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Cognition 96 (2005) 109–126
www.elsevier.com/locate/COGNIT

# Expressing generic concepts with and without a language model

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Received 10 February 2003; revised 17 March 2004; accepted 8 July 2004

**Abstract**

Utterances expressing generic kinds ("birds fly") highlight qualities of a category that are stable and enduring, and thus provide insight into conceptual organization. To explore the role that linguistic input plays in children's production of generic nouns, we observed American and Chinese deaf children whose hearing losses prevented them from learning speech and whose hearing parents had not exposed them to sign. These children develop gesture systems that have language-like structure at many different levels. The specific question we addressed in this study was whether the gesture systems, developed without input from a conventional language model, would contain generics. We found that the deaf children used generics in the gestures they invented, and did so at about the same rate as hearing children growing up in the same cultures and learning English or Mandarin. Moreover, the deaf children produced more generics for animals than for artifacts, a bias found previously in adult English- and Mandarin-speakers and also found in both groups of hearing children in our current study. This bias has been hypothesized to reflect the different conceptual organizations underlying animal and artifact categories. Our results suggest that not only is a language model not necessary for young children to produce generic utterances, but the bias to produce more generics for animals than artifacts also does not require linguistic input to develop.


*Keywords:* Generics; Gesture; Homesign; Categories; Deaf children; Chinese; Language development; Conceptual development

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doi:10.1016/j.cognition.2004.07.003

## 1. Introduction

Utterances expressing generic kinds ("birds fly") can provide insight into a speaker's categories.[1] They refer to an entire category of objects (birds as a class, not just the bird in my living room) and highlight qualities of that category that are stable, enduring, and timeless—not accidental, transient, or tied to a particular context (Lyons, 1977). For example, "birds fly" implies a property that applies to birds generally, whereas "this bird has a broken wing" implies a property that applies to a particular bird in a particular context. Generic utterances are thus made about categories that are coherent, stable entities, often called *kinds* (Gopnik & Meltzoff, 1997). The way in which languages express generics varies considerably (Krifka et al., 1995), but all languages provide some means for expressing generics. Indeed, Gelman and Tardif (1998) have recently found that, despite large differences in the devices English and Mandarin offer for expressing generics, speakers of both languages routinely use generics—even when talking to children as young as two years.

The fact that speakers use generics in their talk to very young children underscores the prevalence of such talk. However, it also raises the possibility that generic talk may be essential to teach children generics and to focus on certain types of classes. Gelman and Tardif (1998: 222–3) suggest two ways in which children could learn to focus on kinds from the generics adults produce. Generics point to properties that members of a kind have in common—properties that might be difficult for the child to observe directly (e.g. birds fly south in the winter). In addition, generics underscore the fact that members of a category have something in common, and thus that the category is a kind about which one can make a broad generalization. For example, telling a child that "birds fly" may not impart novel information even to a young child, but it does confirm *birds* as a stable category, a kind, about which propositions can be expressed.[2]

The question we address in this study is whether children who have not been exposed to an adult model for generics are nevertheless able to express generics. Deaf children born to hearing parents are often not exposed to a conventional sign language until adolescence. Moreover, if their hearing losses are so profound as to preclude the acquisition of spoken language, these children are unable to profit from the conventional spoken language that surrounds them. Despite their lack of access to a usable conventional language model, these deaf children invent gesture systems, called "home signs," to communicate with the hearing individuals in their worlds (Feldman, Goldin-Meadow, & Gleitman, 1978; Goldin-Meadow, 2003; Goldin-Meadow & Mylander, 1983, 1984). Do deaf children of hearing parents, raised in either an American or Chinese culture, use their gestures to express

[1] Generic utterances typically include those referring to generic kinds (e.g. 'birds fly') and those referring to generic events but not generic kinds (e.g. 'John smokes'); see Carlson and Pelletier (1995) for discussion. In this paper, we focus exclusively on the former.

[2] In fact, non-generic common nouns also refer to categories. For example, "that bird is flying" implies the existence of a category of *birds*, although it does so by referring to an individual bird rather than to a class of birds. Thus, every use of a common noun refers to a category of some sort. However, common nouns differ from generics in the scope of predication. Non-generic common nouns predicate something of an individual; generics predicate something of a kind. It is in this respect that we hypothesize that generics emphasize the coherence of a category—"birds fly" not only implies commonalities among members of the bird category but it also specifies a particular commonality in a way that "that bird is flying" does not.

generics? Individual objects (the bird in my living room) are there for the naming, but a class of objects (birds as a generic kind) does not present itself as such and must be constructed. It might therefore be difficult, perhaps impossible, for a deaf child who is not exposed to conventional language to use gesture to make reference to generic classes. It is important to note that deaf children in this situation have been found to invent names for objects, akin to common nouns (Goldin-Meadow, Butcher, Mylander, & Dodge, 1994). Thus, we already have evidence that these children can make implicit reference to a kind. The question we address in this study is whether children not exposed to a conventional language can predicate a property of a kind and, in this sense, make explicit reference to a kind.

If it turns out that the deaf children do express generics, we can then ask whether those expressions resemble generic utterances made by hearing children growing up in the same cultures and learning Mandarin or English. We explore, in particular, whether the children use their generics evenly across semantic domains. There are, in fact, no formal restrictions on which domains can support generics—it is possible to make generic claims about animals, artifacts, plants, food, and so on. However, Gelman and Tardif (1998) found that both Chinese and American adults produced significantly more generics for animals than for artifacts. Gelman and Tardif (1998: 227) suggest that this bias reflects the fact that the adults' animal concepts are structured differently from their concepts in other domains—animal concepts are conceptualized as *deep* (retaining identity over transformations, Keil, 1989, and having many similarities in common that promote rich inferences, Gelman, 1988). This conceptual difference between animals and artifacts would then be reflected in the adults' propensity to form category-broad, generic utterances. Hearing children in both cultures will, of course, receive models for this animacy bias in the generics they hear. If hearing children then display the animacy bias, it could reflect either their own conceptual organization or the influence of the linguistic model that their parents provide. If, however, the deaf children in our study display the animacy bias in their generic gestures, it is likely to reflect the children's own conceptual organization developed without benefit of a language model.

