



## Children expect generic knowledge to be widely shared

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### ARTICLE INFO

#### Article history:

Received 15 March 2011

Revised 6 February 2012

Accepted 7 February 2012

Available online 14 March 2012

#### Keywords:

Generic knowledge

Conceptual development

Psychological reasoning

### ABSTRACT

The ability to acquire and store generic information (that is, information about entire categories) is at the core of human cognition. Remarkably, even young children place special value on generic information, often inferring that it holds important insights about the world. Here, we tested whether children's assumptions about the nature of generic information guide their expectations about how widely known this information is. Across four experiments, 4- to 7-year-old children ( $N = 192$ ) were presented with novel facts in either generic (e.g., "Hedgehogs eat hexapods") or non-generic (e.g., "This hedgehog eats hexapods") format and were asked whether other people (e.g., their moms, grown-ups in general) knew these facts. Overall, children were more likely to say that others knew the generic than the non-generic facts. In addition to highlighting the centrality of generic knowledge in early cognitive life, children's assumption that generic facts are widely known has implications for their social cognition and academic achievement, as well as for the process of language acquisition.

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### 1. Introduction

Generic knowledge—that is, knowledge about entire categories—endows human cognition with tremendous flexibility and power (e.g., Csibra & Gergely, 2009; Gelman, 2003; Markman, 1989; Murphy, 2004; Prasada, 2000; Smith & Medin, 1981). Consistent with this key role, recent evidence suggests that even young children attach special significance to generic information (e.g., Cimpian & Cadena, 2010; Cimpian & Erickson, 2012b; Cimpian & Markman, 2009, 2011; Gelman, Raman, & Gentner, 2009; Hollander, Gelman, & Raman, 2009). For example, when 4-year-olds learn novel generic facts pertaining to living kinds (e.g., that trees have *foliage* on them), they often infer that this information speaks to essential biological processes (e.g., the foliage enables breathing or growth; Cimpian & Markman, 2009). Similarly, generic information pertaining to novel artifact kinds (e.g., that *dunkels* are sticky) is understood as describing essential aspects of these artifacts' de-

sign, without which they would not be able to perform their intended functions (Cimpian & Cadena, 2010). In contrast, when the same information is provided via a non-generic statement (e.g., that a particular tree has *foliage* on it; that a particular *dunkel* is sticky), children infer instead that the novel facts are relatively peripheral (e.g., the foliage and the stickiness are the result of some accident). Importantly, the inference that generic information speaks to the deep structure of the world is not a necessary consequence of the fact that this information is about categories. A feature can be true of a category simply by virtue of being prevalent, without also being deeply, causally linked to membership in that category (e.g., barns are red; see Prasada & Dillingham, 2006). In other words, children's inferences about the significance of generic information are driven by their own assumptions about the nature of this information (and the intentions of those providing it), rather than by something inherent in its form.

What are the consequences of children's beliefs about the nature of generic and non-generic facts? What hinges on their assumption that generic facts highlight important aspects of how the world works? In the present paper, we

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asked whether this assumption guides children's expectations about *how widely known* generic and non-generic facts are. Several considerations are relevant to this question. To start with, it is likely that children see adults as experts on what the world is like (e.g., Callanan & Oakes, 1992; Chouinard, 2007; Frazier, Gelman, & Wellman, 2009; Jaswal & Neely, 2006; Taylor, Cartwright, & Bowden, 1991). Anecdotally, children look to adults for information about a wide range of topics, from why leaves turn yellow in the fall to why toys need to be shared with others. Consistent with the anecdotal evidence, research on this topic has suggested that children expect adults to know such far-flung facts as what a *coleus* plant looks like (Taylor et al., 1991) or how electric wheelchairs work (Callanan & Oakes, 1992; see also Chouinard, 2007; Frazier et al., 2009). In light of this work, it seems plausible to predict that children would expect generic facts, which are typically interpreted as providing general world knowledge (e.g., Cimpian & Markman, 2009), to be more widely known than non-generic facts. However, there is also evidence that children *over-attribute* knowledge to others, raising the possibility that children would expect adults to know all manner of facts, both generic *and* non-generic (e.g., Birch & Bloom, 2003; Gopnik & Astington, 1988; Wimmer & Perner, 1983). For example, when 3- and 4-year-olds were asked if a puppet knew what was inside a toy that he had never played with before, they often attributed knowledge of this non-generic fact to the puppet—particularly when they themselves knew what was inside the toy (Birch & Bloom, 2003). That is, as soon as children learned a non-generic fact about a particular object (i.e., what is inside it), they expected others to know this fact as well. This tendency to over-attribute knowledge to others makes it an open question whether children would in fact be able to use their assumptions about the nature of generic and non-generic facts to calibrate their expectations about how broadly these facts are known.

Some reasons to suspect that children are capable of such fine-grained discriminations can be found in the literature on children's understanding of communicative and cultural conventions (for a review, see Diesendruck & Markson, 2011). For example, young children expect knowledge of count nouns, but not proper names, to be shared by most speakers within a linguistic community (e.g., Birch & Bloom, 2002; Buresh & Woodward, 2007; E. Clark, 1988, 1990, 2007; Diesendruck, 2005; Diesendruck & Markson, 2001; Graham, Stock, & Henderson, 2006; Henderson & Graham, 2005; Sabbagh & Henderson, 2007). This evidence is pertinent to our argument because count nouns such as “donkey” are names for categories of things and are thus themselves *generic* facts about their respective categories (e.g., this kind of animal is called “donkey”). In contrast, proper names such as “Eeyore” are names for individuals and are thus *non-generic* facts about those individuals (e.g., this particular donkey is called “Eeyore”). Within the realm of conventions, then, children can be seen as expecting generic facts (category labels) to be more widely known than non-generic facts (proper names). However, the name of a category is not a generic fact like any other—it is a convention, an arbitrary marker that members of a language community use in

order to refer to that category when communicating with one another. Awareness of the shared nature of count nouns is in fact necessary for them to perform their function: We use the word “donkey” to refer to donkeys in part because we assume that the meaning of this word will be known to anyone who speaks English. Whereas being widely known is part of the very reason count nouns exist, the same cannot be said for other, ordinary generic facts, such as that donkeys hee-haw. Consequently, it is still an open question whether children would make the more general assumption that generic facts, even those that are not conventional, are known to many people.

To test whether children do in fact assume generic knowledge to be more widely shared than non-generic knowledge, in the present research we exposed 4- to 7-year-olds to novel generic facts (e.g., that dogs get sick after eating *carbamates*) and novel non-generic facts that were matched in content to the generic ones but were about a specific individual (e.g., that a particular dog gets sick after eating *carbamates*). We then compared children's expectations about how widely known these two sets of facts were, predicting that children would assume the generic ones to be more broadly distributed in others' minds than the content-matched non-generic ones.

To be clear, our prediction is a qualified one. We do not predict that children will expect every adult to know every possible generic fact. Even if children do make the assumption that generic information is more widely known, the output of this assumption will undoubtedly be modulated by whatever else children know about others' knowledge. For instance, the strength of children's expectation that generic facts are widely known may be influenced by children's prior interactions with the people whose knowledge they are assessing (e.g., Birch, Vauthier, & Bloom, 2008; Jaswal & Neely, 2006; Koenig & Harris, 2005) and by children's assumptions about how knowledge is clustered in people's minds (e.g., Danovitch & Keil, 2004; Keil, Stein, Webb, Billings, & Rozenblit, 2008; Lutz & Keil, 2002). In light of these assumptions, the general expectation that people know generic facts may be stronger with respect to those who possess expertise in a relevant domain than with respect to those whose expertise is unclear. Children might be more likely, for example, to expect that a biology teacher would know that dogs get sick after eating carbamates than to expect that their moms or dads would know this generic fact. In sum, the strength of this expectation may well vary depending on the circumstances. Even so, under most ordinary circumstances, children should still expect generic facts to be more widely known than comparable non-generic facts.

