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The Effect of Generic Statements on Children's Causal Attributions: Questions of Mechanism

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Generic statements, or generics, express generalizations about entire kinds (e.g., "*Girls* are good at a game called 'tooki'"). In contrast, nongeneric statements express facts about specific (sets of) individuals (e.g., "*Jane* is good at tooki"). Aside from simply conveying information, generics and nongenerics also instill different causal perspectives on the facts expressed, implying that these facts stem from deep, inherent causes (e.g., talent) or from external, mechanistic causes (e.g., instruction), respectively. In the present research (with samples of 4- to 7-year-olds and undergraduates, $N = 220$), we proposed that children's causal attributions for the facts learned through these statements are determined not by the generic/nongeneric format of the statements themselves but rather by the generic/nongeneric format of the *beliefs* relevant to these statements. This proposal led to two specific predictions. First, the influence of the generic belief induced by a novel generic statement should be detected in any subsequent context that falls under its scope—even in circumstances that involve particular individuals. Confirming this prediction, participants often attributed a fact conveyed in a nongeneric statement (e.g., a particular girl's tooki ability) to deep, inherent causes if they had previously formed a relevant generic belief (e.g., by hearing that girls are good at tooki). Second, we predicted that nongeneric statements such as "*Most girls* are good at tooki" should also promote attributions to deep causes because they often ultimately give rise to generic beliefs, as suggested by recent evidence. This prediction was confirmed as well. These results clarify and expand our knowledge of the influence of language on children's understanding of the world.

Keywords: generic statements, quantified statements, causal reasoning, essentialism

Humans have a distinctive desire to understand their environments (e.g., Gopnik, 1998; Kelley, 1973; Lipton, 2004; Wilson & Keil, 2000). Rather than settling for purely descriptive knowledge of the world, people are often motivated to understand why the world is the way it is. Essential to this quest is the ability to reason about causes. Discovering the cause of an event or state seems to deepen our understanding of it to an extent unparalleled by most other information we could gather about it.

Owing to their role in understanding, causal attributions can alter the very core of our concepts, down to the level of ontology (i.e., the kind of thing something is believed to be). Consider headaches, for example. If you believe, as it appears our Stone Age ancestors did, that headaches are caused by demons trapped in your skull (Friedman, 1972), this phenomenon becomes the province of the supernatural. Reflecting this ontological assignment, the most popular treatments for headaches in prehistoric times seem to have included performing ritual incantations and cutting holes in the skulls of those affected to allow the demons to escape. Our current understanding of the causes of headaches leads us to categorize them as a biological phenomenon instead, and the treatments deemed effective reflect this understanding. Or, to take another example, causal attributions for success in a domain (e.g., math, sports) have a tremendous impact on one's subsequent thinking and behavior (e.g., Cimpian, 2010; Cimpian, Arce, Markman, & Dweck, 2007; Dweck, 1999, 2006). Attributing good performance to a talent or "gift" frames it as a biological fact, as a matter of innate genetic endowment. On this view, there is relatively little one can do to control future outcomes, since it is largely one's biological inheritance that dictates whether one will succeed or fail. In contrast, attributing good performance to sustained effort and good strategies gives it a different meaning. That is, success becomes a matter of engaging in the right behaviors—the outcome of a mechanistic process that anyone can undertake—rather than of possessing the right gift.

In this article, we examine an important linguistic influence on the process of causal attribution and thus on the concepts that are shaped by these attributions. Specifically, we focus on the effect of generic statements. A statement is generic if it makes a claim about a kind as a whole (e.g., "*Girls* are good at a game called 'tooki'") and is nongeneric otherwise (e.g., "*Some girls* are good at tooki," "*Jane* is good at tooki"). Several studies have now demonstrated that children as young as 4 invoke different causes for facts learned from generic

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and nongeneric statements (Cimpian & Cadena, 2010; Cimpian & Markman, 2009, 2011). Although whether a statement refers to a kind is not overtly relevant to the causal source of the facts described in it, children seem to use this feature of a statement's meaning to make inferences about underlying causes. These causal inferences or attributions, in turn, tend to change how children understand the facts they learn.

Since children acquire much of their knowledge through language (e.g., Gelman, 2009; Harris, 2002), the impact of the generic/nongeneric distinction on children's causal understanding of the world may be extensive. The fact that generic statements are commonplace in child-directed speech (Gelman, Chesnick, & Waxman, 2005; Gelman, Coley, Rosengren, Hartman, & Pappas, 1998; Gelman, Goetz, Sarnecka, & Flukes, 2008; Gelman & Tardif, 1998; Gelman, Taylor, & Nguyen, 2004), along with children's early developing ability to comprehend them (Cimpian & Markman, 2008; Cimpian, Meltzer, & Markman, in press; Gelman & Raman, 2003), further underscores the potential importance of the relationship between this linguistic distinction and children's causal attributions.

We begin with a brief review of the existing evidence suggesting that the generic/nongeneric distinction shapes children's attributions. We then describe a potential mechanism by which generic and nongeneric statements affect children's causal attributions and test two key predictions of this account.

Generics and Causal Attributions: The Evidence

When learning about novel features of living things, 4- and 5-year-old children are more likely to attribute functional, life-sustaining powers to these features if they are introduced via generic than via nongeneric statements (Cimpian & Markman, 2009). For example, when children were told that *snakes* have holes in their teeth, they explained the presence of the holes by invoking the functions they could fulfill: allowing snakes to "swallow things," or to "chew better," or to "drink the blood out of predators." In contrast, framing this feature as characteristic of *a particular snake* led to a different pattern of causal attributions, dominated by appeals to prior, often accidental, causes. For example, one child thought the holes were caused by bug bites ("A bug came in its room, and it bited his teeth"), while another thought they were caused by food ("Maybe it's because it eats so much little stuff").

Cimpian and Cadena (2010) extended this conclusion to the domain of artifacts. When features of unfamiliar artifacts were introduced via generic statements, 5-year-olds often conceptualized them as functional aspects of the artifacts' intended design. For example, when they were told that *dunkels* are sticky, children often believed that dunkels were actually made that way (sticky), and they attributed the stickiness to a function dunkels were meant to perform (e.g., they are sticky "so that drinks don't fall and stay on"). When the same properties were framed nongenerically (e.g., "This dunkel is sticky"), their meaning changed. For example, children understood the stickiness not in terms of functions but in terms of prior mechanistic causes other than the creator's intent (e.g., "'cause the dog chewed on it").

Novel information about other people is also understood differently depending on the generic/nongeneric format in which it is introduced (Cimpian & Markman, 2011). For example, when an ability is said to characterize an entire social kind (e.g., "Boys are good at a game called 'gorp'"), preschoolers think of it as stemming from deep, essential traits of the category (e.g., "'cause boys grow up fast," "maybe 'cause they are stronger than girls"). This ability is thus understood in quasibiological terms, as part of boys' inherent endowment. In contrast, when the same ability is introduced via a nongeneric statement (e.g., "There's a boy who is good at a game called 'gorp'"), preschoolers attribute it to effort and practice much more frequently than in the generic case (e.g., "because he practiced a lot of times," "maybe he learned at school"). By promoting effort attributions, the nongeneric context leads to an understanding of this novel ability as the malleable outcome of a process that is under children's control rather than as a fixed biological reality.

