

LEARNING AND INTERPRETING WORDS FOR KINDS: ADULTS' AND  
CHILDREN'S UNDERSTANDING OF GENERIC LANGUAGE

by

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To Edith and Morris, who would be so happy

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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”). Generic sentences refer to *kinds* rather than to specific individuals. Thus, generics pose a problem of induction even more striking than that of individual reference. Three studies examined how generic language specially links properties and categories.

In Study 1, I assessed comprehension of generics vis-à-vis the quantifier terms “all” and “some”. Generic utterances are distinct in that they are generally true, unlike indefinites (e.g., “Bats live in caves” is generic; “I saw some bats in the cave” is indefinite), but need not be true of all category members, unlike universal quantifiers (e.g. “all”). Four-year-olds and adults appropriately distinguished “some” (e.g. “Do some girls have curly hair?”) from “all” (e.g., “Do all girls have curly hair?”), from generic (e.g., “Do girls have curly hair?”), although 3-year-olds did not. Three-year-olds did distinguish appropriately among category-property pairings of wide-scope (e.g., “Are fires hot?”), of narrow-scope (e.g. “Do books have color pictures?”), and of irrelevant-properties (e.g., “Do garages sing?”), but interpreted sentences with “all” and “some” just as they, and the older participants, treated generics.

In Study 2, I 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. Study 3 replicated and extended Study 2 in a more stringent test of the pull of generic language away from shape as a dimension along which to judge category membership. Altogether, the results of these three studies suggest that the generic is a default interpretation for young children, who may instead need to learn the semantics of specific and set-theoretic expressions.

## Chapter One

### Introduction

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. How to capture, characterize, and contextualize this aspect of generic expressions has been of ongoing concern to linguists (Carlson & Pelletier, 1995) and philosophers (Leslie, 2005). It is also of increasing interest to developmental psychologists studying children's knowledge about kinds (see Gelman, 2003; 2004; Prasada, 2000).

Indeed, although few researchers thus far have systematically referred to conceptual development in terms of the acquisition of 'generic knowledge' (for example, Prasada, 2000; Gelman, 2004), much recent investigation into children's early concepts can be thought of as touching on what children know

about *kinds* as expressed via generics. In many ways, generic language lies exactly at the crossroads between language and concept vis-à-vis the notion of 'kind' itself. But only recently have studies into the production, comprehension, and possible role of generic language in concept acquisition and structure been conducted.

I aim in this dissertation to address a number of important questions about generic language by reporting three studies, all of which are intended to elucidate how generic expressions are understood by children, and by adults, to convey information about kinds. In particular, I focus on how generic language reflects and influences children's understanding of the link between kinds and predicated properties (e.g., between "cats" and "has claws").

In the introduction that follows I will outline key aspects of generic expressions in English, and their relationship to critical issues in cognitive development, providing the context and motivation for the studies included in the dissertation. I will 1) delineate some of the special properties of generics that make them interesting to researchers studying language and concepts; 2) review evidence that generic language appears in the speech heard by young children and thus provides input about kinds; 3) review the evidence regarding what children know about generics; and 4) consider questions that remain concerning the links between generic language and kind concepts. The three studies I will then report in turn are intended to examine how generic language is comprehended and, especially, how it affects reasoning about the links between categories and properties.

### *1.1 Special Qualities of Generics*

Generic expressions have several special properties. First, generics are interpreted as referring to kinds. The generic sentence “Bats live in caves” is taken to be about the kind ‘bat’ and not about an unspecified number of the creatures (as in the indefinite “There were bats in the caves”). Because generics refer to kinds, it means that standard accounts of how meaning is fixed (by means of ostensive reference) cannot fully hold for generics, because kinds cannot be displayed directly or fully, in contrast to individuals. For example, one can point to a dog and say “This is a dog”, but one cannot point to the class of dogs and say “This is the kind ‘dogs’”. In this sense, generics pose a problem of induction even more striking than that discussed with regard to individual reference (e.g., Quine, 1960; Markman, 1989).