Finally, it is important to note that our research question has implications for multiple aspects of development. First, the presence of an expectation that generic facts are more widely known than non-generic facts would reinforce the proposal that kind-based, generic representations are a fundamental component of children's early thinking (Cimpian & Erickson, 2012a). Second, such an expectation would speak to the development of children's theory-of-mind abilities, suggesting that they can assess others' knowledge states on the basis of criteria that are quite abstract (e.g., is this the type of fact that is generally

known?) rather than being limited to situation- and informant-specific criteria (e.g., has this person had perceptual access to the information? does this person's history indicate she is trustworthy?). Third, as already suggested by the conventionality literature, the expectation that generic facts are widely known is important to the acquisition of linguistic forms (e.g., *Diesendruck & Markson, 2011*). More broadly, this expectation may also help children determine what types of information can be presupposed, rather than having to be explicitly stated, in conversations with others. In other words, this expectation may help children narrow in on what counts as communicative common ground (see Section 6.2 for additional elaboration of this point; *H. Clark, 1996*). Fourth, the assumption that generic beliefs are shared by many people may also have implications for children's achievement. Due to this assumption, children who are exposed to stereotypes (which are generic claims; e.g., "Boys are good at math") may infer that knowledge of these stereotypes is widespread and thus that their own performance will be measured against them. In turn, this inference may interfere with children's ability to do their best in achievement settings (e.g., *Ambady, Shih, Kim, & Pittinsky, 2001; Baumeister, Hamilton, & Tice, 1985; Cheryan & Bodenhausen, 2000; Cimpian, 2010; Cimpian, Mu, & Erickson, in press*).

### 1.1. The present studies

We report four studies testing the prediction that children assume novel generic facts are more widely known by adults than are similar non-generic facts. In Experiment 1, we presented 4- to 7-year-old children with novel generic facts about familiar natural kinds (e.g., "Dogs get sick after eating carbamates") and closely matched non-generic facts about individual members of these kinds (e.g., "Last night, this dog got sick after eating carbamates"). We then asked children whether others (specifically, their moms) knew these facts. The results showed that, as predicted, children expected the generic facts to be better known than the non-generic facts. Experiments 2 and 3 ruled out two alternative explanations for this result, reinforcing the conclusion that children assume generic facts to be widely shared. Experiment 4 further highlighted the robustness and generality of this assumption by showing that it was present even when children (1) were asked about the knowledge of a broader range of people (namely, their parents, their teachers, and grown-ups in general), and (2) were provided with facts about social, rather than natural, kinds (e.g., "Boys/Girls play *dackish* games").

## 2. Experiment 1

### 2.1. Method

#### 2.1.1. Participants

Forty-eight children participated in this study: half were 4 and 5 years old (12 boys and 12 girls;  $M = 4.73$  years;  $SD = 0.49$ ) and half were 6 and 7 years old (12 boys and 12 girls;  $M = 7.02$  years;  $SD = 0.61$ ). 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. Although demographic information was not collected formally, the participants were mostly European American and represented a range of socioeconomic backgrounds.

#### 2.1.2. Materials and design

The eight novel facts used in this study are listed in *Table 1* in their generic and non-generic versions. All of the facts contained a low-frequency word (e.g., "carbamates," "hexapod"), which was included to ensure that the facts would be novel to children. To assess whether the low-frequency words were in fact unfamiliar, we asked 22 children who had not participated in the main study (14 boys and 8 girls; mean age = 5.94 years) if they knew what these words meant (e.g., "Do you know what a hexapod is?"). The eight target words, along with four higher-frequency filler words (e.g., "broccoli," "zipper"), were presented to the children in one of two random orders. If children said they knew a word, they were then asked to tell the experimenter what they thought it meant. Children said they knew the meaning of the low-frequency words only 6.3% of the time (compared with 90.9% for the fillers). Moreover, even when children said they knew them, their open-ended answers revealed that their understanding of these words' meanings was far off the mark. In sum, it seems safe to assume that the low-frequency words we used are unfamiliar to children in this age range.

Each child heard four facts in generic format and four facts in non-generic format. The generic and non-generic trials were blocked, and the order of the two blocks was counterbalanced across children. The order of the eight items was counterbalanced as well. An individual child heard either the generic or the non-generic version of an item, never both; however, each item was presented in generic form to half the children and in non-generic form to the other half. All eight facts, regardless of format, were accompanied by a color picture of a single animal from the relevant category (e.g., a dog, a hedgehog).

The design of this study can thus be summarized as follows: 2 (Age Group: 4- and 5-year-olds vs. 6- and 7-year-olds)  $\times$  2 (Wording: generic vs. non-generic)  $\times$  2 (Block Order: generic first vs. non-generic first).

#### 2.1.3. Procedure

Children were tested individually in a quiet room in their school or in the lab. The experimenter wrote down children's responses during testing, and the sessions were also videotaped to check for accuracy.

On each trial, the experimenter first brought out a picture and labeled it for the children (e.g., "This is a hedgehog."). After a brief transition ("And here's what I want to tell you."), the experimenter presented the appropriate fact in either generic ("Hedgehogs eat hexapods. They eat hexapods.") or non-generic ("Last night, this hedgehog ate a hexapod. He ate a hexapod.") format.

We then probed whether children expected others to know these facts. In particular, we asked children whether their *moms* knew these facts because we thought children might be more comfortable venturing guesses about the

**Table 1**

The items used in Experiments 1–3, along with the mean percentage of “yes, mom knows” responses to their generic and non-generic versions.

Item	Expt. 1	Expt. 2	Expt. 3
G Birds feed their babies <i>regurgitated</i> food	66.7	–	87.5
NG Last night, this bird fed her babies <i>regurgitated</i> food	41.7	33.3	–
NG Last night, some birds fed their babies <i>regurgitated</i> food	–	58.3	–
NG This bird feeds her babies <i>regurgitated</i> food	–	–	66.7
G Chimps crack open <i>kernels</i>	41.7	–	62.5
NG Last night, this chimp cracked open a <i>kernel</i>	37.5	33.3	–
NG Last night, some chimps cracked open <i>kernels</i>	–	37.5	–
NG This chimp cracks open <i>kernels</i>	–	–	41.7
G Dogs get sick after eating <i>carbarnates</i>	75	–	75
NG Last night, this dog got sick after eating <i>carbarnates</i>	20.8	47.8	–
NG Last night, some dogs got sick after eating <i>carbarnates</i>	–	36	–
NG This dog gets sick after eating <i>carbarnates</i>	–	–	33.3
G Hedgehogs eat <i>hexapods</i>	37.5	–	27.3
NG Last night, this hedgehog ate a <i>hexapod</i>	29.2	30.4	–
NG Last night, some hedgehogs ate <i>hexapods</i>	–	24	–
NG This hedgehog eats <i>hexapods</i>	–	–	60
G Opossums make their homes in <i>foliage</i>	33.3	–	54.2
NG Last night, this opossum made his home in <i>foliage</i>	25	32	–
NG Last night, some opossums made their homes in <i>foliage</i>	–	50	–
NG This opossum makes his home in <i>foliage</i>	–	–	47.8
G Seals sleep on their <i>dorsal</i> side	50	–	60
NG Last night, this seal slept on his <i>dorsal</i> side	25	21.7	–
NG Last night, some seals slept on their <i>dorsal</i> side	–	32	–
NG This seal sleeps on his <i>dorsal</i> side	–	–	60.9
G Snakes steal <i>embryos</i> from other animals	50	–	66.7
NG Last night, this snake stole <i>embryos</i> from other animals	20.8	19.2	–
NG Last night, some snakes stole <i>embryos</i> from other animals	–	31.8	–
NG This snake steals <i>embryos</i> from other animals	–	–	33.3
G Tigers catch lots of <i>ruminants</i>	50	–	54.2
NG Last night, this tiger caught lots of <i>ruminants</i>	25	25	–
NG Last night, some tigers caught lots of <i>ruminants</i>	–	20.8	–
NG This tiger catches lots of <i>ruminants</i>	–	–	50

Note. “G” stands for “generic,” and “NG” stands for “non-generic.” The low-frequency words in each item are italicized.

knowledge states of a specific, familiar other. To illustrate, the children who heard the non-generic version of the *hedgehog* item were asked, “If you had to make a guess, do you think your mom knows about this? Does she know that this hedgehog ate a hexapod last night?”

#### 2.1.4. Data analysis

Our dependent variable was the percentage of “yes, mom knows” responses. Because many children tended to be consistent in their answers across trials, which meant that many data points clustered around 0% and 100%, the distribution of this dependent variable departed significantly from normality (Shapiro–Wilk test,  $p < .001$ ). As a result, we analyzed children’s responses with a repeated-measures ordinal logistic regression (RM-OLR), which does not require normality in the data (for other examples of this analysis, see Cimpian & Cadena, 2010; Cimpian & Markman, 2009, 2011). The RM-OLR was computed using the Generalized Estimating Equations command in SPSS 17. Finally, we used Cohen’s  $d$  (Cohen, 1988) as a measure of effect size.