The Present Research

In what follows, we propose a partial account of the process by which the generic/nongeneric distinction shapes children's attributions. The central claim is that children's causal attributions are determined not by whether the statements being explained are generic or nongeneric but instead by whether the *beliefs* relevant to these statements are generic or nongeneric. These beliefs may consist of information previously stored in semantic memory and activated by the current statements, or they may be constructed in the moment on the basis of the statements' meaning, the context, children's naive theories, and so on. Either way, we hypothesize that it is the generic/nongeneric format of these beliefs, and not the generic/nongeneric format of the language per se, that is the proximal cause of children's attributions.

Of course, the genericity of a statement and the genericity of the corresponding beliefs often coincide. For example, a child who was exposed to a novel generic statement such as "Girls are good at a game called 'tooki'" would probably also form a generic belief that girls, as a kind, are good at tooki. Thus, any explanations that the child generated for girls' tooki ability in this context would not allow researchers to distinguish between the *belief-proximal* account we proposed and the alternative, *language-proximal* account (according to which the generic/nongeneric format of the statements being explained is the proximal cause of children's attributions): Because the language and the resulting belief are both generic in this context, both accounts predict that children would attribute girls' tooki ability to their inherent talents (Cimpian & Markman, 2011). Thus, in order to adjudicate between these two accounts, it was necessary to create a task context in which the language and the corresponding beliefs differed in genericity. To illustrate, imagine that the child who was told that girls are good at tooki (and formed the corresponding generic belief) later heard a statement about a particular child, such as "Jane is good at tooki." Although this statement is nongeneric, it is consistent with the prior generic belief that *girls* are good at tooki and is thus most likely assimilated under its scope.[1] Thus, on the belief-proximal account, Jane's ability should be attributed to an inherent talent because the causal attribution process operates on the resulting belief, which in this case is generic. In contrast, on the language-proximal account, the causal attribution process operates locally,

[1] In contrast, a generic statement (e.g., "Girls are good at tooki") would most likely cause a prior *nongeneric* belief (e.g., that Jane and Katie are good at tooki) to be updated to generic format. However, because both the statement under consideration ("Girls are good at tooki") and the resulting belief are generic here, this context cannot differentiate between the language-proximal and belief-proximal accounts.

on the meaning of the nongeneric statement about Jane's tooki ability, and thus the more probable attribution would be to effort and practice. We elaborate this pair of contrasting predictions in the next section. We then go on to derive a second set of predictions that distinguish between the belief-proximal and the language-proximal accounts.

Predictions

The first prediction of the belief-proximal account: Generic statements affect attributions even in nongeneric contexts. According to the belief-proximal hypothesis, the factor that determines children's causal attributions for a property is the genericity of children's beliefs on the topic (e.g., whether they believe that math ability is a feature of boys in general or a feature of particular boys) and not the genericity of the statement in which this property is heard at the particular point in time when the attribution is generated (e.g., whether children hear "Boys are good at math" or "Johnny is good at math"). If this hypothesis is correct, then one would expect a novel generic statement such as "Girls are good at a game called 'tooki'" to leave its mark, via the generic belief it induces, on children's causal attributions in a broad range of subsequent contexts—more precisely, in any contexts that fall under the scope of the represented generic belief. In other words, features learned from generic statements such as "Girls are good at tooki" should be attributed to essential factors not just in contexts where children are reasoning about these statements per se or about the kind generalizations to which they refer. According to our belief-proximal hypothesis, even circumstances that involve specific individuals displaying these features (e.g., seeing a particular girl doing well at tooki, or hearing "Jane is good at tooki") may lead to such essentialized attributions because these circumstances are likely to activate the relevant generic beliefs from semantic memory. This is, in fact, our first prediction: that the generic beliefs induced by generic statements will affect children's attributions when they later have to reason about *particular cases* that match the content of these beliefs.

To elaborate, we hypothesized that when children encounter a situation or event that can be subsumed under an existing generic belief, they will understand what has occurred through the lens of this belief. That is, they will conceptualize the situation as a particular instance of the relevant generic pattern and thus as the product of the same (essential, inherent) causes that are responsible for this pattern. For example, the generic belief that girls are good at tooki will color children's understanding of any particular girl's success and will lead them to attribute it to her natural abilities rather than to hard work more often than they would have in the absence of a generic belief about girls' tooki ability.

Prior evidence suggesting that generic beliefs are robust is relevant to this prediction. Most notably, the genericity of a fact seems to be an integral aspect of its representation in long-term semantic memory, even for 3-year-olds (Gelman & Raman, 2007; see also Cimpian et al., in press). Generic beliefs are also particularly resistant to counterevidence (e.g., Abelson & Kanouse, 1966; Chambers, Graham, & Turner, 2008; Cimpian, Brandone, & Gelman, 2010), which adds to their staying power and thus to their potential ability to influence children's causal inferences down the line.

To investigate this first prediction, we devised a two-step task. In Step 1, we introduced a novel piece of information in either generic (e.g., "Boys/Girls are really good at a game called 'tooki'") or nongeneric (e.g., "There's a boy/girl who is really good at a game called 'tooki'") format. In Step 2, which was identical for all children, the experimenter showed children a picture of a single child and said, "This boy/girl is also really good at tooki." Children were then asked to explain this nongeneric fact, and their explanations were used to determine what causal attributions they made for it. This second step was designed to unconfound the genericity of the beliefs induced in Step 1 from the genericity of the statements that children were asked to explain. If generic statements license generic beliefs that in turn affect the causal attributions generated in subsequent nongeneric contexts that fall under the scope of these beliefs, then children who heard generics in Step 1 should be more likely to attribute the ability of the individual in Step 2 to deep, essential traits (e.g., he/she is good because he/she is talented) than children who heard nongenerics in Step 1. On the language-proximal account, however, children's attributions should be identical across the generic and nongeneric conditions: On this account, the factor that determines children's attributions is whether the statement currently under consideration is generic or nongeneric, and in Step 2 all children were asked to explain the same nongeneric statement.

