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Generic language and judgements about category membership: Can generics highlight properties as central?

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Abstract

Many languages distinguish generic utterances (e.g., "Tigers are ferocious") from non-generic utterances (e.g., "Those tigers are ferocious"). Two studies examined how generic language specially links properties and categories. We used a novel-word extension task to ask if 4- to 5-year-old children and adults distinguish between generic and specific language, and judge that predicating a property of a depicted novel animal using generic language (e.g., "Bants have stripes"), rather than non-generic language (e.g., "This bant has stripes") implies a more kind-relevant connection between category and property. Participants were asked to endorse an extension of the label taught to a novel animal matching the target instance on either overall similarity or the mentioned property. Wording was found to have a significant effect on responses for both age groups. Altogether, the results of these studies suggest that the generic may be a default interpretation for young children, who need to learn the semantics of specific and set-theoretic expressions.

Many languages, including English, distinguish generic utterances (e.g., "Tigers are ferocious") from non-generic utterances (e.g., "Those tigers are ferocious"). The generic sentence differs importantly from the non-generic in that it refers to tigers as a *kind* rather than to specific individuals (Carlson & Pelletier, 1995; Gelman, 2003; Leslie, 2005; Prasada, 2000). The present paper examines how generic language may help children acquire knowledge about kinds of things. In the remainder of this Introduction, we first consider the relationship between generic language and kind concepts, next briefly review recent findings regarding what young children know about generic language and concepts, and finally outline the goals and approach of the current studies.

Some Questions Regarding Generic Language and Generic Knowledge

Much of what we know about the world can be expressed in generic sentences. This is an intuition expressed by theorists in the diverse realms of linguistics, philosophy, cognitive

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science, and developmental psychology. Linguists wrestle with the question of how to encompass truth-value judgments in a coherent treatment of generics (e.g., Krifka et al., 1995). Philosophers and researchers in artificial intelligence grapple with the representation of “common sense knowledge” wherein generically stated facts can be ‘logically’ true and yet admit of exceptions (for example, see Leslie, 2005; McCarthy, 1986). Similarly, Prasada (2000) outlines a formalism for representing what he terms “generic knowledge” that he argues not only captures the interesting truth-value properties of generic language but also resolves some important questions about concept acquisition—especially, how do children come to have knowledge about kinds of things?

It is this question which Gelman (2004) dubs “the puzzle of generic knowledge.” How do we come to have beliefs about a kind as a whole based on experience with small numbers of instances? Prasada (2000) posits that we come to have beliefs of the sort expressed in true generic sentences primarily via a formal system that allows experience of even a single instance to be sufficient to acquire a new generic ‘fact’. He suggests that early on in the acquisition of generic knowledge children might be especially likely to rely on the mechanisms he describes, instead of the statistical processes implicit in creating a ‘type’ from the properties held in common by individual tokens (Prasada, 2000, p. 70). As he claims, this turns on its head the typical suppositions about how concepts are acquired.

On this analysis, generic knowledge is fundamentally different from knowledge of statistical regularities, and the distinction is critically captured in generic expressions. The sentence “Dogs are four-legged”, then, can be glossed as “Dogs, by virtue of the kind of thing they are, are four-legged” (Prasada 2000, p. 66). This stands in contrast to sentences with explicit quantifiers, for example “All dogs are four-legged” or “X% of dogs are four-legged”, which are claims about statistical prevalence. Indeed, on this analysis, such statements are inherently subject to qualification as in “X% of dogs surveyed so far in this area are four-legged” (p. 67). In Prasada's model, then, generic expressions explain how *essential* properties become associated with kinds of things.

Generic language may play an important role as children acquire generic knowledge. Gelman (2004) similarly notes that concepts about abstract kinds are not supplied directly by personal observations of the world, because members of a kind cannot be fully enumerated. Therefore generic language likely serves at the very least as a means for conveying information broadly applicable to members of the category, or as Medin and Rips (2005) have suggested, for predicating ‘typical’ properties. Gelman (2004) also addresses the ways in which language generally might be tied to generic knowledge and contends that language may be required to stipulate properties true of a kind and not some sample of individuals, and required also for the important act of naming, whereby individuals are deemed members of a category and therefore likely to share important similarities with other members (Gelman & Coley, 1990; Gelman & Markman, 1986; Waxman & Markow, 1995).

Generic language may play an especially important role in connecting properties to categories. How properties and categories become connected is a central question in the study of concepts. How do children come to understand, for instance, that being striped is an idiosyncratic property of cats or shirts, but a central property of tigers? Children must learn to distinguish specific reference and idiosyncratic properties from generic expression and kind-relevant properties.

One means of determining which properties are more versus less central is by direct observation of the surrounding environment. However, in many (perhaps most) cases, the evidence would be too ambiguous to permit powerful inferences. For example, a child might have seen only one actual tiger in her life, and therefore cannot be certain whether stripedness generalizes to other instances. Or, the evidence might favor a generalization, but one cannot be certain that the sample is representative. For example, perhaps all the cats a child has encountered have been striped, but her sample is rather small. Does this mean that cats in general are striped?

We propose that language is a powerful tool for conveying the scope of a property with respect to a category. Specifically, generic noun phrases may serve as an invitation to link a property to a category. Although it is possible to make inferences about kinds in the absence of language, as non-human animals often do (e.g., learning which foods are edible), with language, we can elegantly convey that a property holds generally true of a kind, without having to enumerate many instances. This can be done by means of quantification (e.g., "All tigers are striped"; "Most tigers are striped"), but as discussed earlier, category-wide generalizations are most typically conveyed by means of generic statement. By hearing the generic statement "Tapirs have white-tipped ears" in reference to a novel animal, the child may form an assumption that the feature of white-tipped ears is relatively important to the identity of tapirs as a category. Thus, children may assume that new instances of the category "tapir" will also have this property.