## 2.2. Results and discussion

We predicted that children would think their moms knew more of the generic than of the non-generic novel

facts. An RM-OLR with Wording, Age Group, and Block Order as factors confirmed this prediction. That is, children were significantly more likely to say that their moms knew generic facts such as “Hedgehogs eat hexapods” ( $M = 50.5\%$ ) than non-generic facts such as “Last night, this hedgehog ate a hexapod” ( $M = 28.1\%$ ), Wald  $\chi^2 = 23.23$ ,  $df = 1$ ,  $p < .001$ ,  $d = 0.67$ . In addition, the generic advantage held across all 8 items (see Table 1). In other words, children were more likely to think that their moms knew the generic than the non-generic versions of all the novel facts they heard, Wilcoxon  $Z = 2.54$ ,  $p = .008$ .<sup>1</sup>

The interaction between Wording and Age Group was not significant, Wald  $\chi^2 = 0.40$ ,  $df = 1$ ,  $p = .525$ . Indeed, separate RM-OLRs confirmed that the effect of generic vs. non-generic wording was significant for both the younger children, Wald  $\chi^2 = 10.39$ ,  $df = 1$ ,  $p = .001$ ,  $d = 0.42$ , and the older children, Wald  $\chi^2 = 15.27$ ,  $df = 1$ ,  $p < .001$ ,  $d = 1.03$  (see Table 2 for means).

No other main effects or interactions were significant in this analysis.

<sup>1</sup> The fact that we had only eight items prevented us from running a full RM-OLR on the by-item data.

**Table 2**

The average percentages of “yes, mom knows” responses for Experiments 1–3 (and SDs).

Study	Wording	Age Group		Overall
		4–5-year-olds	6–7-year-olds	
Expt. 1	Generic (“Xs do Y”)	49.0 (38.6)	52.1 (30.3)	50.5 (34.4)
	Non-generic (“Last night, this X did Y”)	32.3 (40.0)	24.0 (23.9)	28.1 (32.9)
Expt. 2	Non-generic, <i>some</i> (“Last night, some Xs did Y”)	42.0 (38.7)	30.2 (29.5)	36.1 (34.5)
	Non-generic, <i>one</i> (“Last night, this X did Y”)	39.6 (41.6)	20.8 (24.1)	30.2 (35.0)
Expt. 3	Generic (“Xs do Y”)	57.3 (36.5)	64.6 (23.2)	60.9 (30.5)
	Non-generic (“This X does Y”)	53.1 (41.3)	44.8 (28.5)	49.0 (35.3)

### 2.2.1. Replication

To verify that the striking results obtained in Experiment 1 are replicable, we tested an additional sample of 48 children aged 4–7.<sup>2</sup> Closely paralleling the results above, the percentage of “yes, mom knows” responses was significantly higher for the generic ( $M = 52.6\%$ ) than for the non-generic ( $M = 24.5\%$ ) facts, Wald  $\chi^2 = 34.47$ ,  $df = 1$ ,  $p < .001$ ,  $d = 0.87$ . Moreover, the generic vs. non-generic difference was significant both for the 4–5-year-olds ( $M_{generic} = 46.9\%$  vs.  $M_{non-generic} = 29.2\%$ , Wald  $\chi^2 = 8.75$ ,  $df = 1$ ,  $p = .003$ ,  $d = 0.45$ ) and for the 6–7-year-olds ( $M_{generic} = 58.3\%$  vs.  $M_{non-generic} = 19.8\%$ , Wald  $\chi^2 = 36.26$ ,  $df = 1$ ,  $p < .001$ ,  $d = 1.67$ ). In sum, our main results replicated in this additional sample of children.

### 2.2.2. Conclusion

The results of Experiment 1 provide robust evidence for our hypothesis. That is, children’s responses revealed that they believed that other people (specifically, their moms) were more likely to know generic than non-generic facts.

## 3. Experiment 2

The generic and non-generic facts in Experiment 1 differed on at least two dimensions of meaning. First, and most obviously, the generic facts were about a kind, whereas the non-generic facts were not. Second, the generic facts pertained to *more individuals* than the non-generic facts, which were explicitly about a single animal. As a result, children may have expected others to know the generic facts not because these facts were about categories but because they (arguably) applied to more individuals than the non-generic facts.

Therefore, in Experiment 2 we explored whether children’s judgments about others’ knowledge of a fact are sensitive to the number of individuals that fall under the scope of this fact. That is, do children expect facts about more individuals to be better known than facts about fewer individuals? To answer this question, we compared children’s judgments about facts that pertained to *some animals* (e.g., “Last night, some hedgehogs ate hexapods”)

and facts that pertained to *one animal* (e.g., “Last night, this hedgehog ate a hexapod”). If children’s expectations about others’ knowledge are sensitive to this clear prevalence contrast (i.e., if they expect the facts about *some* animals to be better known), then it is also possible that their judgments about the generic facts in Experiment 1 were influenced by the high implied prevalence of these facts. However, if children this age do not consistently differentiate between facts on the basis of their prevalence alone, then it is unlikely that this information played a determining role in their judgments about others’ knowledge of generic vs. non-generic facts.

We chose to contrast facts that have relatively low numerical scope (e.g., facts about one vs. *some* hedgehogs rather than about one vs. *most* or *all* hedgehogs) in order to prevent children from drawing broader, kind-based inferences from these facts. There is considerable evidence that the prevalence of a novel property (e.g., how many hedgehogs eat hexapods) is a source of evidence as to whether this property is generically true of its category (e.g., whether hedgehogs, as a kind, eat hexapods): The more prevalent a novel property is, the more likely people are to infer that it characterizes the category as a whole (Cimpian, Brandone, & Gelman, 2010; see also Cimpian & Erickson, 2012b; Leslie, Khemlani, & Glucksberg, 2011; Meyer, Gelman, & Stilwell, 2011; Prasada & Dillingham, 2006). Thus, although non-generic statements about prevalent properties (e.g., “*Most* hedgehogs eat hexapods”) are clearly distinct from generic statements in their linguistic meaning (e.g., Cimpian, Brandone, & Gelman, 2010; Cimpian, Gelman, & Brandone, 2010; Leslie, 2008), they may nevertheless provide sufficient evidence to license a generic generalization and, ultimately, the adoption of a generic belief.<sup>3</sup>

These considerations suggest that, if we were to use facts about novel properties that are highly prevalent, the basis for children’s judgments in our task would be unclear: Children’s expectations about others’ knowledge could be driven either by the prevalence of these properties or by the generic beliefs potentially licensed by this prevalence information. Our use of facts about one vs. some animals allowed us to avoid this ambiguity because these facts were narrow enough in scope to make category-wide generalizations relatively unlikely. (For exam-

<sup>2</sup> The only difference between this replication and Experiment 1 was that children were asked two questions on each trial: In addition to the question about their moms’ knowledge, they were asked whether they themselves had known the novel facts. The results for this self-knowledge question are not directly pertinent to the goal of this paper, so they are not reported here.

<sup>3</sup> In this respect, the evidence provided by such quantified statements is no less legitimate than the first-hand evidence obtained by observing a property in multiple members of the same category.

ple, knowing that one or some hedgehogs ate hexapods at a certain point in time is relatively unlikely to license an inference that hedgehogs, as a kind, eat hexapods.) Crucially, however, these facts did embody a clear contrast in the number of individuals to which they pertained, allowing us to test whether children use prevalence information in their judgments about others' knowledge.

The results of this study may also speak to an alternative source of children's expectation that others know generic facts. Rather than stemming from children's belief that adults should know generic facts because they know how the world works, it is possible that this expectation could instead be driven by a belief that generic information is more accessible than non-generic information. This would be, in fact, a reasonable belief: Acquiring first-hand knowledge about a specific individual or set of individuals requires exposure to those particular individuals. If you want to learn about John the hedgehog, for example, it will not do to observe Bob the hedgehog instead. In contrast, the evidence that might lead (say, via inductive generalization) to knowledge about a category is typically available across a much wider range of contexts. If children's expectation that generic knowledge is broadly distributed in others' minds is driven solely by accessibility considerations, then they should conclude that facts about multiple individuals are more accessible, and thus more widely known, than facts about a single individual. Conversely, if children's expectations about others' knowledge of facts that contrast in numerical scope are not significantly different, it is unlikely that accessibility computations can fully explain children's assumption that generic knowledge is widely shared.

### 3.1. Method

#### 3.1.1. Participants

Forty-eight children participated in this study: half were 4 and 5 years old (12 boys and 12 girls;  $M = 5.03$  years;  $SD = 0.48$ ) and half were 6 and 7 years old (12 boys and 12 girls;  $M = 6.85$  years;  $SD = 0.54$ ). The participants were demographically similar to those in Experiment 1. None had participated in Experiment 1.