To clarify some terminology, our use of the terms *deep* and *essential* is rooted in the theory of psychological essentialism (e.g., Bloom, 2004; Gelman, 2003; Medin & Ortony, 1989). An important claim of this theory is that the features of a concept differ in terms of their depth or centrality. Although there is no universally accepted account of what makes one feature more central than another, a plausible hypothesis is that a feature's depth/centrality is a function of the number of other features it causes or otherwise constrains (e.g., having a Y chromosome is a deeper feature than having a prominent Adam's apple; Ahn, Kim, Lassaline, & Dennis, 2000; Medin & Ortony, 1989; but see Rehder & Hastie, 2001). The most central feature is the *category essence*, the ultimate causal source of all typical features of a category. Although there is a single essence, features on the deep/central side of the continuum are often known as *essential* (e.g., Gelman, 2003; Gelman & Wellman, 1991). These essential features are not the essence per se, but they are essence-like in that they are judged to be important for category membership (e.g., Gelman & Wellman, 1991; Keil, 1989) and to be causally responsible for many peripheral properties (Ahn et al., 2000, 2001; Gelman & Wellman, 1991).

Thus, our first prediction is that children's explanations for nongeneric facts that fall under the scope of prior generic beliefs will more often invoke features that are deep and essential—in the previously described sense—or will otherwise reveal that children understood these nongeneric facts as being deep and essential.

The second prediction of the belief-proximal account: Generic statements are not unique in their effect on causal attributions. Our belief-proximal account also motivates the following prediction: If it is the generic or nongeneric format of the beliefs that drives causal attributions, then any statement that induces generic beliefs should lead to essentialized attributions, regardless of whether the statement itself is generic or nongeneric. Although generic statements are certainly able to induce generic beliefs, they may not be unique in this respect. Specifically, some nongeneric statements (e.g., "*Most girls* are good at tooki") may also license generic beliefs, which should in turn give rise to essentialized attributions.

This prediction is supported by recent evidence that nongeneric statements quantified with "most" and "all" are often (mis)interpreted as expressing generalizations about kinds (Hollander, Gelman, & Star, 2002; Khemlani, Leslie, Glucksberg, & Rubio-Fernandez, 2007; Leslie & Gelman, 2011). For example, Leslie and Gelman's recent data suggest that both preschool-age children and adults consistently misremember "most" statements (e.g., "Most cats sweat through their paws") as generic (e.g., "Cats sweat through their paws"), but they very seldom make the opposite mistake, namely, misremembering generics as "most" statements.[2] There are at least two possible reasons for such a result. First, unrestricted generalizations to kinds may be a default, or "cognitively primitive," mode of generalization (Leslie, 2007, 2008). Therefore, people may often fall back on this default generic mode (and thus arrive at generic beliefs) when processing the more "cognitively sophisticated" generalizations conveyed by nongeneric statements quantified with "most" and "all." Second, the fact that many members of a kind display a certain property, as implied by a sentence such as "Most girls are good at tooki," may license an inductive inference translating this quantificational fact into a fact about the relevant concept as a whole (Cimpian, Brandone, & Gelman, 2010; Jönsson & Hampton, 2006). That is, people may use the high prevalence of a feature among the entities that fall under a concept (e.g., the high prevalence of tooki ability among girls) to infer that this feature may be legitimately considered part of this concept's meaning (e.g., part of what it means to be female). For example, adults often consider the fact that a feature is relatively common within a kind (e.g., 50% of lorches have purple feathers) as sufficient grounds for adopting the corresponding generic belief (e.g., that lorches, as a kind, have purple feathers; Cimpian, Brandone, & Gelman, 2010). On this second account, people's adoption of a generic belief is not a mistake but rather a legitimate outcome of the interpretive process.

The claim here is not that generic and wide-scope quantified statements are synonymous. There is no doubt that they have distinct linguistic meanings (e.g., Carlson, 1977; Cimpian, Brandone, & Gelman, 2010; Cimpian, Gelman, & Brandone, 2010; Leslie, 2007, 2008). Rather, what we are claiming is that this distinction, which is very clear-cut at the level of the statements themselves, becomes less straightforward at the level of the beliefs that these statements ultimately lead people to adopt. In particular, wide-scope quantified statements may often end up giving rise to *generic* beliefs, either because their interpretation is biased by a default kind-based mode of generalization (Leslie, 2008) or because they license additional inductive inferences about the concept's meaning. Either way, once a generic belief is formed, the essentialist causal attributions should follow—this is what the belief-proximal account would predict.

We tested this prediction in the context of the two-step task described earlier by comparing the generic and nongeneric conditions to a third condition in which the novel properties were introduced via statements quantified with "most"[3] (e.g., "Most boys/girls are really good at a game called 'tooki'"). If the "most" statements in Step 1 lead people to form generic beliefs, then the nongeneric facts in Step 2 (e.g., "This boy/girl is also really good at tooki") should be attributed to deep, essential causes. In other words, we predicted that the causal attributions of participants in the "most" condition would be similar to those of participants in the generic condition and different from those of participants in the nongeneric condition. Again, it is important to point out that this prediction is contrary to the language-proximal account: Because in Step 2 all participants were asked to explain a fact conveyed in a nongeneric statement and because on the language-proximal account the causal attribution process operates at the level of the statements that are being explained, this account would predict no differences in causal attributions across the three conditions.

Summary

We derived two sets of predictions that distinguish the belief-proximal and the language-proximal accounts. First, the belief-proximal, but not the language-proximal, account predicts that the generic beliefs formed on the basis of generic statements will influence children's causal attributions in subsequent nongeneric contexts that fall under their scope. Specifically, children should attribute the nongeneric facts in Step 2 to essential causes more often when these facts are linked to existing generic beliefs (generic condition) than when they are not (nongeneric condition). Second, the belief-proximal, but not the language-proximal, account predicts that any statements that lead to the formation of generic beliefs, regardless of whether these statements are themselves generic or not, should similarly bias children's attributions towards essential causes. In light of the evidence that "most"-quantified statements may often license generic beliefs (e.g., Leslie & Gelman, 2011), the belief-proximal account predicts that such statements should be similar to generic statements in their likelihood of inducing an essentialized causal perspective on the nongeneric facts in Step 2. To the extent that these two predictions are confirmed, they would support the belief-proximal account and undermine the language-proximal account.

Method

Participants

The participants belonged to three age groups: 4- and 5-year-olds ($n = 73$; 37 girls and 36 boys; mean age = 5 years; range = from 4 years to 5 years 11 months), 6- and 7-year-olds ($n = 75$; 38 girls and 37 boys; mean age = 7 years; range = from 6 years to 7 years 11 months), and undergraduates ($n = 72$; 37 females and 35 males). An additional 17 children were tested but excluded from the sample. We used two criteria for determining whether

[2] It is unlikely that this result was simply due to poor memory for the first word of the quantified statements: Participants seldom misrecalled "some"-quantified statements (e.g., "Some cats . . . ") as generic—contrary to what would be expected if they were simply dropping the first word of the original sentences. Similarly, a separate control study found that children were unlikely to forget the first word of quantified statements such as "*No* bees have six eyes" (i.e., they seldom recalled these statements as, e.g., "Bees have six eyes"). In sum, the tendency to misremember "most" statements as generic was in all likelihood driven by the beliefs that these statements ultimately led people to adopt.