## 2. Method

### 2.1. Participants

We examined videotapes of eight deaf children of hearing parents, four from the US and four from Taiwan. Each child was observed twice, once between ages 3 and 4 (American Mean = 3;8, range 3;8 to 3;9; Chinese Mean 3;11, range 3;7 to 4;2) and once between ages 4 and 5 (American Mean = 4;5, range 4;2 to 4;11; Chinese Mean = 4;5, range 4;1 to 5;1). Each child was observed between 1 1/2 and 2 h (American Mean = 1 h, 30 min; Chinese Mean = 1 h, 47 min) and produced on average 456 object references (3645 across the 8 children). None of the deaf children had been exposed to a conventional sign language at the time of our observations, and all had hearing losses that prevented their acquisition of spoken language, even with intensive instruction. However, all eight of the deaf children used spontaneous gesture systems that were structured in language-like ways (Goldin-Meadow & Mylander, 1998).

In addition, we examined videotapes of 16 hearing children during play sessions at home with either their parents or an experimenter, eight children from the Chicago area, US, and eight from Taipei, Taiwan. In each group, four children were approximately 3 years of age (American Mean = 3 years; 1 month, range 3;0 to 3;2; Chinese Mean = 3;0, range 2;11 to 3;1), and four were 4 years (American Mean = 3;11, range 3;8 to 4;0; Chinese Mean = 4;5, range 4;1 to 5;1). Each child was observed for a little less than 1 h (American Mean = 54 min; Chinese Mean = 42 min) and produced on average 111 object references (1778 across the 16 children).

All of the children were observed at home playing with their primary caregiver (the mother in every case) or the experimenter. The same set of books, toys, and pictures was brought to each child's home and served as the focus of the interaction. Each of the four groups spent approximately the same proportion of time looking at books (.13, SD = .08) and playing with toys (.67, SD = .10), and approximately the same proportion of time interacting with their mothers (.83, SD = .13). The videotapes were gathered to explore spontaneous communication in deaf and hearing children (Goldin-Meadow, 2003) many years before we developed an interest in generics. Thus, the experimenter made no special effort to elicit generics from any of the children.

### 2.2. Defining and identifying generics

In order to make our coding system as comparable as possible for all four groups of children, we defined generics semantically (as references to kinds) rather than formally (as indexed by a set of linguistic markers).[3] Indeed, formal cues alone are often insufficient to identify a generic, even in English. For example, the utterance "cows" is ambiguous and context is required to determine its interpretation. If "cows" is preceded by "what kinds of animals say *moo*?" it is considered a generic statement. If, however, "cows" is preceded by "what did we see at the farm yesterday?" it is a non-generic statement.

Nevertheless, in English, formal grammatical cues (both in the noun and outside the noun) may provide important information about generics, and can even override contextual cues. For example, although real-world knowledge would seem to tell us that a reference is non-generic, the grammatical cues in the reference can lead to a generic reinterpretation. An excellent example comes from A. A. Milne's Winnie-the-Pooh books (e.g. Milne, 1928). One frequent topic of generic conversation is Tiggers, despite the fact that there is only one Tigger: "Tiggers don't like haycorns" (p. 25); "Thistles is what Tiggers like best" (p. 25); "Don't *you* know what Tiggers like?" (p. 31), etc. As the Disney song goes, "The most wonderful thing about Tiggers is, I'm the only one!" Here, the formal linguistic cues determine the generic reference. Without the plural marker on

[3] Given that we define generics semantically, why then didn't we include universal quantifiers ("each," "all," "any," "every") in our analyses since they too are general in meaning? There are two reasons for this decision. First, generics and universal quantifiers, in fact, are semantically distinct from one another (Carlson, 1980), even for preschool children (Hollander, Gelman, & Star, 2002). Second, universal quantifiers explicitly mark quantification in a manner that is not available to the deaf children. In order to make coding of the deaf and hearing children more comparable, we needed to exclude these cases. In any case, the question is moot, because the hearing children in our sample never produced these words to refer to general categories.

*Tigger* and the consequent changes in the verb, these utterances would be assumed to be specific ("Tigger doesn't like haycorns" implies a singular Tigger). What language does here is transform a presumed singular interpretation into a generic one.

Conversely, reference to what is ordinarily construed as a kind can be phrased as reference to a particular individual. For example, in our own data, the following exchange occurred between an American hearing child and his mother:

Mother: And who's the new one [dinosaur] who we like the song about? The one that we sing the song about?
Child: Deinonychus.
Mother: Deinonychus, yeah. What does he, what makes him special? Deinonychus?
Child: I don't know.
Mother: What does he have on his foot?
Child: Claws.

In this case, the references to "Deinonychus" are non-generic because mother and child appeared to construe him as an individual, as signaled through their grammatical cues (the singular pronoun). Thus, although generics are defined semantically, we use formal grammatical cues to help us identify generics in the English-speaking children's utterances.

### 2.3. Coding the hearing children's speech

We categorized every noun phrase that each child produced as *generic categorical*, *non-generic categorical*, or *non-categorical*.[4] We used the system described in Gelman and Tardif (1998: 225) to identify *generic categoricals* in the American and Chinese children's speech. As described above, we used formal grammatical cues as a first cut when coding the American hearing children's data. For example, if the child produced a bare plural followed by a verb in the present non-progressive tense ("bears live in caves"), or a singular noun phrase preceded by an indefinite article and followed by a verb in the same tense ("a bear lives in a cave"), the noun phrase was a candidate for a generic. If, however, other linguistic cues (or cues from context) made it clear that the child was not referring to bears generally but only to a subset of bears ("bears live in *that cave*," "a bear lives in *that cave*"), the noun phrase would not be coded as a generic. Thus, no particular set of grammatical cues guaranteed that a noun phrase would be coded as generic in English, but grammatical cues did serve as an important guide in picking out potential generics.