#### 3.1.2. Materials, design, and procedure

The materials, design, and procedure were identical to those of Experiment 1, with one exception: Children were asked about facts quantified with "some" (e.g., "Last night, some hedgehogs ate hexapods") rather than about generic facts (e.g., "Hedgehogs eat hexapods").

### 3.2. Results and discussion

In this study, we asked whether children's expectations about others' knowledge of a fact are influenced by the number of individuals that this fact is about. An RM-OLR with Wording, Age Group, and Block Order as factors revealed that numerical prevalence had little influence on children's responses: The difference between the percentage of "yes, mom knows" responses for the facts about some animals ( $M = 36.1\%$ ) and the facts about a single animal ( $M = 30.2\%$ ) was small and non-significant, Wald

$\chi^2 = 2.23$ ,  $df = 1$ ,  $p = .136$ ,  $d = 0.17$ . This difference was not significant when examining the data by item either, Wilcoxon  $Z = 1.19$ ,  $p = .266$  (see Table 1). In fact, the RM-OLR revealed no significant effects whatsoever, including no Wording  $\times$  Age Group interaction, Wald  $\chi^2 = 0.36$ ,  $df = 1$ ,  $p = .547$ .

Despite the absence of an interaction between Wording and Age Group, we investigated the responses of the two age groups with separate RM-OLRs (see Table 2 for means). The 4- and 5-year-olds showed no evidence of sensitivity to the prevalence contrast: The main effect of Wording was not significant,  $M_{\text{some}} = 42.0\%$  vs.  $M_{\text{one}} = 39.6\%$ , Wald  $\chi^2 = 0.47$ ,  $df = 1$ ,  $p = .491$ ,  $d = 0.06$ , and neither were the main effect of Block Order and the Wording  $\times$  Block Order interaction ( $ps > .33$ ). Importantly, it is unlikely that these null effects were driven by difficulties with the meaning of the quantifier "some." Although children aged 4 and 5 do not typically generate the scalar implicatures that are common in adults' interpretation of this term (that is, children seldom make the pragmatic inference that "some" is meant as "some, but not all"), they nevertheless have no trouble with the actual semantic content of this quantifier (e.g., Huang & Snedeker, 2009; Noveck, 2001; Smith, 1980).

The RM-OLR on 6- and 7-year-olds' data uncovered a similar pattern of results: The percentage of "yes, mom knows" responses for the facts about some animals ( $M = 30.2\%$ ) was not significantly higher than that for the facts about a single animal ( $M = 20.8\%$ ), Wald  $\chi^2 = 3.36$ ,  $df = 1$ ,  $p = .067$ ,  $d = 0.35$ , and the Wording  $\times$  Block Order interaction was not significant either, Wald  $\chi^2 = 0.66$ ,  $df = 1$ ,  $p = .417$ . The only significant effect in this analysis was a main effect of Block Order, Wald  $\chi^2 = 3.89$ ,  $df = 1$ ,  $p = .048$ ,  $d = 0.78$ , which indicated that children who heard the facts about some animals first ( $M = 35.4\%$ ) ended up giving more "yes" responses over the course of the entire session than children who heard the facts about a single animal first ( $M = 15.6\%$ ). Although this result provides a glimmer of evidence that older children use prevalence in their judgments about others' knowledge, their sensitivity to this information is limited: Most importantly, the absence of a Wording main effect and a Wording  $\times$  Block Order interaction suggests that children did not make use of the contrast between the two types of facts as they moved from one block to the next, regardless of which type of fact came first.

Overall, these data speak against the possibility that children's expectations about the social distribution of generic vs. non-generic facts are driven simply by the numerical scope of these facts. Several considerations support this conclusion. First, the 4- and 5-year-olds in this study did not rely on the prevalence of a fact to determine whether others know it, and yet children this age hold clearly different expectations about others' knowledge of generic vs. non-generic facts (as shown in Experiments 1, 3, and 4). Second, although there was some weak evidence that 6- and 7-year-olds factor prevalence information into their judgments, it is unlikely that prevalence was the *only* basis for their previously demonstrated expectation that generic facts are more widely known than non-generic facts. After all, the younger children also distinguished between generic and non-generic facts in Experiment 1, but

they showed little sensitivity to prevalence here. More plausibly, 6- and 7-year-old children's emerging use of this prevalence information may have simply exacerbated the differences between the (more prevalent) generic and the (less prevalent) non-generic items.<sup>4</sup>

These data also suggest that children's expectations about the distribution of generic facts in others' minds cannot be due solely to children's inferences about the accessibility of evidence for such facts. In other words, it is unlikely that children arrive at the expectation that adults typically know generic facts by computing the prevalence of the informative contexts. (If they did, they should have distinguished reliably between facts about multiple individuals vs. one individual.) Rather, a more likely source of this expectation is the one we proposed originally—that children expect adults to possess generic information because (1) such information pertains to how the world works and (2) adults are generally seen as experts on this matter. Nevertheless, this is not to say that accessibility considerations play no role in children's judgments in our task. For example, when asked about others' knowledge of facts about individuals, children may well take into account the improbability of perceptual access to the relevant evidence (e.g., my mom has never seen this hedgehog; e.g., O'Neill, 1996). That is, children may have an active expectation that others, even adults, are *unlikely* to know facts about individual hedgehogs, tigers, etc., because the evidence for such facts is relatively inaccessible. This expectation may operate in parallel to, and complement, the expectation that adults are generally *likely* to know generic facts about hedgehogs, tigers, etc., because they know about how the world works.

Finally, we should clarify that a property does *not* need to be highly prevalent within a category in order to be generically true of that category (e.g., Carlson & Pelletier, 1995; Cimpian, Brandone, & Gelman, 2010; Leslie, 2008). It is generically true, for example, that mosquitoes carry the West Nile virus, although fewer than 1% of them actually do. Thus, in principle we could also have compared children's judgments about novel properties that were provided in *generic* form but that nevertheless differed in how prevalent they were. Conceptually, this alternative test would have been as appropriate as the test performed in the present study, where we contrasted properties provided in non-generic form. Interestingly, however, it is not a trivial matter to manipulate the underlying prevalence for generic facts that are completely unfamiliar. For unfamiliar non-generic facts, prevalence can be easily manipulated by changing the determiner of the noun (e.g., "this hedgehog" vs. "some hedgehogs"). For generic facts, on the other hand, there is no way to indicate prevalence within the generic noun phrase itself. Manipulating the content of the property might not be sufficient either:

For example, a novel generic statement such as "Seagulls carry the *flurpellax* virus," although structurally analogous to familiar generic statements that are about low-prevalence properties, is perfectly compatible with an inference that *most* seagulls carry the *flurpellax* virus (Cimpian, Brandone, & Gelman, 2010). As a result, the only reliable means of manipulating the prevalence of novel properties provided in generic form would probably have been to introduce this information separately (e.g., by illustrating it graphically), which would have made the entire procedure significantly more demanding. We bring up these considerations not only to justify the choices we made in this study but also to illustrate some of the complexities that arise when trying to pull apart genericity and prevalence, especially for unfamiliar properties.

#### 4. Experiment 3

In this study, we focused on another semantic dimension that covaried with genericity in Experiment 1: The generic facts were about *habitual properties* that generalize across time and situations (e.g., what hedgehogs typically eat), whereas the non-generic facts were about *specific events* (e.g., what a hedgehog ate at a particular point in time). In Experiment 3, we equated the generic and non-generic facts on this dimension. That is, we replaced the non-generic facts about events (e.g., "Last night, this hedgehog ate a hexapod") with non-generic facts about habitual properties (e.g., "This hedgehog eats hexapods"<sup>5</sup>). This change afforded a more stringent test of our main hypothesis that children expect generic facts to be more widely known than non-generic facts.

##### 4.1. Method

###### 4.1.1. Participants

Forty-eight children participated in this study: half were 4 and 5 years old (12 boys and 12 girls;  $M = 4.91$  years;  $SD = 0.56$ ) and half were 6 and 7 years old (12 boys and 12 girls;  $M = 6.91$  years;  $SD = 0.61$ ). An additional 4-year-old child was tested but was excluded because he could not complete the task. The participants were demographically similar to those in Experiments 1 and 2. None had participated in these previous studies.

###### 4.1.2. Materials, design, and procedure

The materials, design, and procedure were identical to those of Experiment 1, with one major exception: The non-generic items now referred to general, habitual characteristics of individual animals (e.g., "This hedgehog eats

<sup>4</sup> The conclusion that 6- and 7-year-olds may be starting to use prevalence in their judgments relies on the assumption that the relatively low prevalence implied by the quantifier "some" was not sufficient to license category-wide generalizations. However, if the 6- and 7-year-olds did occasionally draw such generalizations, the block order effect in their data may simply constitute more evidence that they expect (inferred) generic facts to be widely known.