[3] Although "most"-quantified statements are also nongeneric, for simplicity we will refer to only the nongeneric statements about a single individual (e.g., "There's a boy/girl . . . ") as "nongeneric."

a child should be excluded: (a) the child made no response, said "I don't know," or gave unintelligible responses for the first three trials (testing was stopped at this point); and (b) the child made no response, said "I don't know," or gave unintelligible responses for half or more of the trials over the course of the entire session. The present exclusion rate (10.3%) is well within the range observed in other studies that required young children to generate open-ended explanations (Cimpian & Cadena, 2010; Cimpian & Markman, 2009, 2011).

The children were recruited in a small city in the midwestern United States, either from local preschools and elementary schools or from a database of families interested in participating in developmental studies. The undergraduates, who were included to investigate potential developmental differences in the influence of generics, were recruited from the subject pool at a large public university and received course credit for participation. Although demographic information was not collected formally, the participants were mostly European American and represented a range of socioeconomic backgrounds.

Materials and Design

The information presented to participants consisted of eight novel properties. Four of these properties were about abilities (e.g., being good at a game called "tooki"), and the other four were about biological features (e.g., having something called "thromboxane" in one's brain; see Table 1 for the complete set of properties). The ability and biological feature trials were presented in two separate four-trial blocks, and the order of these blocks was counterbalanced across children. Participants were randomly assigned to one of three wording conditions, which differed only in the wording used to introduce the eight properties: nongeneric, generic, or "most" (see Table 1).

The design can be summarized as follows: 3 (age group: 4- and 5-year-olds vs. 6- and 7-year-olds vs. adults; between subjects) × 2 (property type: abilities vs. biological features; within subject) × 3 (wording: nongeneric vs. generic vs. "most"; between subjects).

A number of other variables were counterbalanced across participants: the order of the eight properties, the gender with which each property was paired, and the gender of the first trial. The gender of the eight trials alternated, such that half of the trials within each block were about girls and half were about boys.

Procedure

Children were tested individually in a quiet room in their school or in the lab. Undergraduate participants were tested in groups on a paper-and-pencil version of this task. For children, the experimenter wrote down children's responses during testing, but the sessions were also videotaped for later transcription. To motivate children, the experimenter introduced them to a stuffed animal that was "trying to figure some things out" and asked them to help it. Each of the eight trials proceeded in two steps, as detailed next.

Step 1: Introducing the Information. In this step, children heard the experimenter introduce a novel piece of information in one of three formats, depending on the wording condition to which they had been assigned: (a) nongeneric format (e.g., "I wanna tell you something interesting about a boy/girl. There's a boy/girl who is really good at a game called 'tooki'"), (b) generic format (e.g., "I wanna tell you something interesting about boys/girls. Boys/

Table 1
The Items Used

Abilities	Biological features
Game	Brain
NG: There's a boy/girl who is really good at a kind of game called "tooki."	NG: There's a boy/girl who has something called "thromboxane" in his/her brain.
G: Boys/Girls are really good at a kind of game called "tooki."	G: Boys/Girls have something called "thromboxane" in their brains.
Most: Most boys/girls are really good at a kind of game called "tooki."	Most: Most boys/girls have something called "thromboxane" in their brains.
Sport	Bones
NG: There's a boy/girl who is very good at a kind of sport called "leeming."	NG: There's a boy/girl who has these things called "osteoclasts" in his/her bones.
G: Boys/Girls are very good at a kind of sport called "leeming."	G: Boys/Girls have these things called "osteoclasts" in their bones.
Most: Most boys/girls are very good at a kind of sport called "leeming."	Most: Most boys/girls have these things called "osteoclasts" in their bones.
Dance	Blood
NG: There's a boy/girl who is really good at a kind of dance called "ludino."	NG: There's a boy/girl who has something called "fibrinogen" in his/her blood.
G: Boys/Girls are really good at a kind of dance called "ludino."	G: Boys/Girls have something called "fibrinogen" in their blood.
Most: Most boys/girls are really good at a kind of dance called "ludino."	Most: Most boys/girls have something called "fibrinogen" in their blood.
Puzzle	Muscles
NG: There's a boy/girl who is very good at a kind of puzzle called "zool."	NG: There's a boy/girl who has these things called "sarcomeres" in his/her muscles.
G: Boys/Girls are very good at a kind of puzzle called "zool."	G: Boys/Girls have these things called "sarcomeres" in their muscles.
Most: Most boys/girls are very good at a kind of puzzle called "zool."	Most: Most boys/girls have these things called "sarcomeres" in their muscles.

Note. "G" stands for "generic," and "NG" stands for "nongeneric."

Girls are really good at a game called 'tooki'"), or (c) "most" format (e.g., "I wanna tell you something interesting about most boys/girls. Most boys/girls are really good at a game called 'tooki'"). The key property was repeated once in the appropriate format, and then the experimenter proceeded to Step 2 for that property.

Step 2: Assessing Children's Attributions for a Subsequent Nongeneric Fact. This step was identical for all children, regardless of wording condition. Children were shown a picture of a single child (whose gender matched that used in Step 1) and were then told that this child possesses the property introduced in Step 1. For example, on one trial the experimenter said, "And here's another boy/girl. And you know what? This boy/girl is also really good at tooki. He/She is also really good at tooki." It was particularly important to refer to the child in the picture as "*another* boy/girl" in the nongeneric condition, so as to differentiate this child from the child talked about in Step 1. For consistency, we used this phrase in the generic and "most" conditions as well. Next, children were asked to explain this nongeneric fact: for example, "Why do you think that is? Why is this boy/girl really good at this game called 'tooki'?" After writing down children's answer, the experimenter proceeded to introduce the next property (Step 1). If children said they did not know, they were reassured that there were no right or wrong answers and asked to make a guess. If they still said they did not know, the experimenter went on to the next trial but returned to the unanswered item at the end of the session for a final try. (Only 5.6% of trials required such a return.) Eight different pictures of boys and girls were used during Step 2, one for each property.

At the end of the session, children in the generic and "most" conditions received a short debriefing, in which it was explained to them that "in real life" boys and girls are good at the same things and have essentially the same things inside their bodies.

Coding

We coded participants' explanations into two main categories (for a similar coding scheme, see Cimpian & Markman, 2011). First, responses revealing that the to-be-explained property was understood as a natural, deep, inherent fact about the child in the picture were coded as essentialized. For example, one child explained the presence of fibrinogen in the blood of the child in the picture by saying that "she was made like that from God." Second, responses revealing that the to-be-explained property was understood as the result of a mechanistic, often externally driven causal process were coded as nonessentialized. For example, one child thought that the child in the picture was good at leeming "because his dad teached him." Additional examples of essentialized and nonessentialized explanations are provided in Table 2.