The idea that hearing generic language may influence how powerfully children link a property to a category has been discussed but not tested by others. Prasada (2000) suggests that generic language associates properties with categories, by glossing generics as expressing that a property holds "by virtue of the kind of thing [the category] is"; similarly, Shipley (1993) interprets generics about animals as expressing that members of the category "are the kind of animal such that" the property holds. Indeed, Prasada and Dillingham (2006) argue that generics interpreted as reflecting a principled connection further motivate normative expectations about instances of the type in question—that is, for example, because "Dogs have four legs" by virtue of what they are, we can expect new instances of dogs that we encounter to have four legs, too. Although Prasada demonstrates that not all generic sentences express principled connections (instead, others express mere statistical connections; e.g., the sentence "Barns are red" does not imply that "By virtue of what they are, barns are red"), his work advances the intriguing notion that at least some generics imply that a property is connected to the category of which it is predicated in deep, identity-relevant ways. In short, generics are special in what they imply about the property-category relationship—they seem to link a predicated property to the kind referred to in a 'central', law-like way (Carlson & Pelletier, 1995; Leslie, 2005; Lyons 1977), in a manner related to the acquisition and representation of generic knowledge (Gelman, 2004; Prasada, 2000; Prasada & Dillingham, 2006).

Children's Understanding of Generic Language and Concepts

In order for the above proposal to be plausible, we would want evidence that children appreciate the semantics of generic language. Indeed, despite the multiple and complex cues for expressing generics in English, there is growing evidence that even very young children use them appropriately in context (Gelman, Chesnick, & Waxman, 2005). By 2-1/2 years of age, children produce generics appropriately and spontaneously (Gelman, Goetz, Flukes, & Sarnecka, 2008). By 4 years of age children are able to use multiple cues (both formal and pragmatic) to identify an utterances as generic (Cimpian & Markman, 2008), and even children as young as 2 ½ years go beyond their real-world knowledge about the categories in question, interpreting queries as generic or non-generic based on *both* linguistic form cues *and* contextual information (Gelman & Raman, 2003). Four-year-olds also understand that generics are broad in implication but allow for exceptions, for both familiar categories (Hollander, Gelman, & Star, 2002) and novel categories (Gelman & Bloom, 2007).

Moreover, children display sensitivity to the importance of generics for properties. For example, preschool children extend novel properties more broadly within a familiar category when the property is expressed generically vs. non-generically (Gelman, Star, & Flukes, 2002). For example, "Bears climb trees" leads children to assume that even atypical bears climb trees, in contrast to non-generic utterances (e.g., "This bear climbs trees" or "Some bears climb trees"). They also extend novel properties more broadly within a novel category, when the property is expressed generically vs. non-generically (Chambers, Graham, & Turner, 2008). For example, the generic statement "Pagons are friendly" leads children to assume that other pagons are friendly, in contrast to the non-generic statement "These pagons are friendly".

The Present Studies

The present studies examine whether the link between property and category differs when it is expressed with generic language as compared to when it is expressed with non-generic language. There are two consequences of this hypothesis, with two corresponding implications for how one might test this notion. One consequence is that generic language should lead children to infer that a new property thus expressed generalizes broadly to a range of category members. As noted above, Gelman et al. (2002) and Chambers et al. (2008) have found that preschool children extend novel properties more broadly when the property is expressed with a generic than with a non-generic. The second consequence of this hypothesis is that generic language should lead children to consult the novel property when identifying new instances of a category. For example, if children had never encountered the category "tapirs" before, but heard a new property expressed generically (e.g., "Tapirs have white-tipped ears"), they should consult the generic property to determine whether or not a new animal is a member of the category "tapirs". In order to test this second consequence, one would teach children a new fact (either generic or specific) about a novel category, then test which features children use *to identify new instances of the category*. This is the approach taken in the present studies.

In the current studies, for each of a series of novel items, the researcher presents an item, labels it, and describes a property while systematically varying the wording: in one condition the property is described with a generic sentence (e.g., “Bants have stripes”), in another condition the property is described with a specific sentence (e.g.,“This bant has stripes”). After labeling and describing the item, the researcher asks which of two new items can also be labeled with the new word: one item that matches the target item on the property predicated—either generically or non-generically—and one option that matches the target on overall perceptual similarity.

We use novel animals as the depicted objects here, assuming that the more richly structured categories represented by animal kinds are the most typically expressed with generic language. Indeed, past work consistently demonstrates that generic language is more commonly used when talking about animals than when talking about artifacts (e.g., Gelman et al., 1998; Goldin-Meadow, Gelman, & Mylander, 2005; Gelman & Tardif, 1998).

Study 1

Methods

Participants—There were 33 children, aged 4 years 8 months to 6 years 1 month, with a mean age of 5 years 2 months. Seventeen children were included in the experimental condition and 16 in the control condition. All child participants attended preschool centers affiliated with the same university from which adult participants were drawn. There were 36 adults, 24 in the experimental condition and 12 in the control condition. All adult participants were students at a large, mid-western university, enrolled in an Introductory Psychology course. Their participation in the study partially fulfilled class requirements. All participants were native speakers of English.

Materials—There were 12 item-sets, each comprising 3 pictures of novel animals: one target instance to receive a verbal label from the experimenter (herein referred to as the ‘labeled’ instance) and two choice pictures-- one matched with the labeled instance on the highlighted property (herein referred to as the ‘predicated-property match’ choice) and one matched with the labeled instance on overall perceptual similarity (herein referred to as the ‘overall-similarity match’ choice). The overall-similarity match choice was created in each case to be highly perceptually similar to the labeled instance, but to lack the property shared by the labeled-instance and the predicated-property match. Furthermore, the overall-similarity match differed from the labeled instance on at least two other dimensions, one of which was always subtle variation in coloring. Figure 1 shows one sample item-set. The predicated-property matches were drawn to be more obviously different from the labeled instance, particularly in contour, but were kept at least somewhat similar to the labeled instance. Thus, all 3 items in each set could conceivably be seen as related. This was done to ensure that the labeling would remain plausible for both choice items (Davidson & Gelman, 1990).