<sup>5</sup> In this paper, we use the term "generic" in a somewhat narrow sense, namely to denote reference to a kind. In the linguistics literature (e.g., Carlson & Pelletier, 1995; see also Cimpian, Arce, Markman, & Dweck, 2007), this term is often used more broadly to encompass not only statements expressing facts about kinds but also statements expressing general, habitual properties, regardless of whether they are properties of an individual or a kind. In this broader usage, the facts we termed "non-generic" in this study (e.g., "This hedgehog eats hexapods") would in fact be generic as well.

hexapods”; see Table 1) rather than specific events (e.g., “Last night, this hedgehog ate a hexapod”).<sup>6</sup>

#### 4.2. Results and discussion

An RM-OLR with Wording, Age Group, and Block Order as factors revealed that, as predicted, children expected their moms to know more of the generic facts ( $M = 60.9\%$ ) than of the non-generic facts ( $M = 49.0\%$ ), even though the non-generic facts were now about general features of individuals rather than about events they took part in, Wald  $\chi^2 = 7.02$ ,  $df = 1$ ,  $p = .008$ ,  $d = 0.36$ . The generic advantage held up across 6 of the 8 items (see Table 1), Wilcoxon  $Z = 1.54$ ,  $p = .133$ .

Although the interaction between Wording and Age Group did not reach significance, Wald  $\chi^2 = 3.70$ ,  $df = 1$ ,  $p = .054$ , we nevertheless performed separate RM-OLRs for the two age groups (see Table 2 for means). These analyses revealed that the 6–7-year-olds differentiated between the generic and non-generic facts, Wald  $\chi^2 = 8.54$ ,  $df = 1$ ,  $p = .003$ ,  $d = 0.76$ , but the 4–5-year-olds did not, at least not over all trials, Wald  $\chi^2 = 0.38$ ,  $df = 1$ ,  $p = .536$ ,  $d = 0.11$  (see Table 2 for means).

For the younger children, however, the non-significant main effect of wording is best interpreted in light of an interaction between Wording and Block Order, Wald  $\chi^2 = 4.80$ ,  $df = 1$ ,  $p = .028$ . Crucially, these children did show the predicted wording effect on the *first* block, saying that their moms knew significantly more of the generic facts,  $M_{generic} = 66.7\%$  vs.  $M_{non-generic} = 35.4\%$ , Mann–Whitney  $Z = 1.98$ ,  $p = .051$ ,  $d = 0.87$ . On the second block, however, the children who started out with the generic facts ( $M = 66.7\%$ ) continued to say “yes” at very high levels for the subsequent non-generic facts ( $M = 70.8\%$ ); in contrast, children who started out with the non-generic facts ( $M = 35.4\%$ ) were better able to change their responses when they were subsequently presented with the generic facts ( $M = 47.9\%$ ). This type of order effect—whereby generic stimuli cause children to treat the non-generic stimuli that follow as if they were generic, but not vice-versa—is not uncommon in developmental research on generic statements (see Gelman, Ware, Manczak, & Graham, 2011; Hollander et al., 2009). We speculate about what it might mean in the General Discussion.

In sum, these results suggest that children’s expectation that generic facts are better known than non-generic facts applies even in cases where the non-generic facts are about *habitual characteristics* of individuals (e.g., “This hedgehog eats hexapods”). This finely tuned expectation was present in both age groups, although the younger children only showed evidence for it in their answers to the first block of questions.

#### 5. Experiment 4

The main goal of this study was to provide a more direct test of the hypothesis that children expect generic knowledge to be *broadly distributed* in other people’s minds when compared to non-generic knowledge. Therefore, in the present study we wanted to expand the range of people about whose knowledge we asked children. A first attempt in this direction was made in Experiment 3, where we piloted a question asking whether “just a few” people or “a whole lot” of people knew the relevant facts. Conceptually, this question does provide a direct test of whether generic knowledge is assumed to be widely known; in terms of information processing load, however, this question is relatively complex. To answer it as predicted, children have to (1) interpret the scope of the term “people” (e.g., are children included?), (2) apply their expectations about the social distribution of generic vs. non-generic knowledge to the set they generated in step 1 in order to decide how many of its members would be likely to know the relevant facts, and (3) map the outcome of this computation onto the scale we provided (“just a few” vs. “a whole lot”). Given the computationally demanding nature of this question, it may not be surprising that the children in Experiment 3 chose “a whole lot” equally often for the generic ( $M = 64.1\%$ ) and the non-generic ( $M = 59.9\%$ ) facts.

To avoid these issues, in Experiment 4 we devised other, more accessible, ways of asking children about a broader range of people. Specifically, we asked (1) if their *parents* knew the relevant facts, (2) if their *teachers* knew them, and (3) how many *grown-ups* knew them (“just a few” vs. “a whole lot”). Although the Grown-ups question is similar to the pilot question above, we reasoned that replacing “people” with “grown-ups” would simplify at least one of the steps involved in answering this question (that is, determining its scope) and might thus allow children to respond based on their hypothesized assumption that generic knowledge is more widespread than non-generic knowledge.

A secondary goal of this study was to test whether children’s assumption about the broader distribution of generic knowledge in others’ minds extends to a different domain of knowledge. All of the generic and non-generic facts we used so far concerned (members of) animate natural kinds. In this experiment, we tested whether this assumption would still hold if the facts were about (members of) social categories, namely boys and girls. We chose social categories as a test case because, in this domain, the assumption that generic facts are widely known may contribute to some of the detrimental effects of stereotyping on children’s achievement motivation and performance. That is, exposure to generic statements such as “Boys are good at math” (see Cimpian, 2010, *in press*; Gelman, Taylor, & Nguyen, 2004) could lead children to infer that the relevant ability “facts” are common knowledge, and thus that their own performance will be judged against the expectations set by these “facts.” Such explicit awareness of others’ expectations, be they positive or negative, often causes decrements in performance (e.g., Baumeister et al., 1985; Cimpian, 2010; Cimpian et al., *in press*; see

<sup>6</sup> Another methodological difference relative to Experiment 1 was that children were asked, in addition to the question about their moms’ knowledge, a pilot question about how many people knew the relevant facts. The rationale for this question, as well as children’s responses to it, will be discussed in Experiment 4. The order of these two questions was constant across all trials for an individual child but was counterbalanced across children.

also the stereotype threat literature, e.g., Ambady et al., 2001; Cheryan & Bodenhausen, 2000; Steele, 1997), so it is possible that this assumption about generic knowledge being widely shared may ultimately take a toll on children's ability to do well in academic settings.

## 5.1. Method

### 5.1.1. Participants

Forty-eight children participated in this study: half were 4 and 5 years old (12 boys and 12 girls;  $M = 5.07$  years;  $SD = 0.58$ ) and half were 6 and 7 years old (12 boys and 12 girls;  $M = 7.16$  years;  $SD = 0.61$ ). The participants were demographically similar to those in Experiments 1–3. None had participated in these previous experiments.

### 5.1.2. Materials, design, and procedure

The generic versions of the eight novel facts used in this study were about boys or girls (e.g., “Boys/Girls play dackish games”), whereas their non-generic versions were about a particular boy or girl (e.g., “He/She plays dackish games”; see Table 3 for full list). In order to eliminate any possibility that children would be familiar with the words we judge to be of low frequency, in this study we used entirely novel words in our facts (e.g., “dackish”). Also note that all the non-generic facts were about general characteristics of an individual—as in Experiment 3—rather than about particular events.

We counterbalanced the gender with which each fact was associated. That is, each fact was about boys/a boy for half of the children and about girls/a girl for the other half. In addition, half of the children who heard the *boy* version of an item were boys, and half were girls; the same was true for the *girl* version of each item.

Each child heard four facts about boys/a boy and four facts about girls/a girl. The boy and girl trials alternated,

and the gender of the first trial was counterbalanced across children. Also, as before, half of the trials were generic and half were non-generic, and the order of the generic and non-generic blocks was counterbalanced.

On each trial, the experimenter started out by introducing the novel fact. On a generic trial, the experimenter would say, for example, “Now I want to tell you something interesting about girls. Girls play dackish games. They play dackish games.” On a non-generic trial, the experimenter would say, for example, “Now I want to tell you something interesting about a girl. She plays dackish games. She plays dackish games.” (No pictures were presented with any of the facts.)