Mandarin, like English, expresses generics through a variety of indirect cues (see, for example, Cheng & Sybesma, 1999). However, Mandarin differs from English in that it does not have articles or plural markings on the noun and aspect is marked inconsistently on the verb. Thus Mandarin does not have as many grammatical markers that can serve as a guide to identifying a generic. We therefore relied heavily on contextual cues, both from

[4] Pronouns were excluded from the data base in both English and Mandarin, as they are often dropped in Mandarin. Proper names were also eliminated from our analyses.

the discourse and from our knowledge of the available objects and pictures, to identify generics in the Chinese-speaking children. We coded a noun phrase as generic if the utterance within which it was mentioned referred to prototypical properties that were not present in the context, and did not refer to a specific time point or a specific instance. As in our English coding, particular linguistic specifiers often ruled out a generic interpretation (e.g. the Chinese equivalents of "*this* bear", "*three* bears," "*yesterday* a bear").

Although our English and Mandarin coding schemes for generics differ in their use of articles and plural markers (present in English, absent in Mandarin), it is important to note that, on the whole, the coding schemes pick out the same utterances as generic. Gelman and Tardif (1998) compared the two coding systems in a sample of ordinary English- and Mandarin-speaking adults. Participants were provided with a set of English utterances that had been translated into Mandarin and thus lost the grammatical markers characteristic of generics in English. The question was whether the participants would judge the generic utterances as generic even without their grammatical markers. The participants' task was to judge each utterance as referring to: "one individual member of the category," "a few members of the category," or "most/any members of the category" (the "most/any" category was considered closest to the generic category). There was very high agreement between the Mandarin- and English-speakers' categorizations, suggesting that non-grammatical information (e.g. the absence of specifying information in the utterance, words such as *this* or *yesterday* or *three*) plays an important role in identifying noun phrases as generic or non-generic in both Mandarin and English.

In addition to coding generic categoricals, we also identified noun phrases in utterances that served to place a particular object in a category. These *non-generic categoricals* differed from generics in that they referred to a particular object rather than a class of objects. Most were part of a naming ("that's a bird") or simile (e.g. "that's like a bird") construction and were used in utterances that did not mention any property of the object; that is, the object was classified as a *bird* but the utterance did not specify the properties on which this classification was based. Occasionally, a property was mentioned (e.g. "that's a bird that flies"), and these noun phrases were also considered non-generic categoricals because they serve to identify the referent as a member of a class.

All other nouns that the children produced were considered *non-categoricals*. For example, if a child said, "look, the frog is hopping," then "frog" was considered a non-categorical.

Two additional coding decisions were made. (1) All noun phrases were coded for domain: animals (including people and body parts), artifacts, vehicles, places, food, or other (including non-object human creations, plants, plant products, inanimate natural entities such as clouds, unknown, etc.). (2) Generics were classified according to the property of the categorized object that was highlighted in the generic utterance: action (either performed by the object or on the object), physical attribute of the object, psychological attribute of the object, location of the object, or unclassifiable (e.g. "the frog is also an animal"). Table 1 presents examples of the properties.

A native English speaker (CM) transcribed and coded the American hearing children's speech, and a native Mandarin speaker transcribed and coded the Chinese hearing children's speech and translated it into English. One of us (SG) then independently coded a subset of the translated transcripts to establish reliability. Agreement between coders was

Table 1

Examples of Generic Categoricals Produced by Children in Each of the Four Groups

| Child Group | Example (type of highlighted property) [number produced] |
|---|---|
| American Hearing Children | "turtles swim in the water and splash" (action) [N=4] |
| | "moose like to eat muffins" (psychological attribute) [N=4] |
| | "stables are where horses stay" (location) [N=3] |
| | "that's not how feet go" (physical attribute) [N=1] |
| American Deaf Children | "wheels go around" (action) [N=19] |
| | [a point at a picture of an unmoving pinwheel, followed by a point at an unconnected wheel, followed by a *go-around* gesture] |
| | "squirrels eat nuts" (action) |
| | [an *eat* gesture produced in response to a picture of a squirrel in a tree with nuts nearby; there was no eating taking place in the picture] |
| | "nests are where birds live" (location) [N=2] |
| | [a *fly* gesture for birds produced in response to a picture of an empty nest to indicate the habitual inhabitants] |
| Chinese Hearing Children * | "rabbits can't talk" (action) [N=14] |
| | "dog food and bones can both be eaten" (action) |
| | "turtles are very powerful" (physical attribute) [N=4] |
| | "monsters are scary" (psychological attribute) [N=1] |
| Chinese Deaf Children | "fish can hurt" (action) [N=5] |
| | [a *hurt* gesture produced in response to a toy fish to indicate that fish hurt when they bite] |
| | "gorillas are scary" (psychological attribute) [N=7] |
| | [a *scary* gesture produced in response to a picture of a non-threatening looking gorilla] |
| | "gorillas go in cages" (location) [N=3] |
| | [a point at a toy gorilla followed by a point at a picture of an empty cage in a book] |

* The Chinese hearing children also produced 3 generics classified as *Other* ("the frog is also an animal").

83% ($N=137$) for deciding whether noun phrases were generic categorical, non-generic categorical, or non-categorical; 97% ($N=118$) for assigning noun phrases to a domain (animal, artifact, etc.); and 95% ($N=22$) for classifying the properties mentioned in generic utterances.