Aside from the essentialized and nonessentialized categories, the coding scheme also included a *syllogistic reasoning* category. For example, if a participant was told that girls are good at tooki (Step 1) and was then asked why a particular girl is good at tooki (Step 2), a syllogistic explanation would be that she is good because girls are good, and she is a girl. In principle, such explanations could reflect an essentialized understanding of the information. For instance, explaining why a girl is good at tooki by saying "because she is a girl" seems to imply that this property is a natural, inherent aspect of who she is. In the context of our task, however, a participant might also arrive at this explanation by simply integrating all of the information provided, without any further commitments as to whether this property is essential. This interpretive ambiguity led us to decide against counting syllogistic explanations as essentialized. This was a conservative decision, as syllogistic explanations occurred almost exclusively in the generic and "most" conditions (see Table 3), where we predicted essentialized explanations would be most frequent. Also note that,

Table 2
Examples of Essentialized and Nonessentialized Explanations

Essentialized explanations	Nonessentialized explanations
Inherent explanations	**Problem explanations**
Description: These explanations imply that the property is a natural or normal aspect of development.	Description: These explanations imply that the property is the result of a problem, accident, injury, or disease.
Examples	Examples
"She was made like that from God" [blood]	"Because something got on him, maybe a bug, that might have sucked his blood" [blood]
"That's the way bones are" [bones]	"She's sick" [muscles]
"Because that's the way of the world" [sport]	"Her bones aren't tight enough" [bones]
Trait explanations	**Practice explanations**
Description: These explanations imply that the property is the result of some intrinsic trait or preference of the individual.	Description: These explanations imply that the property developed through practice, learning, instruction, or exercising.
Examples	Examples
"He's strong" [game]	"She practiced every day" [puzzle]
"Because she has good legs" [dance]	"Because his dad teached him" [sport]
"Because he's really smart" [puzzle]	"She took lessons" [dance]
Functional explanations	**External explanations**
Description: These explanations imply that the property serves some (usually life-sustaining) function.	Description: These explanations imply that the property is the result of some situational or external cause (other than contagion/infection or instruction).
Examples	Examples
"Because it helps your body" [blood]	"Because he lives at Kentucky" [game]
"So her muscles can get strong" [muscles]	"She's been eating vegetables a lot" [muscles]
"So she can walk or something" [bones]	"He has the jacket for it" [dance]

Note. The word in square brackets indicates the item for which the explanation was provided.

Table 3
Mean Number of Syllogistic Explanations (and SD*s) by Wording Condition and Age Group*

Age group	Nongeneric condition		Generic condition		"Most" condition	
	M	*SD*	*M*	*SD*	*M*	*SD*
4- to 5-year-olds	0.00	0.00	1.00	2.50	0.67	1.81
6- to 7-year-olds	0.12	0.43	1.08	2.58	0.58	1.35
Adults	0.42	0.88	5.42	3.34	4.54	3.59

Note. All means are out of a possible 8.

within the generic and "most" conditions, adults were more likely to produce syllogistic explanations than children were. This age difference may be due to adults' superior formal reasoning skills (e.g., Galotti, 1989) or to the fact that adults' booklets provided simultaneous access to the information in Steps 1 and 2, which may have helped them detect the syllogistic structure of this information.

Any responses that did not fit into the three categories were coded as *other*. For example, one child explained why a girl is good at the *ludino* dance by saying, "Because she is my best friend, and I love her," and another child explained why a boy had sarcomeres in his muscles by saying, "Because he knew he had it." These explanations decreased in frequency with age (M_{4-5} = 2.33 vs. M_{6-7} = 1.21 vs. M_{adult} = 0.94 on eight trials) but did not show any condition differences ($M_{nongeneric}$ = 1.47 vs. $M_{generic}$ = 1.49 vs. $M_{\text{“}most\text{”}}$ = 1.53), so we will not discuss them further.

Coding was blind to the wording of the property in Step 1 and followed a present/absent rule: Any explanation categories that were present on a particular trial were assigned a 1; all absent categories were assigned a 0. To assess reliability, a second researcher coded 180 of the 220 transcripts. Intercoder agreement was 91.9% (κ = .82) for the essentialized explanations, 93.8% (κ = .86) for the nonessentialized explanations, and 98.8% (κ = .96) for the syllogistic explanations. Disagreements were resolved by discussion.

Data Analysis

Our main analyses compared the distribution of essentialized and nonessentialized explanations across wording conditions. However, we did not compare the *raw numbers* of these explanations. This decision was motivated by the condition differences in the number of syllogistic explanations: These explanations clustered in the generic and "most" conditions and were rare in the nongeneric condition (see Table 3). The substantial presence of syllogistic explanations in the generic and "most" conditions—in combination with subjects' tendency to generate a single explanation per trial (they did so on over 93% of trials)—drove down the raw frequency of all other explanation types in these two conditions. This pattern was most pronounced in the adults' data, where syllogistic explanations accounted for roughly half of all explanations in the generic and "most" conditions, leaving less room for other responses.

As a consequence, we used as our dependent measures the proportions of *nonsyllogistic* explanations that were essentialized and nonessentialized. This measure corrected for the imbalance due to the syllogistic explanations, and thus reduced the likelihood that comparisons across wording conditions and across age groups would be biased by this imbalance. Participants who produced only syllogistic explanations on all eight trials were dropped from the analysis (three 4- to 5-year-olds, two 6- to 7-year-olds, and 21 undergraduates; all had been in the generic and "most" conditions).

The distribution of these dependent measures departed from normality (Shapiro–Wilk test *ps* $<$ .001), violating one of the main assumptions underlying parametric statistics. Therefore, we analyzed participants' responses with nonparametric repeated-measures ordinal logistic regressions (RM-OLRs) computed using the Generalized Estimating Equations command in SPSS 17 (for analogous analyses, see Cimpian & Cadena, 2010; Cimpian & Markman, 2009, 2011).[4]

Finally, note that the essentialized and the nonessentialized proportion measures are not redundant. Statistically, the two are not redundant because they do not make up the totality of the nonsyllogistic explanations (recall that the explanations coded as *other* were also nonsyllogistic); therefore, these measures are not perfectly negatively correlated. In fact, the negative relationship between the essentialized and nonessentialized measures was only moderate in strength, $r = -.62$. Along the same lines, participants were free to produce *neither* or *both* of these explanations on a single trial; these outcomes occurred on 19.9% of the trials included in our analyses. There are also some theoretical reasons to suspect that these measures may not always be mirror images of each other. For example, preschoolers are typically less likely than older children and adults to interpret other individuals' behaviors in terms of stable traits (e.g., Rholes & Ruble, 1984), which may lower the overall number of essentialized explanations they produce for the features of the individual children in Step 2. In turn, this might make it more difficult to detect the predicted differences between wording conditions on the essentialized measure than on the nonessentialized measure, especially in young children's responses. (To preview, our data confirmed this suspicion.) For the reasons just laid out, we report the results for both of these explanation measures.