Furthermore, generic expressions can be deemed true even in the face of exceptions; the fact that some bats live in zoos and some hang in bat-houses doesn’t seem to render the sentence false. But generics do not only appear to convey that a property is relatively common among members of a category. For example, “Birds lay eggs” seems true even though there are many exceptions—only mature females do so. Even so, the generic “Birds are mature females” seems patently false. Moreover, sentences such as “Sharks attack humans” can be taken as true even though exceedingly few individual sharks ever do, and actual episodes which could count as inspiration for such a generalization are similarly few and far between (see, for instance, Leslie, 2005). Generic expressions appear to be resistant to revision at times as well, and do not seem

to require extensive experience for formulation. Someone who proclaims that “Rock stars are egomaniacs” would probably still stand by their statement in the face of a selfless one, for example.

Taken together, these intuitions about generics make for a linguistic and cognitive phenomenon which has proven resistant to wholly satisfying analysis, and which I will argue is also fertile ground for exploring the connections between language and concepts. Krifka et al. (1995) survey the linguist’s landscape for signs of a theory to convincingly cover the interesting phenomena of genericity. They point out that the ways in which generic sentences can be deemed true yet allow for exceptions is especially problematic for any ‘precise semantic framework’. For example, any framework that assumes that generics function like quantifiers (such as “all” or “some”) will have difficulties with generics, because there is no stable amount or proportion that they refer to (sometimes referring to 99% of a category, sometimes referring to 50% of a category, sometimes referring to well under 10% of a category). I will return to this point in the general discussion, but offer here the suggestion that a study of how generic language is acquired and comprehended might challenge existing linguistic accounts. In particular, the evidence will suggest that generic expressions may be a default interpretation for children, rather than being built up out of concepts of individual instances.

A further quality of generics is that there is no unique formal device for their expression, and no one-to-one mapping between generic form and generic meaning (Gelman, 2004). Instead, there are multiple formal and contextual

considerations at play, jointly important and singly insufficient to determining the status of an utterance as kind-referring or not. I have referred above, for instance, to how the same bare plural noun phrase (“bats”) can be used generically (as in “Bats live in caves”) or non-generically, to refer to an indefinite number of individuals (as in, for example, “Bats flew into the cave”).

Although there are no one-to-one cues, identification of generics is quite systematic. In particular, morphosyntactic, semantic, and contextual (pragmatic) sources of information are all relevant. The example above (“bats live” vs. “bats flew”) demonstrates one of the morphosyntactic cues to genericity; it is very difficult to achieve a generic reading of a sentence with a verb in the past tense. “A dog barks”, for instance, can be generic, whereas “A dog barked” can only be non-generic. Other morphosyntactic cues to genericity in English include number (plural vs. singular), determiners, and aspect (Gelman, 2004). Determiner and number *together* cue generic readings: generic sentences may include NPs with a plural noun and no determiner (e.g. “*Leopards* are capable of acrobatic jumps”), a singular noun and the definite determiner (e.g., “*The iguana* is a cold-blooded animal”), or a singular noun and the indefinite determiner (e.g., “*A koala* eats only eucalyptus leaves”). The combination of a plural noun and the definite determiner (e.g., “*The leopards* are capable of acrobatic jumps”) is usually read as referring to specific leopards, and rarely to leopards generally. Furthermore, aspect is also relevant to the availability of a generic reading. For example, it is difficult to interpret the progressive present —“A bird is laying eggs”—as generic,

whereas the simple present—“A bird lays eggs”—is readily interpreted as generic.

Gelman (2004) provides compelling illustrations of how discourse-contextual factors, such as the construction of the sentence as a whole or extrasentential information, may also push construal toward or away from a generic reading. For examples, Gelman considers the contrast between pairs of sentences such as “Lions live in Africa” and “There are lions in Africa”. The first sentence is more readily understood to stipulate something about the kind ‘lion’ as a whole, whereas the second sentence seems to be indefinite, referring to a subset of the kind. The differences between the two sentences lie at the level of the sentence overall—there are no morphosyntactic cues per se in either the noun phrase or the verb to distinguish them. Gelman also cites the resolution of anaphoric reference as illustrative of discourse-relevant determinants of genericity. She points to the contrast between the utterances “This is a tapir. They like to eat grubs”, and “These are my tapirs. They like to eat grubs.” (Gelman 2004, p.452). In the first pair of sentences, ‘they’ is read generically, as referring to the class of tapirs, whereas in the second, ‘they’ is read non-generically, as referring to a plurality of tapirs demonstrably present. As Gelman points out, in each case the pronoun whose referent must be determined is a plural pronoun, but in the first, generic reading the plural referent is inferred, alluded to via the abstraction of reference to the kind as a whole.