The experimenter then asked the three questions: (1) *Parents* (“If you had to make a guess, do you think your parents know about this? Do they know that...?”), (2) *Teachers* (“How about your teachers? Do they know that...?”), and (3) *Grown-ups* (“How many grown-ups do you think know about this? How many grown-ups know that...? Is it just a few grown-ups, or is it a whole lot of grown-ups?”).

The Grown-ups question was accompanied by a visual representation of the two answer options, consisting of a letter-size page with 3 large dots on one half (“just a few”) and about 50 large dots on the other half (“a whole lot”). To ensure that children understood how the quantities in the question mapped onto the scale in front of them, the experimenter pointed to the two scale options while asking the question.

The Parents and Teachers questions were always presented adjacently and in the same order (Parents first, then Teachers). However, we counterbalanced whether the Parents and Teachers questions came first, followed by the Grown-ups question, or whether the Grown-ups question came first, followed by the other two.

At the end of the session, the children received a debriefing in which they were told that the facts they

**Table 3**

The items used in Experiment 4, along with the mean percentage of “yes” or “a whole lot” responses to their generic and non-generic versions.

	Item	Parents question	Teachers question	Grown-ups question	Expt. 4 average
G	Boys/girls read zorbish books	45.8	62.5	45.8	51.4
NG	He/she reads zorbish books	37.5	50	50	45.8
G	Boys/girls play dackish games	62.5	45.8	70.8	59.7
NG	He/she plays dackish games	45.8	50	62.5	52.8
G	Boys/girls listen to feppy music	54.2	50	62.5	55.6
NG	He/she listens to feppy music	37.5	25	33.3	31.9
G	Boys/girls draw glippy pictures	54.2	54.2	58.3	55.6
NG	He/she draws glippy pictures	41.7	37.5	33.3	37.5
G	Boys/girls have blickish rooms	54.2	41.7	45.8	47.2
NG	He/she has a blickish room	37.5	25	29.2	30.6
G	Boys/girls wear zavy shirts	66.7	66.7	75	69.4
NG	He/She wears zavy shirts	37.5	37.5	50	41.7
G	Boys/girls are good at using wuggish tools	66.7	58.3	70.8	65.3
NG	He/she is good at using wuggish tools	33.3	12.5	33.3	26.4
G	Boys/girls eat frammy vegetables	50	45.8	58.3	51.4
NG	He/she eats frammy vegetables	41.7	39.1	45.8	42.3

Note: “G” stands for “generic,” and “NG” stands for “non-generic.” “Expt. 4 average” refers to the average percentage of “yes”/“a whole lot” responses across the Parents, Teachers, and Grown-ups questions.

heard were “just for pretend” and that “in real life, boys and girls like pretty much the same things, and they are good at the same things.”

## 5.2. Results and discussion

Because the Parents, Teachers, and Grown-ups questions all measured the same underlying construct (how widespread children assume knowledge of a fact to be), and because preliminary inspection of the data revealed that children’s answers to these questions were similar, we used as our dependent measure the average percentage of “yes”/“a whole lot” responses across these three questions. Although the analyses reported below used this aggregate measure, in Tables 3 and 4 we break out the results for each question separately.

An RM-OLR on the average proportion of “yes”/“a whole lot” responses revealed the predicted main effect of Wording, Wald  $\chi^2 = 20.74$ ,  $df = 1$ ,  $p < .001$ ,  $d = 0.63$ . Children thought that other people (their parents, their teachers, grown-ups) were more likely to know novel generic facts about boys and girls ( $M = 56.9\%$ ) than novel non-generic facts about particular boys and girls ( $M = 38.6\%$ ). This difference held up over all 8 items, Wilcoxon  $Z = 2.52$ ,  $p = .008$ .

Two interactions are pertinent to the interpretation of this main effect. First, a significant Wording  $\times$  Age Group interaction, Wald  $\chi^2 = 4.49$ ,  $df = 1$ ,  $p = .034$ , suggested that the effect of generic vs. non-generic wording was stronger for the 6–7-year-olds. Follow-up RM-OLRs revealed that the generic vs. non-generic difference was significant for the 6–7-year-olds, Wald  $\chi^2 = 19.00$ ,  $df = 1$ ,  $p < .001$ ,  $d = 0.98$ , but only marginal for the 4–5-year-olds, Wald  $\chi^2 = 2.09$ ,  $df = 1$ ,  $p = .088$ ,  $d = 0.37$  (see Table 4 for means).

Second, a significant Wording  $\times$  Block Order interaction, Wald  $\chi^2 = 10.28$ ,  $df = 1$ ,  $p = .001$ , suggested that the effect of generic vs. non-generic wording was stronger for the children who started out with the non-generic block than for those who started out with the generic block. (If you recall, this pattern is similar to that observed in Experiment 3.) In fact, both age groups successfully discriminated between the generic and non-generic facts when the non-generic trials were first (4–5-year-olds:  $M_{non-generic} = 43.8\%$  vs.  $M_{generic} = 64.6\%$ , Wilcoxon  $Z = 2.14$ ,  $p = .031$ ,  $d = 0.76$ ; 6–7-year-olds:  $M_{non-generic} = 12.8\%$  vs.  $M_{generic} = 51.4\%$ , Wilcoxon  $Z = 2.81$ ,  $p = .002$ ,  $d = 1.71$ ), but neither age group did so when the generic trials were first

(4–5-year-olds:  $M_{generic} = 55.6\%$  vs.  $M_{non-generic} = 53.5\%$ , Wilcoxon  $Z = 0.40$ ,  $p = .720$ ,  $d = 0.06$ ; 6–7-year-olds:  $M_{generic} = 56.3\%$  vs.  $M_{non-generic} = 44.4\%$ , Wilcoxon  $Z = 1.55$ ,  $p = .141$ ,  $d = 0.48$ ).

Finally, the RM-OLR uncovered a significant main effect of Age Group, Wald  $\chi^2 = 4.22$ ,  $df = 1$ ,  $p = .040$ ,  $d = 0.44$ , which indicated that the 4–5-year-olds ( $M = 54.3\%$ ) were overall more likely to attribute knowledge to others than the 6–7-year-olds ( $M = 41.2\%$ ).

In sum, the results of Experiment 4 suggest that children are able to reason about the social distribution of generic vs. non-generic knowledge on a relatively broad scale; in other words, they are not limited to reasoning only about whether familiar, specific others (e.g., their moms) possess these types of knowledge. Children’s inferences about the knowledge states of larger, and less familiar, groups of people (e.g., teachers, grown-ups) demonstrate that they truly believe generic knowledge is widely shared. Finally, Experiment 4 also revealed that children’s expectation that generic facts are widely known extends to facts about social groups and may thus apply across a variety of knowledge domains.

## 6. General discussion

From an early age, children assume that generic information provides special insights into the structure of reality (e.g., Cimbian & Markman, 2009; Hollander et al., 2009). Given children’s tendency to also assume that adults know how the world works (e.g., Callanan & Oakes, 1992; Taylor et al., 1991), we predicted that children would expect adults to be broadly knowledgeable about generic facts, more so than about non-generic facts matched in content. Four studies investigated this prediction.

### 6.1. Summary of the findings

In line with our prediction, the results of Experiment 1 showed that children aged 4–7 expected their moms to know novel generic facts (e.g., “Hedgehogs eat hexapods”) more often than facts that were matched in content but were non-generic (e.g., “Last night, this hedgehog ate a hexapod”). This result was also replicated in a separate sample of 4- to 7-year-olds.

Next, we explored whether children’s expectation that generic facts are more widely known than non-generic facts is based simply on the numerical scope of these facts.

**Table 4**

The average percentages of “yes” or “a whole lot” responses in Experiment 4 (and SDs).

Age Group	Wording	Parents question	Teachers question	Grown-ups question	Expt. 4 average
4–5-year-olds	Generic	58.3 (36.6)	57.3 (37.2)	64.6 (31.2)	60.1 (30.0)
	Non-generic	47.9 (41.6)	43.8 (44.4)	54.2 (30.1)	48.6 (31.8)
6–7-year-olds	Generic	55.2 (36.8)	49.0 (36.5)	57.3 (29.9)	53.8 (27.3)
	Non-generic	30.2 (37.6)	25.7 (29.4)	30.2 (32.1)	28.6 (24.4)
Overall	Generic	56.8 (36.4)	53.1 (36.7)	60.9 (30.5)	56.9 (28.5)
	Non-generic	39.1 (40.2)	34.7 (38.3)	42.2 (33.1)	38.6 (29.8)

Note: Responses to the Parents and Teachers questions were either “yes” or “no.” Responses to the Grown-ups question were either “just a few” or “a whole lot.” “Expt. 4 average” refers to the average percentage of “yes”/“a whole lot” responses across the Parents, Teachers, and Grown-ups questions.