### 2.4. Coding the deaf children's gestures

The deaf children have two ways of referring to objects: (1) deictic gestures, e.g. pointing at the bird, and (2) mimetic characterizing gestures, e.g. flapping two hands in the air, *fly*, to refer to a bird. We coded only those characterizing gestures that were used as nouns (and not those used as verbs or adjectives, see Goldin-Meadow et al., 1994). When a deaf child uses a gesture like *fly* to refer to a bird, that child is, in effect, saying "that's a bird." However, the *fly* gesture goes beyond the label "bird" in that it identifies the particular property of the bird the child is focusing on. The gesture consequently reveals what the child means by "bird". Thus, all of the deaf child's noun characterizing gestures are, in this sense, categoricals. The question was whether any of them could be considered generic.

The first criterion that a characterizing gesture had to meet to be considered generic was that it had to reflect a general characteristic rather than an idiosyncratic one. Consider, for example, a deaf child reacting to a picture of an elephant wearing a bow. If the child were to produce a *trunk* gesture (a characteristic of all elephants), the gesture would make the first cut as a possible generic (it then had to meet two additional criteria, see below). In contrast, if the child produced a *bow* gesture (a characteristic of that particular elephant), the gesture would not be considered a generic under any conditions. The vast majority of the deaf children's characterizing gestures (93% of 680) satisfied this criterion.

The second criterion that a characterizing gesture had to meet to be classified as generic was that the characteristic reflected in the gesture could not be present in the context. Thus, the *trunk* gesture in the above example would not, in the end, be coded as generic simply because the child might merely be identifying the nose of the elephant in the picture rather than commenting on a general characteristic of elephants.[5] If, however, the elephant in the picture were trunkless, the gesture could be classified as a generic, assuming it met the third criterion.

The final criterion that a gesture had to meet to be classified as generic was that it had to refer, not to a particular object, but to a class of objects. If the deaf child produced a *trunk* gesture and shook his head *no* in response to the trunkless elephant, the gesture would not

[5] When reacting to a picture of an elephant with a trunk, an English-speaking child could, of course, produce a perfectly acceptable generic—"elephants have trunks". In order to ensure that our coding systems for the deaf and hearing children were comparable, we did not count utterances of this sort as generic in the American hearing children. Thus, utterances that were generic in form but referred to present characteristics were *not* included as generic in our analyses. This practice differs from the coding procedure used by Gelman and Tardif (1998). However, only three potential generics were eliminated from the American hearing children's corpus using this criterion, and including these three does not change the pattern of any of the findings. Note that this coding problem does not arise for the Chinese hearing children simply because there are no clear-cut linguistic forms that identify an utterance as generic in Mandarin. As in the deaf children, form was not used as a criterion for the Chinese hearing children—generics were determined by context and the non-present criterion was essential.

be considered a generic simply because the utterance is referring to a particular elephant ("this elephant doesn't have a trunk") and is not a statement about the class of elephants. If, however, the *trunk* gesture were produced without a headshake and perhaps with a second gesture reflecting another general characteristic of elephants (e.g. a *spray* gesture indicating how trunks can be used to give oneself a shower), the gesture would be classified as a generic. Cases in which the property highlighted in a gesture for an object was true of the *class* to which that object belonged, but not true of the *particular* object itself, are particularly convincing. These cases illustrate a crucial aspect of generic knowledge—that it is not rendered invalid by the existence of what appears to be a counter-example (Prasada, 2000).

Thus, as in our Mandarin coding, we relied on contextual cues, both from the discourse and from our knowledge of the available objects and pictures, to identify generics in the deaf children's gestures. A gesture was considered to be a *generic* if it represented a prototypical, non-present property typically found in all members of the class to which the object belonged, and if it appeared to refer, not to that particular object, but to a class of objects.

Note that we can never really be certain that a deaf child is expressing a generic. In the last *trunk* example, the gesture could either mean "elephants have trunks" or "this elephant could/should have a trunk". Whereas the former statement is a generic referring to elephants as a class, the latter is a non-generic referring to a particular individual elephant. In either case, however, the speaker is going beyond the specifics of the immediate situation and is making use of kind-based (generic) knowledge. That is, "this elephant could have a trunk" expresses a property that is known only by reference to the generic category of which this individual is an instance. We return to this issue and discuss it more completely in the discussion section.

All other noun characterizing gestures were classified as *non-generic categoricals*. Note that, by definition, all of the deaf children's characterizing gestures mentioned a property of the object (cf. Goldin-Meadow et al., 1994), and thus were different from the hearing child's naming or simile non-generic categoricals which did not. In addition to these characterizing gestures, we included as non-generic categoricals combinations of pointing gestures that were used to identify an object by indicating a similar object (e.g. the child pointed at an elephant and then pointed at one or more other elephants) or by indicating the habitual location of the object (e.g. the child pointed at a watch and then pointed at her wrist). These gestures serve the same equating function as a name or a simile (i.e. "this is like an elephant") without, of course, explicitly providing a label for the object.

We classified all of the other pointing gestures that the deaf children produced as *non-categoricals*. For example, a child pointed at a puzzle piece and then at the puzzle board to ask his mother to put the piece in the board; both points were considered non-categoricals.

As in our speech coding, two additional coding decisions were made. (1) All noun characterizing gestures and pointing gestures were coded for domain. (2) Generics were classified according to the property of the categorized object that was highlighted in the generic, using the categories developed for speech coding (see Table 1).

One of us (CM) transcribed the gestures of both the American and Chinese deaf children and coded these transcripts in conjunction with the videotapes. Another (SG)

independently coded a subset of the transcripts to establish reliability. Agreement between coders was 83% ($N=58$) for deciding whether gestures were generic categorical, non-generic categorical, or non-categorical; 81% ($N=31$) for assigning gestures to domain; and 90% ($N=33$) for classifying the properties mentioned in generics.