Children learning generic language are faced not only with these subtle discourse-based distinctions but further semantic ones, ostensibly as subtle, in



mastering generic forms. For instance, Gelman (2004) gives examples of world-knowledge cues relevant to reading utterances as generic, such as choice of verb (e.g., “I like spaghetti” as generic vs. “I want spaghetti” as non-generic), or complex, possibly ‘naive-theory’-based interactions between subjects and predicates (for examples., “A tiger is carnivorous” can seem generic while “A tiger is sick” does not; “A pig is dirty” is interpretable as generic while “A pot is dirty” is perhaps not).

Although real world knowledge and discourse-contextual cues are relevant to interpreting a sentence as generic or non-generic in all languages, the formal properties specific ones may exploit for such distinctions do, of course, vary (Dahl, 1995). All of the above considerations hold for English specifically, and this dissertation is meant to address only the puzzle presented to learners of English. Other languages pose different but parallel problems of acquisition to their learners (as addressed, for instance, in Tardif & Gelman, 1998; Goldin-Meadow, et al., 2005), and to the linguists attempting formal analysis of generic expressions within them (Chierchia, 1998; Krifka, 2004). Because the present work is not intended to directly address how to best account for genericity as a linguistic phenomenon, I merely remind the reader here that I am covering English alone.

The brief review provided above illustrates the challenge children face in learning generics. This dissertation will not directly examine which cues children make use of to distinguish generics from non-generics (but see Gelman & Raman, 2003, for evidence on this point). Nonetheless, to the extent that

children meet this challenge successfully and learn generic expressions at an early age, this suggests that the distinction between generic and non-generic concepts is a fundamental one for humans.

### *1.2. Generics in Child-Directed Speech*

Although generic language presents an interesting theoretical puzzle to linguists and philosophers, until recently it has been little explored in spontaneous speech. Knowing how generics appear in natural contexts is important for several reasons. First, we need to know how often children hear generic expressions to better gauge its importance as a source of input about kinds. Are generic statements a relative rarity in speech directed to children, or do they come up frequently? Their relative frequency has implications both for our thinking about what children have available to process, and about what parents and caretakers implicitly believe about the cognitive capacities of their young conversational partners. Second, as with any question in language development, the form of input can give us clues to the acquisition process. We would want to know, for instance, whether child-directed speech includes a greatly restricted range of forms for expression of generic meanings, thereby simplifying the language-learner's task. Finally, analysis of the particular situations in which generics are heard by children may tell us something about the sort of content more likely to be encoded in generic speech, and help us in creating more ecologically sound experimental probes of generic language.

In their 1998 monograph, Gelman and colleagues considered

maternal input about richly structured categories (Gelman, Coley, Rosengren, Hartman, & Pappas, 1998). They aimed to move beyond studies of labeling routines and toward a more inclusive and complex snapshot of the information potentially available to young children about animal and artifact kinds. They observed mother-child dyads reading picture books together—videotaping and analyzing the language and language-related behaviors of mothers reading to their 20-month-old children and 30 mothers with their 35-month-old children. Among the forms of language they considered were generic expressions, and until their investigation there had been no reports of their frequency or distribution of generic noun phrases in adults' or children's speech.

Strikingly, almost all of the mothers used at least one generic in the 10-15 minute session, and 42% used more than five. Generics accounted for between 2.5 and 4% of maternal utterances in the 3 sub-studies. Although this may not seem to be a large proportion, it is useful to put the number in some context. In one of the sub-studies (as reported in Gelman 2004), for example, the rate at which generics were used exceeded that for talk about object size and color (2-3% of utterances), number (<1% of utterances), or shape and texture (each <0.5% of utterances). Comparing generics to other topics typically touched on in child-directed adult speech, generics appeared about as often as the belief-desire talk relevant to theory-of-mind (Bartsch & Wellman, 1995).