On this alternative interpretation, children might expect others to know generic facts because such facts typically pertain to many individuals. Experiment 2, however, provided evidence against this interpretation by demonstrating that children's expectations about others' knowledge of a property are not sensitive to the prevalence of this property. In this study, children did not expect others to know non-generic facts about *some* animals any more often than they expected others to know non-generic facts about a *single* animal. Children's failure to capitalize on this prevalence contrast makes it implausible to claim that their expectations about others' knowledge of generic properties are based entirely on the prevalence of such properties. This finding also speaks against the idea that children's assumption that generic facts are well known can be accounted for entirely by their reasoning about the accessibility of these facts (i.e., about how much evidence there would be, across contexts, to learn these facts); if accessibility was a prominent criterion for deciding who knows a fact, then children should have expected the facts about multiple individuals to be better known than the facts about a single individual.

It could also be argued that the generic vs. non-generic difference in the first study was due to the fact that the non-generic items described events (e.g., "Last night, this hedgehog ate a hexapod") rather than habitual characteristics, as the generic items did. Contrary to this alternative hypothesis, in Experiment 3 we found that children assume generic facts to be more widely known than non-generic facts even when the latter are about a habitual feature of an individual (e.g., "This hedgehog eats hexapods").

Finally, Experiment 4 explored the coverage of children's assumption that generic facts are generally well known. In particular, we tested whether this assumption extends to adults other than children's moms (i.e., parents, teachers, and grown-ups in general) and to categories other than natural kinds (i.e., social groups). The results suggested that children's expectations do in fact apply relatively broadly, both in terms of who is expected to possess generic knowledge and in terms of what types of generic facts are expected to be known.

## 6.2. Potential implications

In addition to providing evidence about the privileged status of generic knowledge in early cognitive life, the current findings have implications for our understanding of several other developmental phenomena.

First, as mentioned before, the assumption that generic information is widely known may play a role in mediating the effect of stereotypes on children's academic performance. Our results suggest that, on exposure to a novel stereotype about the abilities of a social group (which is a type of generic information), children might automatically infer that this stereotype is known by many and thus that it guides other people's expectations about the performance of the targeted group. If the children are themselves members of the stereotyped group, these inferred public expectations may have a detrimental effect on their performance because they may cause children to worry about

confirming them (if the expectations are low, as in the case of a negative stereotype) or about not living up to them (if the expectations are high, as in the case of a positive stereotype; for additional discussion, see Cimpian, 2010, *in press*).

Second, the assumption that generic knowledge is widely shared is involved in communication and language use. We have already discussed a specific instantiation of this assumption at the lexical level—namely, children's expectation that count nouns are known by all in their language community (e.g., Buresh & Woodward, 2007; Diesendruck, 2005). In fact, this expectation applies to other lexical categories as well. For example, although young children's sparse vocabularies often drive them to coin new *verbs* (e.g., "to crack out," used instead of "to hatch"), they readily adopt the conventional verbs that express the same meanings, presumably because they realize it is these conventional forms that most people will know rather than their own idiosyncratic creations (E. Clark, 1988, 1990).

There is, however, another level at which assumptions about generic knowledge may be involved in the process of communication. Whenever we formulate an utterance, we are required to decide what has to be stated explicitly and what can be left unsaid. These decisions are based in part on what we perceive to be common ground (H. Clark, 1996) with our audience: Knowledge that is part of this common ground can often remain unstated during the course of a conversation. Importantly, *generic* knowledge about the world is a major component of common ground (H. Clark, 1996) and is therefore presupposed on most occasions. For example, when producing an utterance such as "The toddlers started crying when they saw the tigers," a speaker might assume that listeners are aware of several background generic facts—that tigers are large and frightening, that toddlers are easily scared, that they cry when they are scared, and so on. Because this utterance was constructed assuming an audience who knows these generic facts, its intended meaning may not be fully grasped without this knowledge. (If a listener mistakenly thought that tigers are cute and cuddly, for example, this sentence would make much less sense.) It is thus essential that speakers' assumptions about what can be presupposed are accurate. Children's realization that generic facts are widely known may be a crucial step in this direction—that is, a crucial step towards learning what knowledge can reasonably be presupposed when communicating with others.

Third, the present results add to a growing body of work on children's ability to reason about others' knowledge states. The existing data on this topic suggest that children evaluate others' knowledge routinely, from an early age, and on the basis of a wide range of factors. In assessing another person's knowledge, children take into account, among other things, whether the person has perceptual access to the relevant objects or events (e.g., Akhtar, Carpenter, & Tomasello, 1996; Luo & Baillargeon, 2007; Luo & Johnson, 2009; Nadig & Sedivy, 2002; Nayer & Graham, 2006; Nilsen & Graham, 2009; O'Neill, 1996; Onishi & Baillargeon, 2005; Perner & Leekam, 1986; Pillow, 1989; Scott & Baillargeon, 2009; Scott, Baillargeon, Song, & Leslie, 2010; Wellman & Bartsch, 1988), whether the

person has a history of being accurate or inaccurate (e.g., Birch et al., 2008; Jaswal & Neely, 2006; Koenig & Harris, 2005), and what else the person knows or has expertise in (e.g., Danovitch & Keil, 2004; Keil et al., 2008; Lutz & Keil, 2002; Shatz & Gelman, 1973). The present results suggest that children's reasoning about others' knowledge is also guided by abstract expectations about the distribution of generic vs. non-generic information in people's minds.

### 6.3. Relationship to the omniscience assumption of the natural pedagogy hypothesis

Our prediction that children should expect generic facts to be known by many adults is consistent with some aspects of the natural pedagogy hypothesis (e.g., Csibra & Gergely, 2006, 2009; Gergely, Egyed, & Király, 2007; Yoon, Johnson, & Csibra, 2008). According to the proponents of natural pedagogy, children have an innate bias to interpret as *generic* any information they receive subsequent to an adult's ostensive-communicative cues (e.g., making eye contact with the child or calling the child's name). Csibra, Gergely, and their colleagues speculate that such a bias may have been favored by natural selection because it allowed the efficient transmission of survival-relevant generic information from one generation to the next. Importantly, in order for the pedagogical bias to perform this function, children must assume that adults actually possess the knowledge they are manifesting—an *omniscience* assumption, as Csibra and Gergely (2006) termed it.

This omniscience assumption is similar to our own proposal that children assume generic facts to be well known, at least insofar as the term “omniscient” is understood in the restricted sense of “typically knowledgeable about generic facts.” So far, however, the evidence for the omniscience assumption is limited. A study by Egyed, Király, Krekó, Kupán, and Gergely (2007) provided the clearest test of this assumption, so we will describe it here (but see also Gergely et al., 2007). In this study, an experimenter emoted positively towards one novel object (A) and negatively towards another (B) while the 18-month-old participants watched. For half of the infants, these emotional displays had been preceded by ostensive-communicative cues (e.g., eye contact); for the other half, the ostensive cues had been absent. Then, a second experimenter came into the room and asked the infants to give her one of the objects. The logic of this test is as follows: If ostensive-communicative cues signal to children that the subsequent information is generic, and thus widely known, then children should infer that the second experimenter shares the first experimenter's positive evaluation of object A, as well as her negative evaluation of object B. If so, infants should be more likely to hand object A to the second experimenter in the ostensive condition than in the non-ostensive condition, where the absence of ostensive cues prevents children from inferring that the evaluative information is widely shared. Although the results were in the predicted direction, with 13 of the 19 infants in the ostensive condition touching object A first compared to only 10 of the 19 infants in the non-ostensive condition, this cru-

cial difference was not significant,  $\chi^2(1, N = 38) = 0.99$ ,  $p = 0.319$ .<sup>7</sup> Further complicating matters, Buresh and Woodward (2007) found that 13-month-old infants did *not* expect one person's positive evaluation of an object to be shared by a different person, even though the evaluative information was preceded by ostensive cues. To conclude, although the omniscience assumption is compatible with the argument we make here, the evidence for it is weak. In fact, the present studies may provide the strongest evidence to date for this hypothesized assumption.

### 6.4. Order effects: possible causes and consequences

Across several of our studies (especially Experiments 3 and 4), children (especially the younger ones) behaved differently depending on whether they heard the generic or non-generic items first: When the non-generic block was presented first, children had no difficulty differentiating between these non-generic items and the subsequent generic items. However, when the generic block was first, children often appeared to treat the subsequent non-generic items as if they were generic.