Items were divided into an A and a B group for the purpose of counterbalancing items across wording conditions. Although the creatures were novel ones, in most cases they resembled known animals, and so animal-types were balanced across the groups as well.

Each group included two mammal-like creatures, one water-dwelling creature, and two reptile-like creatures.

A nonsense name of either one or two syllables (equal numbers of each, counterbalanced across the two item-groups) was assigned to each labeled animal. Group A names were: bant, dorn, bleen, tepin, febbit, vorzyd; group B names were: fep, plog, scred, kevta, bactra, yanci. The sorts of properties stipulated of the animals also fell into types which were counterbalanced across item groups. Each group included predications about the target animal's color, texture (e.g., wooly), color-pattern (e.g., striped), salient and/or disproportionately-sized parts (e.g., big ears), and number of parts (e.g., has 2 humps). A list of all items appears as Appendix A.

Procedure—Children were tested individually in a quiet room in their school. Each child was told beforehand that he or she was going to be playing a special ‘game’. At the beginning of the session, the experimenter sat across from the child at a table and explained that the child would “be seeing some pictures of animals”. Adult participants were tested individually in a small office in a university building. They were told that they would be engaging in an experiment designed to be conducted with young children. The participant sat across a desk from the experimenter, and the protocol was identical to that used with children.

For each of the twelve trials, the experimenter presented the labeled-instance drawing and stated its name, for example, “This is a kevta”. For a Generic trial, the experimenter then said, “Let me tell you something about kevtas. Kevtas have two humps”. For a Non-Generic trial, the wording was instead, “Let me tell you something about this kevta. This kevta has two humps”. For the Non-Generic wording, emphasis was placed on the word “this”. The labeled-instance drawing was left on the table for the participant to observe, and two new drawings—the overall-similarity match choice and the predicated-property match choice—were placed side by side and above the labeled-instance. The left-right placement of the overall-similarity match and predicated-property match choices was counterbalanced across trials for each participant. The experimenter called the participant's attention to the two new drawings, and asked, “Which of these is also a kevta?”

Trials were blocked into two 6-item sets, one block using generic wording and one block using non-generic wording, and presentation order of the blocks was counterbalanced across participants. The 2 item lists (“A” and “B” groups described above) were counterbalanced between the wording conditions so that each item appeared equally often in each wording, and the trials within each block were randomly ordered.

For the control condition, the same scripts were used as for the experimental condition, but the statements giving information, generically in one block and non-generically in the other, were omitted and replaced with a repeating of the labeling sentence, for emphasis (e.g., “This is a kevta. This is a kevta”). The query language (e.g., “Which of these is also a kevta?”) remained the same as in the experimental condition. Left-right placement of the overall-similarity and predicated-property match choices was counterbalanced as in the experimental condition.

Results

Responses were scored as 1 for a property-match choice, and as 0 for a shape-match choice. The scores were summed across the 6 items in each testing block (generic wording or non-generic wording) for each participant, yielding one score per block ranging from 0-6 (where 0 represents all overall-similarity choices, and 6 represents all predicated-property choices). See Table 1 for the results.

These scores were entered into a 2 (age: adult, child) × 2 (wording: generic, non-generic) × 2 (order: generic-first, non-generic-first) ANOVA. The effect of wording was significant, $F(1,37) = 36.27$, $p < .005$. As predicted, when participants heard information stated generically about the novel animal they saw, they were significantly more likely to say that the picture-choice possessing the predicated property was a member of the target category than when the property was predicated using non-generic phrasing. There was also a significant Age × Wording interaction, $F(1,37) = 8.22$, $p < .05$.

In order to determine whether the condition effect held up within each age group separately, we also conducted separate 2 (wording: generic, non-generic) × 2 (order: generic-first, non-generic-first) ANOVAs on responses from adults and from children. As predicted, there was a main effect of Wording for both adults, $F(1,22) = 32.37$, $p < .001$, and children, $F(1, 15) = 13.99$, $p < .005$. Additionally, there was a non-significant Wording × Order interaction for children, $F(1,15) = 4.40$, $p = .053$. Pairwise comparisons indicate that while the effect of wording was significant for adults in both the generic-first and non-generic-first orders (both ps < .01), for children the effect of wording was significant only when the non-generic wording block was presented first ($p < .005$).

Comparisons by t-test to chance levels (50%, or 3 out of 6) shows that in the generic wording condition, both adults and children chose the predicated-property match significantly more often than what would be expected by chance ($M = 5.50$ for adults, $M = 5.24$ for children). On the non-generic wording trials, however, adults chose the predicated-property at chance levels ($M = 2.3$), whereas children's predicated-property choices were significantly higher than chance ($M = 4.09$).

Control Condition—The control condition was included to measure baseline responding to the item-sets used in the experimental conditions, in the absence of any linguistic input to the participant regarding the predicated property. Responses were coded as in the experimental condition, as 1 for a property-match choice, and as 0 for a shape-match choice. The scores were summed across the 12 items for each participant, yielding one score per block ranging from 0-12 (where 0 represents all overall-similarity choices, and 12 represents all predicated-property choices). For the purposes of comparisons to the experimental conditions, each participant's score was divided by 2.

Adults in the control condition were significantly less likely to choose the predicated-property match than would be expected by chance ($M = 1.00$; $p < .001$), but children were not ($M = 3.25$). Comparisons of the control condition to each of the wording conditions (generic; non-generic) by independent-sample t-tests showed that adults ($p < .001$) and children ($p < .001$) chose the predicated-property match significantly less often for the control than for the generic wording condition. Furthermore, both adults (p = .054, one-tailed) and children (p = .044, one-tailed) also chose the predicated-property match significantly less often for the control than for the non-generic wording condition. Thus, for both age-groups responses were affected by mentioning the properties even in the non-generic wording, compared to the simple labeling presented in the control condition.