Two subsequent studies by Gelman and colleagues (Gelman & Pappas, 1998; Gelman & Tardif, 1998) also examined the speech heard by young children, and replicated the above findings. In their task most closely resembling

the book-reading activity from Gelman et al.'s monograph, Gelman and Tardif found that all of the 24 English-speaking mothers of 20-month-old children they observed used at least 1 generic in a 30-minute session, and that generics appeared in 3.6% of their utterances. Pappas and Gelman (1998) also conducted a picturebook-reading study, with children ranging from 1 year 11 months to 4 years 9 months old. Twenty-four of the 26 mothers in their study used at least one generic during the short session, and on average 11% of all maternal utterances were generic.

A further interesting point from the input data is that even when speaking with young children (2 years of age), parents use a range of forms to express generics (Gelman, 2004). For example, in their picture-book reading studies of mother-child pairs, Gelman et al. (1998) found that of the mothers who produced at least one generic, just 21 percent restricted themselves to a single morphological form for expressing it. Instead, mothers used the bare plural (e.g., "Rabbits like carrots"), the plural pronoun (e.g. "They [bats] come out at nighttime"), and the indefinite singular (e.g., "A chipmunk's a little smaller than a squirrel"). Furthermore, 45% of these mothers used both a plural and a singular generic in the same session. Indeed, sometimes they used them in the same sentence (e.g., "Did you know that when a pig gets to be big, they're called hogs?")! Gelman (2004) notes that while in observational studies (e.g., Gelman et al., 1998; Gelman & Pappas, 1998) mothers never used the definite singular generic (e.g., "The lion is a predatory cat"), the same form (e.g., "bats") was often used both generically (e.g. "Bats live in caves") and non-generically (e.g.

“There are bats in that cave”). Thus, a simpler form-to-function mapping is not provided in the input to ease the task of learning generics. Adults speak to children as if children could readily interpret a variety of forms as referring to generic concepts.

*Contexts of Use.* The contexts in which parents produce generics are different from the contexts in which non-generics are produced. Importantly, these differences have implications for the sorts of meanings expressed in parental generics. In particular, generics are used to refer to relatively richly structured categories, and to refer to concepts abstracted away from the immediate context.

Generics appear particularly frequently in talk about animals; controlling for many possible confounding factors, generic expressions were significantly more likely to occur in talk about animals than about artifacts (Gelman et al., 1998; Gelman et al., in press; Gelman & Tardif, 1998; Goldin-Meadow et al., 2005). Given that animal kinds are more stable and essentialized than artifact kinds (Gelman, 2003), this implies that parental generics may be particularly suited for expressing properties of stable, inductively rich categories.

Generic utterances are also more likely to occur during reading activities and while looking at pictures of objects, than during free play with toys (Gelman & Tardif, 1998; Gelman, Chesnick, & Waxman, 2005). Although the significance of this pattern is debatable, it suggests that generics may be associated less with immediate experience (e.g., objects and animals that function and behave in the

real world), and more with abstractions less closely tied to immediate experiences (e.g., pictures, that abstract away from real-world objects).

Altogether, although the evidence is indirect, contextual differences in expression of generics implies that parental generics are particularly suited to richly structured categories that are abstracted away from concrete experiences.

*Generics versus Other Kind-Referring Expressions.* All of these findings suggest that speech containing generics is reliably present as input to children, and that the frequency of generics is correlated with interesting differences related to the ease with which a speaker might move conversation away from the current context and toward an abstraction. Moreover, the frequency with which generics appear in the input stands in contrast to the relative dearth of other and more explicit reference to kinds. Utterances about members of categories in terms of set-theoretic notions—for instance, those including the universal quantifier ‘all’—are comparably scarcer. Gelman et al. (1998) found that less than 2% of the total maternal uses of “all” expressed a universal quantifier, accounting for less than 0.03% of total maternal utterances. It was far more common for ‘all’ to refer to specific referents.

Furthermore, Gelman, Hollander, Star, and Heyman (2000) analyzed the spontaneous conversations recorded in the CHILDES database (MacWhinney & Snow, 1985, 1990). They examined the speech directed to eight English-speaking children between 2 and 5 years old recorded in CHILDES to determine the nature and frequency of appearance for the words “kind”, and a fuller list of universal quantifiers: “all”, “every”, “each”, and “any”. The word ‘kind’ was

searched for exhaustively in the transcripts for “Adam” (Brown, 1973), and of more than 20,000 parental utterances culled from 55 taping sessions, only 10 included “kind” in reference to a basic-level generic kind. A further 27 referred to a subordinate-level generic kind (e.g., distinguishing among kinds of balloons, for instance, in “Yours looks like a dirigible, the kind of balloon people used to fly inside of”), and the rest of the 204 total target uses of ‘kind’ (i.e., those other than its homonym form meaning ‘nice’) were specific references, most often in requesting a label or further information about an individual instance of a category, as in for example “What kind of gun is that?”.