To summarize our coding procedures, generics were semantically defined in all four groups of children in our study—a noun phrase was considered to be generic if the utterance within which it was mentioned referred to prototypical properties that were not present in the context and did not refer to a specific time point or a specific instance. We used the grammatical cues that are associated with generics in English to identify a pool of possible generics for the American hearing children. However, for all four groups of children, we relied on contextual cues, both from the discourse and from the scene itself, to make the final decision as to whether a noun phrase was generic (e.g. we used words like *yesterday*, *three*, or *this* for the hearing children and gestures like the *no* headshake accompanying the *trunk* gesture for the deaf children to rule out a generic interpretation).

## 3. Results

### 3.1. Does a language model influence a child's production of generics?

Children in all four groups produced generic categoricals: 6 of the 8 American hearing children, 7 of the 8 Chinese hearing children, 3 of the 4 American deaf children, and 3 of the 4 Chinese deaf children produced at least one generic. Generic production rates (number of generics as a percentage of the total number of nouns produced[6]) were as follows: American hearing 1.2% (SD=1.3%), Chinese hearing 3.0% (SD=1.8%), American deaf 1.4% (SD=1.7%), Chinese deaf 0.5% (SD=0.5%).[7] These rates are similar to those found in American and Chinese hearing adults (Gelman & Tardif, 1998)—.79 and .19% of utterances, respectively, in naturally occurring activities in the home, and 3.6 and 1.4%, respectively, in book-reading contexts.

There were no significant differences in rate of generic production across cultures ($F(1,20)=.53$, *ns*) and a marginal difference between hearing and deaf children ($F(1,20=3.32$, $p=.08$). There was, in addition, an interaction between culture and hearing status ($F(1,20)=4.49$, $p<.05$) but posthoc Scheffé tests revealed no reliable differences between pairwise comparisons of any of the four groups.

Not only did children in all of the groups produce generics, but they also mentioned many of the same types of object properties in those generics (see Table 1). All four groups

[6] These percentages are based on an average of 120 (SD=61) references to objects (i.e. noun phrases) for the American hearing children, 103 (SD=58) for the Chinese hearing children, 309 (SD=104) for the American deaf children, and 602 (SD=231) for the Chinese deaf children. The numbers are larger for the deaf children because each deaf child was observed at two ages, whereas each hearing child was observed at only one age.

[7] There were no significant differences in generic production between the 3- and 4-year-old hearing children in either culture: American 3-year-olds 1.7% (SD=2.0%); American 4-year-olds 1.2% (SD=1.6%); Chinese 3-year-olds 3.0% (SD=1.3%); Chinese 4-year-olds 3.2% (SD=1.3%) (F(1,12)=.02, *ns*). Data are therefore collapsed across age in the analyses.

highlighted *actions* in their generics. In addition, each group mentioned at least one other property, although there was little consistency across culture or hearing status in which additional property types were mentioned: *physical attributes* in American and Chinese hearing children; *psychological attributes* in American and Chinese hearing children and Chinese deaf children; *location* in American hearing children and American and Chinese deaf children. The children appeared to focus on whatever dimension was salient about the object they were categorizing, with no shared bias other than to notice action. Given the ease with which action can be portrayed in the manual modality, it is striking that the deaf children were not restricted to highlighting action in their gestures and were able to convey other properties as well.

### *3.2. Does a language model influence whether children exhibit an animacy bias in their generics?*

Fig. 1 displays the proportion of generic categoricals, non-generic categoricals, and non-categoricals that the children in each of the four groups produced for animals and artifacts.[8] There were no significant effects of culture (American, Chinese; $F(1,15)=.06$, *ns*), hearing status (hearing, deaf; $F(1,15)=.31$, *ns*), or type of noun phrase (generic, non-generic categorical, non-categorical; $F(2,30)=.99$, *ns*).[9] There was, however, an effect of domain (animal, artifact; $F(1,15)=30.48$, $p<.0001$) and an interaction between domain and type of noun phrase ($F(2,30)=14.61$, $p<.0001$). The four groups of children used their *generics* to refer to animals reliably more often than they used them to refer to artifacts ($p<.0001$, Scheffé), thus displaying the pattern found in Gelman and Tardif's (1998) adults. Importantly, the children did not display this animacy bias for *non-generic categoricals* ($p=.47$) or *non-categoricals* ($p=.99$). The absence of a preference for animals, particularly in non-categorical references, makes it clear that the bias toward making generic reference about animals is not merely an outgrowth of a tendency to talk about animals. Thus, the animacy bias does not reflect idiosyncracies in which pictures or toys were present in the context for if that were the case we would expect to find an overall animacy bias regardless of utterance type.

However, the hearing children also used their *non-generic categoricals* to refer to animals more than they used them to refer to artifacts. Indeed, there was a significant interaction between hearing status and domain ($F(1,15)=6.39$, $p=.02$)—the hearing children (but not the deaf children) reliably produced more references to animals than to artifacts overall ($p<.0001$), a reflection of the high proportion of references to animals that the hearing children produced in their non-generic (as well as their generic) categoricals.

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[8] For this analysis, we classified the few references that the children made to food, vehicles, and places as *other*.

[9] The five children who produced no generics at all were eliminated from this analysis, two from the American hearing group (one 3-year-old and one 4-year-old) and one from each of the other three groups. Proportions were subjected to an arcsine transform prior to analysis.