Item analyses—To ensure that there weren't any systematic differences attributable to variability in the items, the rate of predicated-property match responding was calculated for each of the 12 items. Analysis of the child responses indicated that 9 of the 12 items showed the expected response pattern, with a higher percentage of predicated-property match choices for the generic wording condition than for the non-generic condition. For adults, all 12 items showed the expected response patterns as well. Thus, overall, the results hold generally across items.

Discussion

Study 1 examined whether adults and preschool-aged children distinguish between information provided about a category generically and specifically. We expected that when participants were told that a depicted animal possessed a property, their subsequent word extensions would be affected by whether a generic or non-generic phrasing was used to convey the connection. The results supported the hypothesis. Overall, generic wording yielded more selections of the predicated-property match than non-generic wording. This effect was more pronounced for adults than for children, but was significant at both ages. Although the wording differentiation was quite subtle (“bants” vs. “this bant”), and although in both wording conditions the predicated property was mentioned, both children and adults treated the generic and non-generic wording condition consistently differently.

Furthermore, children were more likely to choose the predicated property in the generic condition than in the control condition, in which no property was mentioned. However, children were also more likely to choose the predicated property in the *non*-generic condition than in the control condition. Indeed, children's responses in the control condition did not differ significantly from chance. This result was unexpected, and presents a problem for interpreting children's responses in the experimental conditions.

With regard to the control condition, we had predicted that in the absence of any predicated property information, overall similarity in shape would have guided children's extensions, as they did adults'. Many studies have found that overall similarity in shape is critically important to how children extend words (Diesendruck & Bloom, 2003; Landau, Smith, & Jones, 1998; Smith, Jones, & Landau, 1996). However, it is also possible that items that we intended to represent shape matches were not perceived as such by young children. Prior research has shown that there are important developmental changes in children's perception of shape (Abecassis, Sera, et al., 2001). Indeed, a closer inspection of the items revealed that some of the predicated properties in fact may have affected judgments of overall shape. For example, although “large ears” was intended to be a property match on one triad, animals that have the same large ears are also more alike in head-shape than animals that differ in their ear-size. The 3 triads for which children did not show the expected response pattern (generic wording leading to greater choice of the predicated property matches) were all potentially affected in this way.

A further consideration is that we deliberately designed the item sets such that the contrast between shape-match and property-match was not too stark. For example, if a set consisted of two rabbit-shaped items and a snake-shaped item, the overall similarity between the two rabbit-shaped items would be so extreme that one would not expect wording effects to be sufficiently powerful to overcome the perceptual pull. Indeed, Gelman and Davidson (1990) found that preschool children are confused by stimuli sets in which animals that looked quite different were nonetheless given the same label, and animals that looked very similar were given different labels. They found evidence that this was particularly so for novel words, and argue that children may expect a minimum amount of similarity before they accept objects would share a label. Thus, although the similarity among members in each item-set may be justified, it could have affected the judgments of child participants in particular by creating a trio of animals which looked sufficiently similar in overall shape that the property predicated of the target instance in the experimental condition was saliently ‘a match’, and thus guided participants' choices about label extension in some instances.

It is therefore unclear whether these patterns reflect developmental differences in interpretation of overall shape, in perceived similarity among items that were designed to be plausibly of the same kind, or in conceptions of perceptual similarities relevant to labeling specifically. Therefore, we conducted Study 2 to follow up on these issues.

Study 2

Study 1 examined whether stipulating a property of an animal generically can modify children's judgments about category membership. In particular, in Study 1 we found that hearing a generic noun phrase leads children to extend a word to another item that shares the predicated property with the target, in contrast to another item that is similar to the target in appearance but does not share the predicated property. Study 2 follows up on this finding by providing a more stringent test of the effect of wording. Specifically, in Study 2, the same-property choice is pitted against a *same-shape* choice that is clearly more similar to the target. As noted previously, children are particularly attentive to shape in their early categorizations and word extensions (Baldwin, 1992; Landau et al., 1998; Smith et al., 1996), and some scholars have proposed that young children base their word extensions primarily on shape. It is therefore a particularly strong test to ask if predicating a property with a generic noun phrase induces children to extend a new word in a way that “trumps” shape similarity.

There are three possible patterns of response that we might plausibly expect to find. First, children may be so focused on object shape that they choose the shape-match in both the generic and the non-generic wording conditions. If this pattern were found, it would indicate that although generic wording is capable of affecting children's classifications (as shown in Study 1), it is not sufficiently powerful to overcome children's shape bias. Second, children may be so attentive to the predicated property as expressed in both the generic and non-generic wording conditions, that they show an overwhelming tendency to select the predicated-property choice in both the generic and non-generic wording conditions. Finally, the third plausible pattern, the one we predict, is that generic wording would guide children's selection of new instances away from the same-shape choice and toward the predicated-property choice. Specifically, this suggests that children would select the predicated-property choice after hearing a generic statement, and in contrast would select this choice less frequently after hearing a non-generic statement.

Methods

Participants—Thirty children participated in the experimental condition and 16 in the control condition. Children in the experimental condition ranged in age from 4 years 3 months to 5 years 11 months, with a mean age of 5 years 1 month; children in the control condition ranged from 4 years 4 months to 5 years 11 months, with a mean age of 5 years 1 month. Sixteen adults participated in the experimental condition and 16 in the control condition. All were undergraduates at a large, Midwestern university. Additionally, there were a total of 16 child participants for the pre-testing of materials, ranging in age from 4 years 0 months to 4 years 11 months, average age 4 years 6 months. Children were recruited from university-affiliated preschool centers and from the participant pool for a university-based child cognition lab. None of the children or adults had participated in the earlier studies.

Pre-test of Items—Items from Study 1 were the starting point for creation of a new set of items meeting our goal of more directly pitting shape against target properties. Therefore each item-set was designed to make the similarity match more clearly into a shape-match, and to make the property-match less similar to the target (especially with respect to shape).