#### 6.4.1. Possible causes

A plausible framework for interpreting these order effects (see also Hollander et al., 2009; Gelman et al., 2011) is provided by the natural pedagogy hypothesis. If children's cognitive systems were particularly attuned to, and privileged the acquisition of, generic information about the world, as implied by the pedagogy hypothesis (see also Cimpian & Erickson, 2012a; Leslie, 2008), it is reasonable to expect stronger carryover from the generic trials to the non-generic trials than in the opposite direction: Starting the session with the generic facts may have functioned as a pedagogical cue that biased children to expect further generic information from the adult they were interacting with—similar to how simpler cues such as eye contact bias even younger children's learning. Influenced by this expectation, the children in our studies may have interpreted the non-generic statements in the second block as expressing facts that generalize to the entire relevant kinds.

It is also possible that, rather than serving as a pedagogical cue per se, hearing the generic facts first primed children to think in terms of categories, which subsequently caused them to construe the individuals mentioned in the non-generic facts as *representatives* of their respective categories. In turn, this construal might have led children to generalize the facts learned about these exemplars to their entire categories, hence the generic-like responses. In contrast, although starting out with the non-generic facts could have primed children to think in terms of individuals, generic facts may be more resistant to distortion or assimilation by such an individual-level construal: Intuitively, it seems unlikely for a fact about an entire category to be ultimately understood as being about a single individual.

<sup>7</sup> We provide this statistic here because this comparison was not performed in Egyed et al.'s (2007) original report.

Yet another, and less rich, interpretation of this order effect might be that exposure to generic facts in the first block induced a bias to respond “yes” that skewed children’s answers on the second, non-generic, block. When the non-generic facts were presented first, however, whatever “no” bias they induced may have dissipated more easily, perhaps because “no” answers in this task (e.g., mom doesn’t know) are less socially desirable than “yes” answers. Although this is a possible account of our order effects, it cannot explain why the same pattern of results was also found in studies with entirely different procedures and dependent measures. For example, Hollander et al. (2009) investigated 5-year-olds’ use of features highlighted in generic vs. non-generic statements as criteria for category membership. On each trial, children saw a picture of a novel animal (e.g., a kevtta) and heard one of its features described in either generic (e.g., “Kevtas are woolly”) or non-generic (e.g., “This kevtta is woolly”) terms. Children were then shown two test items and had to decide which one is the same kind of animal as the target. Crucially, only one of the test items possessed the key feature (e.g., being woolly), while the other one was more perceptually similar to the target. In this task, children who received the generic block first categorized on the basis of the highlighted properties (e.g., being woolly) both on the generic block and on the subsequent non-generic block. In contrast, when the non-generic block was first, children used the highlighted property as a criterion for category membership only on the second, generic, block. Since the order effect obtained with this two-alternative match-to-sample procedure is identical to ours and yet is not susceptible to an explanation in terms of a “yes” bias, it seems more parsimonious to favor an explanation that could encompass both sets of results (such as the first two explanations above).

#### 6.4.2. Possible consequences

In examining children’s responses across our studies, two patterns emerge that are intriguing but that may best be understood as artifacts of the order effects in Experiments 3 and 4.

**6.4.2.1. Different expectations for different types of non-generic facts?** It may at first appear that children made strong distinctions among the various types of non-generic facts to which they were exposed. For example, children seemed to expect event-specific facts about individuals (28.1% “mom knows” responses in Experiment 1) to be less well known than habitual facts about individuals (49.0% in Experiment 3; see Table 2). However, we suspect that these differences arose simply because Experiments 3 and 4 showed strong order effects whereas Experiment 1 did not.<sup>8</sup> Thus, the high percentage of “mom knows” responses to the habitual facts about individuals in Experiment 3 may have been artificially inflated by the responses of children who were asked about these facts in the second block, after answering questions about generic facts. To test this possibility, we performed a cross-experi-

ment comparison on the data from children who received the non-generic facts *first*. In particular, this analysis compared children’s responses to three types of non-generic facts: *event-specific* facts about *one* individual (e.g., “Last night, this hedgehog ate a hexapod”; Experiments 1 and 2), *event-specific* facts about *some* individuals (e.g., “Last night, some hedgehogs ate hexapods”; Experiment 2), and *habitual* facts about *one* individual (e.g., “This hedgehog eats hexapods”; Experiment 3). This three-level Wording factor, along with Age Group, was entered as a predictor in an OLR performed on the first-block non-generic data from Experiments 1–3. We limited our comparison to these studies because they were methodologically similar—in fact, they were identical except for the wording of the stimuli. As predicted, this OLR revealed no significant main effects and no interaction. Most importantly, the absence of a main effect of Wording, Wald  $\chi^2 = 3.34$ ,  $df = 2$ ,  $p = .189$ , suggested that event-specific facts about one individual ( $M = 28.1\%$  “mom knows” responses), event-specific facts about some individuals ( $M = 39.6\%$ ), and habitual facts about one individual ( $M = 39.6\%$ ) were treated similarly when they were presented first, without interference from a preceding generic block. Thus, although dimensions other than genericity may very well influence the *actual* social distribution of a fact (e.g., accessibility; see Section 3), there is little evidence in our studies that children paid attention to such alternative dimensions.

**6.4.2.2. Age differences in expectations about generic vs. non-generic facts?** It may also appear that 4- and 5-year-olds’ expectations about others’ knowledge of generic vs. non-generic facts were more weakly differentiated than 6- and 7-year-olds’ were. For example, the younger children in Experiments 3 and 4 did not judge the generic facts to be significantly more widely known than the habitual non-generic facts (e.g., “This hedgehog eats hexapods”). In contrast, these two sets of facts clearly pulled apart in the older children’s judgments. This pattern of results may be taken to suggest that preschoolers are still in the midst of learning about the distribution of generic vs. non-generic knowledge in others’ minds: Although they may be able to differentiate between generic and *event-specific* non-generic facts (Experiment 1), they have difficulties when judging generic and non-generic facts that are more similar semantically.

As before, however, we suspect that this pattern of results was driven in large part by the order effects in Experiments 3 and 4, to which the younger children were particularly susceptible. If 4- and 5-year-olds were particularly likely to treat the habitual non-generic facts that followed the generic block as if they were themselves generic (perhaps for the reasons discussed in Section 6.4.2.1 above), then it stands to reason that their responses would not, in the aggregate, differentiate very strongly between the two sets of facts. Nonetheless, this does not mean that their expectations about the social distribution of generic and non-generic facts are undifferentiated. When the habitual non-generic facts were presented *first*, the 4- and 5-year-olds showed clear evidence of expecting these facts to be known by fewer people than the relevant generic facts (see Sections 4.2 and 5.2). As a result, the absence of

<sup>8</sup> In Experiment 1, the surface and semantic differences between the generic and non-generic stimuli were more obvious, which may have allowed children to switch response sets more easily.

an overall main effect of generic vs. non-generic wording for the young children in Experiments 3 and 4 cannot plausibly be attributed to the absence of the requisite conceptual understanding (i.e., that generic facts are more widely known than non-generic facts). Rather, the weaker aggregate result for the 4- and 5-year-olds in these studies may simply be a byproduct of the order effects in these younger children's responses, and thus due perhaps to general cognitive factors such as inhibitory control, which undergoes development over the school years (e.g., Williams, Ponesse, Schachar, Logan, & Tannock, 1999) and has often been invoked as an explanation for young children's inability to switch responses between tasks (e.g., Kirkham, Cruess, & Diamond, 2003).

### 6.5. Conclusion

The four studies reported here provide compelling evidence for the hypothesis that children assume generic facts are more widely known than non-generic facts. These results reinforce the conclusion that generic information plays a privileged role in children's cognition. More broadly, the assumption that generic knowledge is widely shared may have implications for children's motivation and performance in achievement settings, for how children learn language, and for how they reason about others' minds. Together, these findings illuminate an intriguing, and previously unexplored, aspect of children's cognitive development.

### Acknowledgments

Many thanks to the participating children and their families; to the University of Illinois for generous financial support; to Ben Boldt, Melissa Yako, Gina Petro, and the Cognitive Development Lab team at UIUC for assistance in testing and coding; to Renée Baillargeon, Luke Butler, Cindy Fisher, Vikram Jaswal, Meredith Meyer, and Joe Robinson, and three anonymous reviewers for providing comments on previous drafts of this manuscript; and to the principals, teachers, and staff at the participating schools in the Champaign-Urbana area.

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