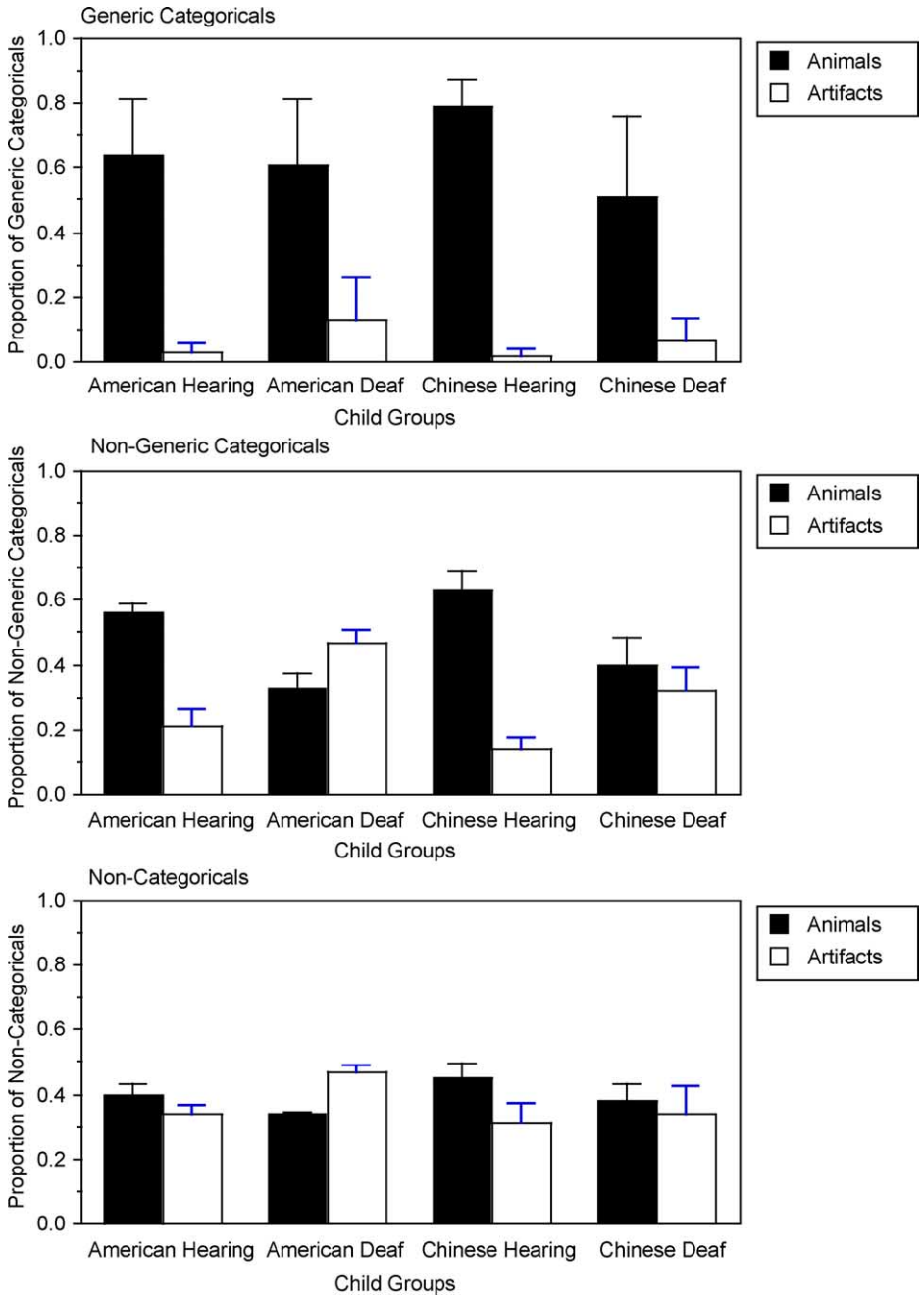


Fig. 1. Proportion of Generic Categoricals, Non-Generic Categoricals, and Non-Categoricals used for Animals and Artifacts by American Hearing Children, American Deaf Children, Chinese Hearing Children, and Chinese Deaf Children. Error bars reflect standard errors.

## 4. Discussion

Do children need a language model to produce generic references? Our data suggest that they do not. Chinese and American deaf children who had not been exposed to a conventional language model were nevertheless able to produce generics in the gesture systems they invented. Indeed, the rate of generic production for the deaf children was comparable to the rates for the hearing children we observed, and comparable to rates previously reported for adults in these same two cultures.[10] Children do not appear to require a model for generics in order to produce them.

The data from our study speak to a distinction between two learning problems that children face (Gelman, 2004): the problem of generic *language* and the problem of generic *knowledge*. Children who are learning conventional languages must learn how to express generic ideas using the linguistic devices that their language provides—a task made more difficult by the variety of expressions and the lack of 1:1 mapping between generic form and meaning in the languages of the world. This is the problem of generic language. However, children must also learn about kinds, a challenging task simply because of the indeterminacy of experience—people encounter specific exemplars, not kinds as wholes. The fact that the deaf children in our study produced generics in their gesture systems suggests that the problem of generic knowledge can, at least in some cases, be solved by children in the absence of linguistic input. Although this suggestion has been made in the past (e.g. Prasada, 2000), as far as we know, our findings provide the first empirical data that bear on the claim.

There are no formal restrictions on which domains can support generics. Nevertheless, children in all four groups produced more generics for animals than for artifacts. Gelman and Tardif (1998) found an animacy bias in both American and Chinese adults, and suggested that it reflects a common conceptual basis for generic use in English and Mandarin. We know that, in our own sample, the animacy bias found in the children's generics cannot reflect a general tendency to talk about animals more than artifacts simply because this bias did *not* appear in the children's other references to objects (in particular, their non-categoricals).