The new item-sets were subjected to a pre-test protocol wherein participants judged shape similarity and property presence. It was reasoned that this would clarify a priori whether the shape-choice items captured our intuitions about what children would consider to be the same shape as the labeled-item, and whether the property-choice items would be clearly seen as sharing the predicated property with the labeled-item. The items were presented in 2 blocks: a shape-question block and a property-question block. For each trial in the shape-question block, the experimenter presented the participant with the target picture, and said, for example, “This is a bant”. The experimenter then placed the shape-match and property-match choices side by side beneath the target instance and asked, “Which of these has the same shape as the bant?” The left-right placement of the shape- and property-match choices was counterbalanced across trials for each participant. The property-question block used the same items, but the experimenter said (for example), “This is a bant. A bant has stripes. Which of these has stripes?”

The goal here was to ensure that the shape-match instance clearly was perceived by children as being of the same shape as the target, and that the property-match instance clearly was perceived by children as sharing the same predicated property as the target. Pretesting of materials proceeded in two phases. In each phase, 8 participants rated a set of items. In order for an item to qualify for inclusion in the study proper, at least 6 out of 8 children (75%) needed to answer correctly on both the shape and the property questions. In Phase 1, five out of 12 item-sets tested met these requirements; in Phase 2, a further five item-sets met the study requirements.

Materials—The materials for Study 2 were modifications of those used in Study 1, as detailed in the pre-test section above. There were 10 item-sets, each consisting of a labeled-instance, a property-match choice, and a shape-match choice. The novel names were kept the same as for Study 1. A list of the item-sets appears in Appendix B; a sample picture appears in Figure 2.

Procedure—All procedures for Study 2 were the same as for Study 1.

Results

Responses were scored as 1 for a property-match choice, and as 0 for a shape-match choice. The scores were summed across the 5-item generic wording block, and across the 5-item non-generic wording block for each participant, yielding 2 scores between 0 (reflecting all shape-match choices) and 5 (reflecting all property-match choices) for each participant. See Table 2 for the results. These scores were entered into a 2 (age: adult, child) × 2 (wording: generic, non-generic) × 2 (order: generic-first, non-generic-first) ANOVA. As predicted, there was a significant main effect of wording, $F(1,42) = 64.10$, $p < .001$. There was also a significant Age × Wording interaction, $F(1,42) = 35.22$, $p < .001$, and trend toward a three-way interaction among Age, Wording, and Order ($p = .076$). Planned comparisons by paired t-tests reveal a significant effect of Wording at each age considered separately: for adults, $t(15) = 7.14$, $p < .001$, and for children, $t(29) = 1.95$, $p < .05$ (one-tailed).

Given that we had obtained a significant Age × Order interaction in Study 1, thereby suggesting that there may be unintended carry-over effects from the first to second block of items, we also conducted an analysis of participants' responses to the first block of items only. In this analysis, both wording and age were treated as between-subjects factors. On a 2 (Age: adult, child) × 2 (wording: generic, non-generic) ANOVA, there was a significant effect of wording, $F(1,42) = 34.97$, $p < .001$, and a significant Age × Wording interaction, $F(1, 42) = 7.90$, $p < .01$. Post-hoc pairwise comparisons confirm that the effect of wording, although more pronounced for adults than for children, held for both adults (M(generic) = 5.00, M(non-generic) = 1.25, $p < .001$) and children (M(generic) = 3.87, M(non-generic) = 2.53, $p < .05$).

Comparisons by t-test to chance levels (50%, or 2.5 out of 5) show that in the generic wording condition, both adults and children chose the predicated-property match significantly more often than what would be expected by chance ($M = 4.75$ for adults, $M = 3.70$ for children, ps < .001). On the non-generic wording trials, however, adults chose the predicated-property significantly *less* often than chance levels ($M = 0.94$.$p < .001$), whereas children's predicated-property choices were significantly higher than chance ($M = 3.13$, $p < .05$).

Control—In the control condition, both adults and children chose the property-match significantly less than would be expected by chance (adults: $M = 0.34$ out of 10; $p < .001$; children: $M = 2.6$ out of 10, $p < .001$). Indeed, the majority of the time, both children and adults selected the shape-match in the control condition. Thus, as intended, we were successful in designing the item sets such that the shape-match was clearly more perceptually similar to the target item, for children.

We also compared responses to the control condition directly (namely, comparing each of the two experimental conditions, generic and non-generic to the control condition, by means of planned comparison t-tests). In order to compare responses to the control condition (10 items) to responses to the experimental conditions (5 items each), we divided responses to the control condition by 2, to put all responses on the same scale. Results indicated that, as predicted, both children and adults selected the predicated-property choice significantly more often in the generic condition than the control condition (children: $t(44) = 6.07$, $p < .001$; adults: $t(30) = 17.55$, $p < .001$). Surprisingly, children also selected the predicated-property choice significantly more often in the non-generic condition than the control condition, $t(44) = 4.53$, $p < .02$. Thus, despite the strong pull toward the shape-match when only perceptual information was available (i.e., the control condition), children switched to selecting the property-choice match more often in both the generic and non-generic conditions. In contrast, adults' choice of the predicated-property choice did not differ in the control condition compared to the non-generic condition, n.s.

Item analyses—To ensure that there weren't any systematic differences attributable to variability in the items, the rate of predicated-property match responding was calculated for each of the 10 items. Analysis of the child responses indicated that 7 of the 10 items showed the expected response pattern, with a higher percentage of predicated-property match choices for the generic wording condition than for the non-generic condition. Considering the first-block responses only, 8 of the 10 items showed the expected pattern. For adults, all of the 10 items showed higher propertymatch responding on the generic wording trials.

Discussion

The current study replicates and extends Study 1. As in Study 1, we asked whether children and adults are sensitive to the subtle distinctions in the language (generic vs. non-generic) when providing property-relevant information. Specifically, we examined whether providing property-highlighting information about a novel animal, after first presenting a novel label for it, would influence children's naming extensions. Study 1 provided evidence that both children and adults were sensitive to the differences between generic and non-generic wording, although adults showed greater sensitivity than did children. Study 2 replicates this finding: both children and adults were more likely to extend the novel label to an item with the predicated property, when the property was expressed with generic vs. non-generic wording.