Results

Our belief-proximal proposal—that causal attributions are driven not by the generic/nongeneric format of the statements being explained but rather by the generic/nongeneric format of the relevant beliefs—led to two specific predictions. The *first prediction* was that, in the generic condition, participants' causal understanding of the nongeneric facts in Step 2 should be filtered through, or skewed by, the generic beliefs established in Step 1. As a result, these participants should produce more essentialized explanations and fewer nonessentialized explanations in Step 2 than participants in the nongeneric condition. The *second prediction* was that, in the "most" condition, participants' attributions for the nongeneric facts in Step 2 would also be skewed towards essential causes, arguably because "most"-quantified statements such as the ones in Step 1 often give rise to generic beliefs (e.g., Leslie &

[4] Although not reported here, a parallel set of analyses of variance (ANOVAs) revealed the same main findings.

Gelman, 2011). As a result, the responses of participants in the "most" condition should resemble those of participants in the generic condition and should differ from those of participants in the nongeneric condition.

Essentialized Explanations

An RM-OLR was performed on the essentialized explanation data, with wording condition, age group, and property type as independent variables. Crucially, this analysis revealed a significant main effect of wording condition, Wald $\chi^2 = 33.27$, $df = 2$, $p < .001$.

To test our *first prediction*, we performed a planned follow-up RM-OLR comparing the generic and nongeneric conditions. As predicted by the belief-proximal account, the participants who heard generic statements in Step 1, and presumably formed the corresponding generic beliefs, produced more essentialized explanations (e.g., she is good at tooki because she is smart) for the facts in Step 2 than did the participants who heard nongeneric statements in Step 1, $M_{generic} = .55$ vs. $M_{nongeneric} = .32$, $p < .001$.

To test our *second prediction*, we performed planned follow-up RM-OLRs comparing the "most" condition with the other two. These analyses revealed the predicted pattern: The proportion of essentialized explanations in the "most" condition ($M = .48$) was not significantly different from that in the generic condition ($M = .55$), $p = .253$, but was significantly higher than that in the nongeneric condition ($M = .32$), $p < .001$. For example, participants who were told in Step 1 that *most* boys or girls are good at a certain activity were likely to attribute the ability of the individual boys or girls in Step 2 to their natural talent or other inherent traits, much as participants who heard generics in Step 1 did. To reiterate, these condition differences are consistent with the belief-proximal account but not with the language-proximal account, since the wording of the statements children were asked to explain (in Step 2) was identical, and nongeneric, across all three conditions.

The main RM-OLR also revealed a marginally significant Wording Condition × Age Group interaction, Wald $\chi^2 = 9.24$, $df = 4$, $p = .055$. With respect to *first prediction*, RM-OLRs performed within each age group revealed that the difference between the generic and nongeneric conditions was significant for the 6- to 7-year-olds and the adults (ps $< .001$) and approached significance for the 4- to 5-year-olds ($p = .113$; see Figure 1, top). With respect to the *second prediction*, RM-OLRs performed within each age group revealed that the predicted pattern (generic = "most" > nongeneric) held up for the 6- to 7-year-olds and the adults; however, for the 4- to 5-year-olds, the "most" condition was not significantly different from either of the other two (ps $>$ .286; see Figure 1, top).

The main RM-OLR identified two other effects. First, the main effect of property type was significant, $M_{ability} = .39$ vs. $M_{biological} = .48$, Wald $\chi^2 = 12.65$, $df = 1$, $p < .001$, suggesting that participants were more likely to essentialize biological features than abilities. Second, the main effect of age group was significant, $M_{4-5} = .35$ vs. $M_{6-7} = .43$ vs. $M_{adult} = .56$, Wald $\chi^2 = 27.53$, $df = 2$, $p < .001$, suggesting that the tendency to produce essentialized explanations increased with age.

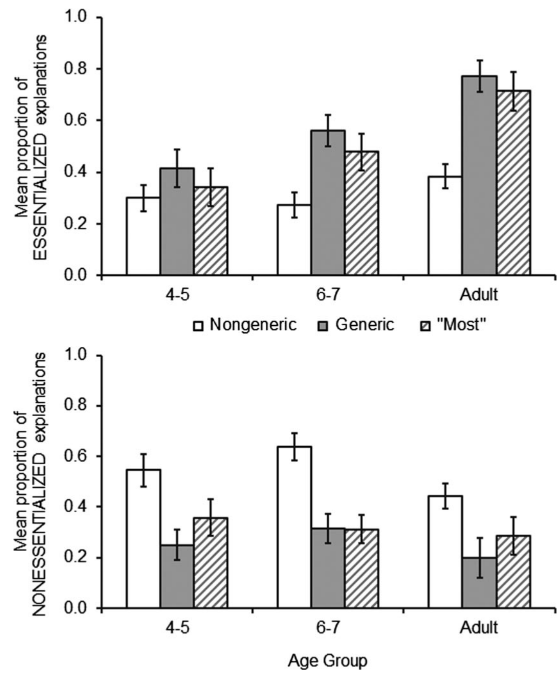

Figure 1. The mean proportion of essentialized (top) and nonessentialized (bottom) explanations, by wording condition and age group. The error bars represent ± 1 *SE*.

Nonessentialized Explanations

An analogous RM-OLR performed on participants' nonessentialized explanations provided further evidence for our belief-proximal account. The crucial main effect of wording condition was again significant, Wald $\chi^2 = 46.71$, $df = 2$, $p < .001$.

Supporting our *first prediction*, a planned follow-up RM-OLR revealed that participants in the generic condition produced significantly fewer nonessentialized explanations (e.g., she is good at tooki because she practiced) for the facts in Step 2 than participants in the nongeneric condition, $M_{generic} = .26$ vs. $M_{nongeneric} = .54$, $p < .001$.

Supporting our *second prediction*, planned follow-up RM-OLRs revealed that the proportion of nonessentialized responses in the "most" condition ($M = .32$) was comparable to that in the generic condition ($M = .26$), $p = .339$, but significantly lower than the analogous proportion in the nongeneric condition ($M = .54$), $p < .001$. For example, participants who were told in Step 1 that *most* boys or girls are good at a task were relatively reluctant to attribute the ability of the individual boys or girls in Step 2 to hard work, which mirrored the behavior of participants in the generic condition.

The interaction between wording condition and age group in the main RM-OLR was not significant, Wald $\chi^2 = 2.06$, $df = 4$, $p = .725$. Despite the nonsignificant interaction, we tested whether the predicted patterns achieved statistical significance within each age group. In line with our *first prediction*, follow-up RM-OLRs revealed that the differences between the generic and nongeneric conditions were significant at all age levels (see Figure 1, bottom): 4- to 5-year-olds ($p < .001$), 6- to 7-year-olds ($p < .001$), and adults ($p = .001$). In line with our *second prediction*, follow-up

RM-OLRs confirmed that the predicted pattern (generic = "most" < nongeneric) held up for all three age groups (see Figure 1, bottom).

Finally, the RM-OLR on all participants' data revealed significant main effects of property type, $M_{ability} = .49$ vs. $M_{biological} = .29$, Wald $\chi^2 = 32.33$, $df = 1$, $p < .001$, and age group, $M_{4-5} = .38$ vs. $M_{6-7} = .44$ vs. $M_{adult} = .34$, Wald $\chi^2 = 8.98$, $df = 2$, $p = .011$.