We suggest that the animacy bias in generics reflects *conceptual* differences between animal and artifact categories. Animal categories are more "kind-like" than artifact categories (see Keil, 1989; Gelman, 1988) and children as young as 3 or 4 seem to already have grasped this difference. Young children know that animals and human-made artifacts differ in internal

[10] Although the rates at which the children produced generics may seem low, they represent a substantial amount of generic expression. Nouns can function in many different ways, including generic reference ("birds fly"), singular definite reference ("that bird is flying"), general definite reference ("those birds are flying"), distributive general reference ("every bird flies"), collective general reference ("all birds fly"), specific indefinite reference ("I saw a bird"), and non-specific indefinite reference ("I want to see a bird") (Lyons, 1977: 177–197). Given this variety of functions, any particular noun phrase type will constitute only a small fraction of speech. Accordingly, even the most salient of noun phrase types will occur in less than the majority of utterances. (Analogously, although food is a highly salient and important concept for young children, mention of food appears in much less than half of their utterances because there are many competing topics of conversation.) The rate of generics in our sample is comparable to the rate at which children produce genuine psychological references to thoughts and beliefs at six years of age (Bartsch & Wellman, 1995). Indeed, the children in our study produced generics *more often* than children typically make comments about reality-nonreality distinctions, and even these comments, when tallied over hours, days, and weeks, add up to quite a lot of talk (Woolley & Wellman, 1990).

parts (Gelman, 1990; Simons & Keil, 1995), object identity (Keil, 1989), inheritance (Hirschfeld, 1996; Springer, 1992), origins (Gelman & Kremer, 1991; Keil, 1989), self-generated movement (Gelman, Durgin, & Kaufman, 1995; Massey & Gelman, 1988), and spontaneous growth and healing (Backscheider, Shatz, & Gelman, 1993; Rosengren, Gelman, Kalish, & McCormick, 1991). For example, children treat animals as having richly structured internal parts that differ from their exteriors and cause self-generated movement; simple artifacts have the same parts inside as outside, and inner parts are unrelated to movement. For animals, transformations cannot influence the item's identity; for artifacts, changes can alter identity. In animals, growth and healing are highly patterned, predictable processes stemming from the animal itself; in artifacts, size changes and mending are less predictable, and require external agents of change. On the assumption that children construe animal kinds as more richly structured than artifact kinds (deeper similarities, greater coherence, etc.), they may more easily conceptualize animal categories as abstract wholes.

More richly structured kinds are also more likely to have generic knowledge associated with them—that is, more properties that are generally true of the kind, and not just idiosyncratically true of some instances of the kind. It is therefore likely that the children in our study had more generic knowledge about animals than artifacts (as a consequence of the conceptual differences outlined above) and, as a result, used generics more often when talking about animals than artifacts.

Our data take the argument one step beyond Gelman and Tardif (1998). Our findings suggest that the conceptual difference between animals and artifacts does not either underlie or reflect conventional languages alone, but also guides self-created communication systems. The conceptual organization that leads communicators to express generics about animals more often than artifacts thus appears to be present in child minds, even those developing without benefit of a language model.

One unexpected finding was that the animacy distinction cropped up not only in generics (for the deaf and hearing children), but also in non-generic categoricals (for the hearing children only). At first blush, this finding might appear inconsistent with prior studies which have not found an animacy bias in non-generics. However, in the past, non-generics have not been divided into categoricals and non-categoricals. An animacy effect may therefore have been present in these other data sets, albeit hidden by the fact that, within the set of non-generics, non-categoricals are typically more frequent than categoricals. However, to be cautious, we will need to replicate the animacy bias in non-generic categoricals.

This finding raises two questions: first, why do hearing children show an animacy bias for categoricals, and second, why don't deaf children do so?[11] We believe the answer to the first

[11] The fact that animals have more deep similarities than do artifacts could make it easier to produce similes between animal kinds ("that's like a bird") than between artifact kinds ("that's like a clock"). This natural alliance between similes and animal kinds could be responsible for the fact that the hearing children produced more non-generic categoricals for animals than for artifacts simply because, in our coding system, similes were classified as non-generic categoricals. In addition, since it is likely that the deaf children in our study would find it harder to produce similes than the hearing children, similes might also be responsible for the fact that the deaf children did *not* produce more non-generical categoricals for animals than artifacts. However, it turns out that neither the hearing children nor the deaf children produced many similes during our observations, making this explanation for the differences we found unlikely.

question lies in the conceptual similarities between categoricals and generics. Both generics and categoricals focus on category membership. A generic utterance ("birds fly") calls attention to birds *as a category*, and indeed refers directly to the category as a whole. Similarly, a categorical utterance ("this is a bird") calls attention to the bird category (the utterance could be paraphrased as "this is an instance of the bird category"), although unlike generics it does not refer to the category as a whole. In contrast, a non-categorical utterance ("the bird is trying to fly") does not call attention to the bird category in any direct way, and makes implicit mention of the category only in the selection of the label itself. Non-categorical utterances emphasize the individual, not the class. The animacy bias, we believe, reflects heightened attention to animal categories, attention which stems from the greater coherence and inductive potential of these categories relative to other domains (see Gelman, 2004, for review). On this view, it is not surprising to find greater attention to animal categories not only in generics (which refer to categories directly), but also in non-generic categoricals (which express an individual's membership in a category).

Why then don't we see the same animacy bias in the deaf children's non-generic categoricals?[12] Modality may be working against the animacy bias here. Intuitively, it seems easier to come up with names for artifacts (which tend to have systematic gestures that correspond to their use, e.g. pounding for a hammer) than to come up with names for animals (which often do not have obvious gestures associated with them, e.g. pig). Note, however, that under this account, it is that much more striking that the deaf children displayed an animacy bias in their *generic* categoricals. Another possible explanation is that the deaf children's non-generic categoricals may not tap into categorical information in the same way that hearing children's non-generic categoricals do. The hearing children's non-generic categoricals were, for the most part, simple naming statements, such as "a chicken" or "here's a cow". Acts of naming focus explicitly on category membership. It is possible that the deaf children are not intending to classify an object as a member of a class when they use their non-generic categorical gestures to identify it, and are instead merely identifying the particular object by referring to one of its characteristics (which just so happens to be a characteristic shared by other members of the class). It is, however, clear that the deaf children *can* classify an object as a member of a class—they do so in their generic gestures which they use in precisely the same ways that speakers of a conventional language use their generic words.