Another feature of Study 2 that is worth noting is that we employed an improved set of items, in which the baseline preference (in the absence of stated property information) was to select the same-shape match. This preference was confirmed both in pretesting with children, and in the control condition. Materials developed in this way appear to have overcome the problems of the stimuli-set from Study 1, in that children were now significantly more likely to choose the shape-match in the control condition, as expected.

Importantly, this means that when children did select the predicated-property choice, this was particularly impressive, as it entailed *not* choosing a same-shape choice that was strongly preferred a priori.

One surprising result from Study 2 was that, for children, the non-generic wording condition also led to higher selection of the predicated-property response than in the control condition. Although such responses are lower in the non-generic than the generic wording condition, it is noteworthy that the non-generic wording condition yielded such high levels of performance. In some respects this may not be an altogether unexpected result, in that both experimental conditions emphasize the predicated property. Nonetheless, there appears to be a developmental change in the *non-generic* wording condition. Adults interpreted the non-generic statements as implying *lack* of generality. For example, “This bant has stripes” indicated that the property of stripedness is likely to be idiosyncratic and particular to this individual bant (as can be seen by the lack of significant difference between the non-generic condition and the control condition, for adults). In contrast, children seem not to understand that the non-generic statement can imply *less* generality than a neutral control condition. Perhaps this is a pragmatic implication that is too subtle for preschool-aged children. Another possibility is that children have heard “this” used in didactic contexts to refer to kinds (e.g., a teacher pointing to a classroom wall chart may say, “This dinosaur is a meat-eater” to refer to the dinosaur kind rather than an individual). In the future, it would be intriguing to examine interpretation of this linguistic form more directly, and from a developmental perspective.

In any case, one very interesting potential suggestion that emerges from this finding is that developmental change may take place more in how children interpret *non*-generics than in how children interpret *generics*. Although speculative, this result may suggest the possibility that generics are readily interpreted by young children, perhaps even as a default, and that it is non-generics that are more complicated and require further linguistic experience to attain.

General Discussion

The present studies indicate that 4- to 5-year-old children and adults distinguish between generic and non-generic sentences in guiding their extension of novel labels for animals. As far as we know, this is the first demonstration of the effect of generic language on word extension, and adds to a recent literature demonstrating that children distinguish generic from specific utterances on a variety of tasks (Chambers, Graham, & Turner, 2008; Cimpian & Markman, 2008; Gelman & Bloom, 2007; Gelman & Raman, 2003). These studies are notable for examining how preschool children interpret generics for novel categories, use generic language to link properties to kinds, and make use of generic expressions in the service of word learning.

The present findings indicate that children can exploit generic language in decisions about the extension of a novel word. Thus, these studies place generic language among the kinds of linguistic information that children can attend to in determining the referent of a novel term. Many studies have indicated, for instance, that preschool-aged children can use formal cues when interpreting novel words (Brown, 1958; Macnamara, 1982; Hall, Waxman, Bredart, & Nicolay, 1993; Hall, 2004; see Bloom, 2000, for review). For example, children interpret mass nouns as referring to substances, verbs as referring to actions, proper names as referring to individuals, etc. One notable difference between this work and the prior demonstrations, however, is the subtlety of the semantics underlying the generic/non-generic distinction. Whereas the semantic contrast in prior work tended to have some sort of material correlate (e.g., substances are materially different from individuated objects, at least when one considers the sets to which they refer), there is no such distinction between a set of individuals and a kind, other than an abstract conceptual difference. Nonetheless, children attend to this distinction by 4 to 5 years of age.

At the same time, however, there is clearly some development occurring. Although the effect of generic wording holds in both studies, for both adults and children, the effect is markedly greater for adults. That is, adults seemed to be more sensitive to the distinct semantics of generic versus non-generic phrasing for predicating properties of the novel animals presented to them. The age differences came in children's responding to the *non-generic* language trials, more than in response to the generic language trials (as compared to the control label-only condition). This raises the intriguing possibility that children understand generic language, but have more trouble interpreting the *specific* expressions.

One clear way to interpret the specific, non-generic wording in Studies 1 and 2—“This bant has stripes”—is in a contrastive sense. The utterance implies that *this particular bant* (only) has the property of stripedness, and that the property is not kind-relevant. This indeed was how adults seemed to interpret this wording. Although adults were no higher than chance in Study 1, they extended the labeled property significantly *below* chance in Study 2 (where the materials were preselected to provide an especially clear and compelling shape alternative). In both studies, adults chose the same-property match upwards of 90% of the time on generic-wording trials. Thus, adults appeared to be sensitive to the pragmatic issues related to the non-generic wording.

It was surprising, then, that children chose the same-property match at levels higher than chance on the non-generic wording trials, in both studies. This result again implies that what changes developmentally is not the interpretation of generic language, but rather the interpretation of non-generic language. However, it should also be noted that children's bias toward providing a property match may reflect other, task-related factors. For example, inattention could cause children simply to place greater weight on the property that had been mentioned.

Another finding of interest in both studies was that order of presentation seemed to affect children's (but not adults') responses. In both studies, the non-generic-first order resulted in a greater distinction between the property-match scores for the generic wording and the non-generic wording. Another way of thinking about this, is that children seem to have been affected by carryover from the generic-wording block, but not from the non-generic block, suggesting that once they hear and interpret the generically stated connections between having a property (say, having 2 humps), and being a member of a novel category (say, being a ‘dorn’), they have greater difficulty in interpreting appropriately the non-generic statements of the following block.