Scope-Restricted Analyses

Although in Step 2 all participants were asked to explain a fact about a single individual, it is possible that the generic and "most" statements in Step 1 may have occasionally caused the participants in those conditions to think they were asked to explain something about (most) boys/girls. Such confusions may have introduced variability in the perceived wording of the questions across the three conditions, which in turn could have exaggerated the effects identified above and biased the results in favor of the belief-proximal account.

To determine how frequent these scope confusions may have been, we went back and coded which explanations referred to more than one individual (e.g., "*They* do it a lot" [puzzle]; "Because *girls* can get longer hair than boys can" [brain]). The coding (agreement = 98.5%; $\kappa = .93$) revealed that such explanations occurred on only 13.2% of all trials, suggesting that scope confusions were relatively rare. Moreover, producing a plural explanation in response to a singular question does not necessarily indicate confusion about the scope of the question. It is perfectly legitimate, for example, to explain a fact about an individual by appealing to a feature of the category to which he or she belongs. Consistent with this idea, plural explanations were in fact more prevalent in adults' responses (25%) than they were in children's (7%); it seems implausible to claim that the adults would be more confused than the children about the scope of our nongeneric questions.

Nevertheless, to test more directly whether these plural explanations had biased our previous conclusions, we also performed another set of RM-OLR analyses that excluded them; in other words, we used as our dependent measures the proportions of *nonsyllogistic*, *nonplural* explanations that were essentialized and nonessentialized. These scope-restricted analyses replicated the main results described earlier. Most important, the main effect of wording condition was significant both for the essentialized explanation measure, $M_{generic} = .53$ vs. $M_{\text{“most”}} = .45$ vs. $M_{nongeneric} = .30$, Wald $\chi^2 = 29.15$, $df = 2$, $p < .001$, and for the nonessentialized explanation measure, $M_{generic} = .27$ vs. $M_{\text{“most”}} = .32$ vs. $M_{nongeneric} = .56$, Wald $\chi^2 = 45.42$, $df = 2$, $p < .001$), and follow-up RM-OLRs revealed the patterns of significant condition differences that would be expected given our two main predictions.

Conclusion

These results confirmed both predictions of the belief-proximal account. First, they suggested that the generic beliefs formed on the basis of exposure to generic statements influence children's causal attributions in subsequent nongeneric contexts that can be linked with these beliefs. Second, the results suggested that wide-scope quantified statements can also lead, presumably via the generic beliefs they license, to essentialized causal attributions in subsequent nongeneric contexts.

Discussion

Causal relationships are fundamental to human understanding and human concepts (e.g., Ahn et al., 2000; Gelman, 2003; Murphy & Medin, 1985). By shaping the causal perspective children adopt with respect to the facts they are learning, the linguistic distinction between generic and nongeneric statements may have an important part to play in the development of children's lay theories and of the concepts that are embedded within these theories. Our goal in this article was to explore the process by which the generic/nongeneric distinction affects causal attributions. We proposed that the influence of this linguistic distinction on children's attributions is indirect: The generic or nongeneric format of the statements that are being explained does not directly determine (i.e., is not the proximal cause of) children's causal attributions; rather, it is the generic or nongeneric format of the beliefs relevant to these statements that determines what causal attributions children will make. To evaluate this proposal, we formulated and tested two predictions that follow from it and that distinguish it from the competing language-proximal account, on which the generic or nongeneric format of the statements that are being explained is the direct, or proximal, cause of children's attributions.

The First Prediction: Generics Affect Attributions in Subsequent Nongeneric Contexts

We first predicted that, once formed, a generic belief should be available in subsequent situations to which it is relevant and should skew children's inferences toward essential causes. In the presence of a generic belief, an outcome that might typically be construed as the product of external or mechanistic causes (e.g., she is doing well because she tried hard; Cimpian & Markman, 2011) is likely to be understood in terms of the deep traits of the individuals involved (e.g., she is doing well because, as a girl, she has a special aptitude for this task).

Our data supported this prediction. Participants who heard generic statements in Step 1 (e.g., "Boys/Girls are really good at a game called 'tooki'") were (a) significantly more likely to invoke deep, essential causes and (b) significantly less likely to invoke external, mechanistic causes in their explanations for the facts in Step 2 than were participants who heard nongeneric statements in Step 1 (e.g., "There's a boy/girl who is really good at a game called 'tooki'"). These results were strikingly consistent across all the age groups, with the possible exception of 4- to 5-year-olds' essentialized explanations, where the difference between the generic and nongeneric conditions only approached significance.

The Second Prediction: Generics Are Not Unique in Their Effect of Attributions

The second main prediction of our belief-proximal account was that generic statements should not be unique in their effect on causal attributions. In particular, we hypothesized that some nongeneric statements—especially ones with wide-scope quantifiers such as "most" or "all"—might also lead to inferences about deep, essential causes. This prediction was motivated by hints in the literature that such quantified statements may often give rise to generic beliefs (Leslie & Gelman, 2011; see also Hollander et al., 2002; Khemlani et al., 2007). If the information conveyed by these quantified statements is indeed sufficient to form generic beliefs, then ultimately these statements should prompt people to essentialize just as generic statements do, since we propose it is the beliefs (and not the statements themselves) that are the proximal cause of the attributions.

Our results supported this second prediction as well, in that the causal attributions of participants exposed to "most" statements clustered with those of participants who had heard generic statements in Step 1 and were significantly different from those of participants who had heard nongeneric statements in Step 1. This result was consistent across the two measures (essentialized and nonessentialized explanations) and across the three age groups, with the same exception of 4- to 5-year-olds' essentialized explanations (see Figure 1, top). Several ideas about the source of this developmental difference are discussed in the next section.

We should reiterate that our claim here is not that generic and "most" statements have the same meaning. They do not, and there are many demonstrations that adults draw clear distinctions between them (e.g., Carlson, 1977; Cimpian, Brandone, & Gelman, 2010; Cimpian, Gelman, & Brandone, 2010). However, the fact that adults can distinguish between these statement types when asked to reflect on their meanings does not automatically entail that the representation of the facts learned from these statements will be distinct. In fact, the evidence that adults frequently convert facts learned from "most"- and "all"-quantified statements to generic form (Leslie & Gelman, 2011) suggests the opposite may be true. In sum, our claim is that generic and "most" statements may often be equivalent at the level of the beliefs to which they ultimately give rise. The link from "most" statements to generic beliefs might be relatively fragile, however, since such quantified statements can give rise to generic beliefs only with the aid of additional inductive inferences or under circumstances that cause people to fall back on a default kind-based mode of generalization (Leslie, 2007, 2008).