### *4.1. Are "generics" in home sign truly generics?*

Can we be sure that the utterances we have coded as generic in the home-signing children are intended as generic by the children producing them? That is, how valid is our interpretation of these gestures?

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[12] It is quite likely that the deaf children did not play language games, in particular, naming games, with their hearing parents. This lack could have affected how often the deaf children produced non-generic categoricals. Indeed, the deaf children did produce proportionately fewer non-generic categoricals than the hearing children (.22 [SD = .07] vs. .34 [SD = .14], $F(1,20) = 5.06$, $p = .04$). However, the lack of naming games in the deaf children's worlds is not likely to have affected the number of non-generic categoricals that the children produced for animals relative to artifacts, and thus cannot account for the absence of an animacy bias in the deaf children's non-generic categoricals.

Generic coding in this study was conservative in that a statement describing a property that was present in the context was *not* considered generic. Thus, we excluded any utterances referring to present information (as in the "elephants have trunks" example provided earlier), despite the fact that many generic properties will be present in context (e.g. a picture of a bird will often show it flying). This conservative coding strategy was designed in part to exclude utterances that might appear to be generic but in reality referred to a particular (current) context.

However, it is possible that some of the utterances that we did code as generic were actually not referring to a generic kind, especially for the Chinese and American deaf children for whom conventional linguistic cues were not available. For example, if a child says or gestures the equivalent of "dog eat bone" in the presence of a dog that is *not* eating a bone, the utterance can be translated as a generic statement ("dogs eat bones"). But the utterance can also be translated as a statement about a hypothetical event ("the dog might/should/can eat a bone"), a past event ("the dog ate a bone"), a future event ("the dog will eat a bone"), or even a pretend event ("the dog is eating a bone"). Thus, an utterance classified as generic purely on contextual grounds is always open to alternative interpretations.

Despite this interpretive problem, there are three reasons that our data are of interest. First, as mentioned earlier, regardless of whether a child means "ducks fly" (a generic interpretation) or "this duck can fly" (a non-generic interpretation), the utterance expresses generic *knowledge* (in this case, that flying is a property of ducks). It is one thing to express a property that is currently available; it is something different altogether to express a property that is *not* present and must be inferred on the basis of category cues. We therefore believe that the data reveal an important conceptual understanding on the part of these deaf children.

Second, a closer look at the English data suggests that non-generic interpretations for utterances that refer to a general property were rare in the American hearing children and therefore are likely to have been rare in the deaf children as well (and, for that matter, in the Chinese hearing children). We examined the English data and did find several *non-generic* utterances in which the child referred to a general property that was not present in the context (e.g. "I caught this fish" [past]; "This ball is gonna knock the pins down" [future]). Without linguistic cues, these utterances might have been (incorrectly) classified as generic ("fish are for catching," "balls knock down pins"). However, all but two utterances of this type would have been excluded from the generic category on *contextual* grounds. In other words, the linguistic cues indicating that these utterances were *not* generics (e.g. *caught* and *this* in "I caught this fish") were not necessary for us to conclude that the utterance was about a particular object in a particular context. For example, some utterances containing a non-present general property referred to what we call *imminent future*, namely, the event was about to occur, and thus the utterance clearly referred to an individual or object in the impending context. Some utterances made reference to a pretend action that the child had just carried out (e.g. moving the duck in a flying motion).

Importantly, the same types of disambiguating contextual cues were present in the deaf children's interactions and were used to determine when an utterance referred to a particular object. For example, one deaf child pointed at his dog (who was not barking at the time), pointed outside, and then gestured *bark* (Morford & Goldin-Meadow, 1997).

This utterance could have been interpreted as a generic statement about all dogs ("dogs bark outside"). However, the child produced the utterance right after the milkman arrived and his mother brought the dog inside; he was telling us that his mother brought the dog in because, if left outside, the dog would bark at the milkman—a statement about a particular dog in a particular context. He had *not* produced a generic statement and it was very clear from the context that he had not. As another example, a deaf child pointed at a jar of bubbles and gestured *expand*. This utterance could have been interpreted as a generic statement about all bubbles—"bubbles expand". However, the fact that the child went on to blow a bubble (which, of course, expanded as he blew it) suggests that his utterance had been a statement about his imminent actions—a specific statement about the bubble he was about to blow, rather than a generic statement about all bubbles. The important point is that the same contextual cues that can distinguish non-generic statements referring to general properties from generic statements in the American hearing children can be (and were) used to make the distinction in the deaf children (and the Chinese hearing children).

Finally, there is one subset of utterances that are particularly clear-cut in interpretation, namely, cases where the target item not only *did not* display the generic property, but also *could not* display the generic property. The deaf children occasionally produced such utterances. For example, one deaf child produced a *scary* gesture to refer to a picture of a rather pleasant-looking and clearly non-threatening gorilla. The child had used a general characteristic of gorillas to identify a particular gorilla that did not and, in fact, could not display this characteristic. In these cases, because the target item is not capable of displaying the property, it seems most parsimonious to interpret the utterance as referring to the generic kind.

In sum, we have found that American and Chinese deaf children use generics in the gestural communication systems they invent despite the fact that they have no linguistic input to model this use for them. Moreover, they use generics about as often as American and Chinese hearing children learning English or Mandarin from conventional language models. Finally, all of the children—deaf or hearing, American or Chinese—produce generics more often for animals than for artifacts, suggesting that this bias does not need linguistic input to develop and thus is likely to reflect the different conceptual organizations that underlie these categories.

## Acknowledgements

This research was supported by RO1 DC00491 from NIDCD to SGM and grant RO1 HD36043 from NICHD to SG. We thank Emily Hammer, Shuhong Lim, Sae Kim, June Poon, and Shanping Qiu for their help during the project, and three anonymous reviewers whose insightful comments greatly improved the paper.

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