The Puzzle of Generic Knowledge

Generic language not only presents an inductive puzzle to the child learning to produce reference to kinds but also relates to the question of learning about kinds of things at all (Gelman, 2003, 2004; Prasada, 2000). We can never see a kind, only instances thereof, and yet we speak of kinds via generic expressions, and do so from a young age (Gelman et al., 2008; Gelman & Tardif, 1998; Goldin-Meadow et al., 2005). The current studies can be seen as speaking to these concerns.

As we found, generic wording increases children's tendency to link a property to a kind. One open question that remains is the nature of this property-kind link. It is unclear whether children think that the property is relatively central to the category (i.e., that it has a principled or essential link), or instead whether they think that the property is statistically prevalent in the category (Prasada & Dillingham, 2006). In either case, this result shows that the generic-non-generic distinction has important conceptual implications as children build knowledge about the world. It is also interesting that even with non-generic wording, hearing a property linked to an *individual* increases children's tendency to link the property to the corresponding kind. Thus, once again this suggests that preschoolers have no difficulty accessing generic knowledge. This tendency to generalize from a specific example to the kind is all the more remarkable when we consider that the kinds under study here are not familiar ones about which children have a rich a priori knowledge base of existing generalizations. Rather, these were wholly novel kinds, indicated only by an individual picture and an individual property.

Importantly, both studies demonstrate that generic language can be used in the service of word learning. In this way, linking a property to a category via generic language can be seen as similar to other linguistic manipulations shown to affect the constitution of a kind, like labeling does (Waxman, 2004; Waxman & Markow, 1995). Insofar as extending words to new instances can reveal something about how a kind is conceptualized, both studies also indicate that generic language can serve to stipulate kind-relevant properties. Generically phrased property predication was shown to ‘trump’ the cue to kind-status typically evidenced by shared shape (Bloom, 2000; Smith et al., 1996). Thus, adults and children in these studies seemed to appreciate that generics are kind-referring, and they imply that the predicated properties are not ‘merely’ true of an individual, that the semantics speak to types, rather than tokens. This is just the sort of result one would need to show if generic stipulation were to play a role in the acquisition of commonsense knowledge (Prasada, 2000, in press).

Of course, one issue that demands further investigation is whether kinds are equivalent in their accessibility to young children. The present studies included only animals, and it may be that animal categories are more likely to foster the sort of extension-from-the-individual-instance as we have seen here. The use of animals may thus have reduced the sensitivity of our test, insofar as we were gauging children's willingness to move their label extensions away from a shape choice. There is reason to believe that the processes inherent to determining category status for animals are more complex than they are for artifact kinds

(Landau, Smith, & Jones, 1998; Booth & Waxman, 2006). It would have been interesting to compare animal and artifact kinds on this task.

A further limitation of the current work concerns the nature of the predicates used in both studies. We did not systematically vary the content of the properties that were included. All the properties were perceptual (as required by the task design). Certainly there is reason to believe that children already have a priori beliefs concerning the centrality of particular features (or feature types) to the kinds under investigation (Keil, 1994). For example, color is more central to foods, whereas shape is more central to artifacts (Macario, Shipley, & Billman, 1990). Moreover, property centrality may interact in interesting ways with language form (generic vs. specific). For example, Hollander et al. (2002) found that actions were more likely to be mentioned in response to generically worded queries and that physical attributes were relatively less likely to be mentioned in reply to generic queries. This is intriguing given previous findings that behavior—rather than external properties—may be more important to determining what something is (Shipley, 2000; Gelman & Wellman, 1991). Thus, it would be interesting in future work to vary systematically the nature of the property taught, to determine whether children are more likely to accept certain types of properties than others in generic vs. specific wording conditions. Such results could provide insight into the nature of young children's conceptual representations.

In sum, the current studies indicate that generic language is understood by preschool-aged children to link property to category in kind-relevant ways. These findings set the stage for further explorations into how generic language influences the nature of knowledge acquisition.

Acknowledgments

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Appendix A. Study 1 items, shown with generic wording

This is a **TEPIN**. Let me tell you something about tepins. Tepins have big ears.

This is a **FEBBIT**. Let me tell you something about febbits. Febbits are spiky.

This is a **BLEEN**. Let me tell you something about bleens. Bleens have long necks.

This is a **BANT**. Let me tell you something about bants. Bants have stripes.

This is a **DORN**. Let me tell you something about dorns. Dorns have 2 humps.

This is a **VORZYD**. Let me tell you something about vorzyds. Vorzyds are red.

This is a **FEP**. Let me tell you something about feps. Feps are spotted.

This is a **PLOG**. Let me tell you something about plogs. Plogs are green.

This is a **BACTRA**. Let me tell you something about bactras. Bactras have three legs.

This is a **YANCI**. Let me tell you something about yancis. Yancis have a crest.

This is a **SCRED**. Let me tell you something about screds. Screds have a long tail.

This is a **KEVTA**. Let me tell you something about kevtas. Kevtas are wooly.

Appendix B. Study 2 items, shown with generic wording

This is a **TEPIN**. Let me tell you something about tepins. Tepins have whiskers.

This is a **FEBBIT**. Let me tell you something about febbits. Febbits are spiky.

This is a **BANT**. Let me tell you something about bants. Bants have stripes.

This is a **DORN**. Let me tell you something about dorns. Dorns have long hair.

This is a **VORZYD**. Let me tell you something about vorzyds. Vorzyds are red.

This is a **FEP**. Let me tell you something about feps. Feps are spotted.

This is a **PLOG**. Let me tell you something about plogs. Plogs are green.

This is a **YANCI**. Let me tell you something about yancis. Yancis have stars.

This is a **SCRED**. Let me tell you something about screds. Screds have a long tail.

This is a **KEVTA**. Let me tell you something about kevtas. Kevtas are wooly.