It is important to note that the subsequent step in this process—that of generating causal attributions on the basis of the genericity of the relevant beliefs—may be similarly variable and sensitive to contextual factors. Having a generic belief does not automatically cause an essentialized understanding. Other considerations, such as the nature of the kinds and properties involved, are also taken into account in constructing a causal perspective on this fact. For example, Cimpian and Markman (2011) demonstrated that inferences about the essential nature of the properties introduced via generic statements were blocked when the categories to which these statements referred (in this case, boys/girls at a particular school) were relatively shallow or arbitrary and thus could not plausibly support attributions to deep, inherent causes.

The Source of the Developmental Differences

Why did 4- to 5-year-olds' responses deviate from our predictions on the essentialized measure? One interpretation of this result might be that the belief-proximal mechanism proposed here is not fully in place in children by the age of 5, such that preschoolers' causal attributions are less likely to be mediated by their beliefs—and instead more likely to be driven by the format of the language—than are older children's and adults' attributions. Such a development might also explain the contrast between this result and Cimpian and Markman's (2011) Experiment 1. In that study, preschoolers were significantly more likely to provide essentialized explanations when they were asked about features of kinds (e.g., why girls are good at gorp) than when they were asked about features of individuals (e.g., why a particular girl is good at gorp). That is, when the generic/nongeneric format of the language and of the beliefs covaried (as in Cimpian & Markman's study), the predicted differences in preschoolers' essentialized explanations were stronger than when the format of the language was held constant (as in the present study). This is exactly the pattern one might expect if 4- to 5-year-olds' causal attributions were less likely to be mediated by their beliefs than older children's attributions.

However, other evidence speaks against this idea. Most important, notice the striking similarity between the three age groups on the nonessentialized explanation measure (see Figure 1, bottom). If the belief-proximal mechanism we hypothesized was still immature at in children at the age of 5, the differences between wording conditions should have been equally weak across the essentialized and nonessentialized measures. In other words, if young children were less likely to explain the properties of the individuals in Step 2 (e.g., a girl is good at tooki) in light of the beliefs induced in Step 1, there is no reason why they should have produced significantly fewer nonessentialized explanations (e.g., she practiced) in the generic and "most" conditions. Incidentally, this result also rules out the possibility that 4- to 5-year-olds were simply unable to comprehend the quantifier "most" (Papafragou & Schwarz, 2005–2006; but see Halberda, Taing, & Lidz, 2008). If understanding "most" had been an issue, young children's responses should have looked different from those of older participants on the nonessentialized measure as well (and they did not).

If there is no developmental change in the process by which language shapes causal attributions, then what explains 4- to 5-year-olds' deviation from the predicted pattern on the essentialized measure? One clue is provided by the fact that 4- to 5-year-olds produced overall fewer essentialized explanations than the older groups (see Figure 1, top). This pattern is consistent with previous findings that young children are generally less likely than older children and adults to think of other individuals' behaviors as stemming from stable traits (Benenson & Dweck, 1986; Lawson & Kalish, 2006; Rholes & Ruble, 1984; but see Rhodes & Gelman, 2008). Thus, even in the presence of a generic belief, children at this age may be relatively reluctant to attribute the facts in Step 2 to essential traits of the individuals involved.

Further Questions

Our current proposal raises many additional questions about the process by which generic and nongeneric statements, and the beliefs they give rise to, shape causal attributions. For example, one outstanding question concerns the range of contexts whose understanding may be influenced by a generic belief. In our study, the nongeneric fact provided in Step 2 (e.g., "This boy/girl is also good at tooki") was a straightforward example of the generic fact introduced in Step 1. What about circumstances that are related to a stored generic belief but that nevertheless differ from it on some important dimension? For example, if children have a generic belief that boys are good at math, will this belief be accessed when they see a girl excelling at math? If so, how will it be factored into their attributions? Will the causal attributions that would likely be made in the case of individual boys (that there is some talent or gift underlying their math ability) extend here as well? Or will inferences about underlying talents be restricted to boys and any girl's ability be explained as the outcome of her sustained efforts? Along similar lines, we can ask how the attribution process might unfold when children encounter exceptions to a stored generic belief. For example, given the generic belief that boys are good at math, how do they make sense of the performance of individual boys who are not?

Another outstanding question about the process outlined here concerns how long-lasting the effect of a generic statement might be. In our experiment, participants were asked to generate causal attributions (Step 2) very soon after exposure to the generic statement (Step 1). We expect that similar results would hold even if a delay was introduced between these steps, especially given the evidence that generic beliefs seem to be encoded robustly in long-term memory (e.g., Cimpian et al., in press; Gelman & Raman, 2007). However, a study that actually manipulated this delay would speak more directly to the persistence of generics' influence across time.

Finally, in future work, it would be important to adjudicate between the two hypothesized mechanisms that could lead from "most" statements to generic beliefs and thus to essentialized attributions. Do "most"-quantified statements give rise to generic beliefs (a) because they license inductive inferences about the kind as a whole or (b) because they are more resource-intensive to process and remember than generic statements, leading people to distort the quantified meaning of these statements into generic meaning (Leslie, 2007, 2008; Leslie & Gelman, 2011)? One possible means of distinguishing between these two mechanisms would be to reduce the cognitive load involved in processing "most" statements (e.g., by providing subjects with extensive exposure and training before the test).[5] If such a reduction was achievable, the cognitive load account would predict that subjects' tendency to default to generic meaning should be diminished, along with their tendency to essentialize this information. In contrast, on the inductive inference account, there is no reason to expect that this reduction in cognitive load should affect subjects' tendency to essentialize the information conveyed by the "most" statements; the relevant inductive inferences are equally valid regardless of how difficult the "most" statements are to process and remember.

Conclusion

Generic and nongeneric statements do more than just convey facts. They also promote particular causal perspectives on these facts, leading children to understand them either as the result of deep, inherent, essential factors or as the result of external, mechanistic factors, respectively. Our main claim here was that children's causal attributions for the facts learned through these statements are determined not by the generic or nongeneric format of the statements themselves but rather by the generic or nongeneric format of the beliefs that are relevant to these statements. The two predictions we derived from this claim were confirmed by our data. We found, first, that the influence of generic statements is not limited to just situations in which children are reasoning about these statements or about the generalizations they express. That is, generic statements—or, as we claimed, the generic beliefs they give rise to—also shaped children's causal attributions in subsequent nongeneric contexts that fell under their scope. Thus, the range of circumstances whose understanding may be influenced by generic language (via the generic beliefs it induces) is quite extensive. The second prediction was that wide-scope quantified statements should also lead to attributions in terms of deep, essential causes, arguably because these statements often license the formation of generic beliefs. By demonstrating that generic language is not unique in its effects on causal attributions, this result adds a layer of nuance to our knowledge about the process by which language shapes understanding. To conclude, this research illustrates the complex interactions among linguistic input, conceptual knowledge, and causal reasoning, interactions that are at the core of cognitive development and undoubtedly among its major driving forces.

[5] We thank one of our anonymous reviewers for this suggestion.

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