be quite important for understanding some kinds of distortion such as persuasion (e.g., recognizing that a customer might not know that the salesperson is thinking about purposefully focusing on one aspect of a product to cover up a negative feature). Future research will be needed to examine how other aspects of advanced social cognition may relate to children's ability to understand distortion.

Finally, it is also important to note that the direction of causality between these individual difference measures and the ability to detect distortion is unknown. For instance, although we suggest that having a higher IQ may make it easier to detect distortion, it is also possible that the causal relationship may work the other way; children who are better at detecting distortion and better at filtering out misinformation may be more likely to obtain accurate information. In the long run, this ability to filter out misinformation may lead these children to have more accurate knowledge and to actually be more intelligent. Longitudinal research should shed light on this relationship.

In sum, there are significant developmental differences in children's ability to recognize and explain when a source of information should be doubted. Some of these developmental changes may relate to the kind of information being evaluated; after all, some ways that information can be skewed are easier than others to detect. But beyond these developmental differences, there are also clear individual differences; both general intelligence and social cognitive skills play some role in how children evaluate potential sources of distorted claims. Thus, when deciding who to trust, it may be important to be both smart and savvy.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.jecp.2014.01.015.

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