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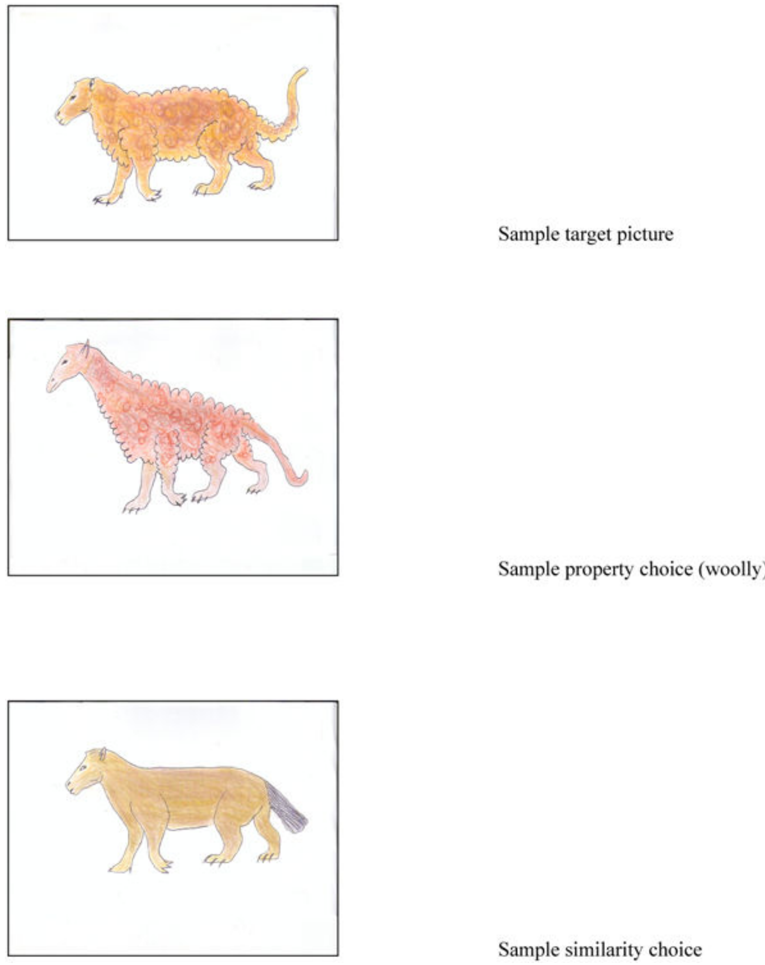

Figure 1.
Sample item set, Study 1.

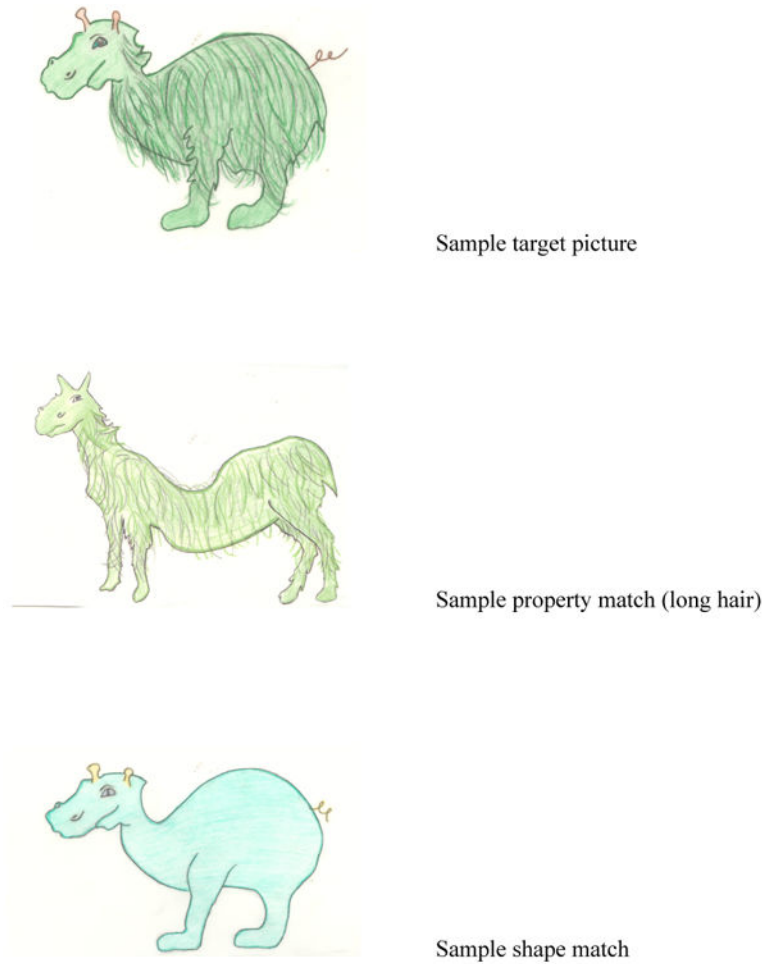

Figure 2.
Sample item set, Study 2.

Table 1

Study 1, Mean number of trials (out of 6) on which the predicated-property choice is selected, as a function of age group.

	Generic	Non-Generic	Control
Adults			
Overall Mean	5.50 *	2.29	1.00 ^
Generic First	5.50 *	2.58	--
Non-Generic First	5.50 *	2.00	--
Children			
Overall Mean	5.23 *	4.09 *	3.25
Generic First	5.13 *	4.63 *	--
Non-Generic First	5.33 *	3.56	--

* = significantly greater than chance (3.0), $p < .05$

^ = significantly lower than chance (3.0), $p < .05$

Table 2

Study 2, Mean number of trials (out of 5) on which the predicated-property choice is selected, as a function of age group.

	Generic	Non-Generic	Control
Adults			
Overall Mean	4.75**	0.94ˆ	0.17ˆ
Generic First	5.00	0.63	--
Non-Generic First	4.50	1.25	--
Children			
Overall Mean	3.70**	3.13*	1.31ˆ
Generic First	3.87	3.73	--
Non-Generic First	3.53	2.53	--

* = significantly greater than chance (2.5), $p < .05$

** = significantly greater than chance (2.5), $p < .001$

ˆ = significantly lower than chance (2.5), $p < .001$