All occurrences of the words ‘all’, ‘each’, ‘every’, and ‘any’ in adult speech directed toward Adam were also examined and, similarly, it was found to be exceedingly rare for these quantifier terms to be used about kinds. The term ‘all’ was notably more frequent in these samples of spontaneous speech than in the picturebook-reading studies (Gelman et al., 1998; Gelman & Pappas, 1998; Gelman & Tardif 1998), and accounted for the majority of target utterances; but altogether there were just 38 instances of kind-referring universal quantifiers, less than 0.4% of maternal utterances.

Gelman and colleagues suggest that the evidence be taken to indicate the unlikelihood that universal quantifiers, or explicit reference to ‘kinds’ of things, convey much to children about the properties shared by members of categories (Gelman et al., 2000). They offer three criteria that should be met when deciding whether a linguistic form might be considered to play a role in cognitive development: that it be reliably present in the input, that its use by caretakers

correspond to relevant conceptual distinctions (for instance, the differences between animate and artifact kinds in the complexity of the knowledge structures with which they are associated; see, for example, Gelman, 2003 for a summary), and that it be comprehended by children. Generic language seems to meet the first two, but they note that little research had at that point been done on how children understand the form.

### *1.3 What Children Know about Generics*

*Children's Generic Production.* 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. Pappas and Gelman (1998) found that 1% of their 2-year-old, and 5% of their 3- and 4-year-old participants' utterances were generic. Furthermore, in their sample of 35 mother-child dyads engaged with toys and pictures in two sub-studies, Gelman, Chesnick, and Waxman (2005) found that 3.6% of the 2 and 3-year-old children's on-task utterances were generic. While the consistent appearance of generic speech is notable, these observational experiments were designed to elicit generic language, and thus leave open questions about whether fully spontaneous conversations would show similar frequencies and developmental trends. A study done by Goldin-Meadow, Mylander, and Gelman (2005) included analyses of 8 children between 3 and 4 years old, taped in their homes playing with toys, books, and pictures brought by researchers but which were not intended to elicit



generics. They found that 1.6% of these children's utterances contained generic expressions.

Gelman, Goetz, Sarnecka, and Flukes (in press) have conducted the most thorough analysis of generics in spontaneous speech to date, surveying the CHILDES database (MacWhinney & Snow, 1990) of extensive, longitudinal, natural language samples from 8 children. The percentage of children's utterances they coded as generic increased from under 1% at 2 years of age, to over 2% at age 3, and over 3% at age 4. Caretaker speech in these naturalistic samples were also in keeping with those from the observational studies—ranging from 1.5% when the target children were 2 years old, to over 3% when they were 3 and 4 years old. Furthermore, they found that every child produced generics in all three—plural, singular, and mass—of the forms they tracked. The researchers also analyzed utterances containing generics in terms of their conversational context, and found that although exchanges which included a generic expression were more likely to be initiated by the parent at age 2 or 3, at age 4 children were as likely as adults to serve as the source of an initial generic reference. Moreover, for sequences in which children used at least one generic themselves, at all ages examined they were more likely than their adult conversational partners to have initiated the exchange.

*Children's Generic Comprehension.* To date there has been little research on how generics are understood. Gelman and Raman (2003) provide one of the first systematic investigations into how children make use of formal and pragmatic cues to distinguish between generic and non-generic utterances.

They point out that although the patterns of language use detailed above suggest that children make appropriate semantic distinctions between generic and non-generic speech, the question of how they do so remains. Gelman and Raman found that by 4 years of age children were able to use multiple cues (both formal and pragmatic) to identify an utterances as generic, and that 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.

That children are demonstrably able to use linguistic cues to distinguish between specific and generic reference is important to the total background I aim to convey. There is obviously some development at work, indicated by the increase from age 2 to age 4 in both the use of multiple cues to genericity, and the frequency of generic production. But even at young preschool age, children are capable of processing generic language remarkably well. This ability leads me to ask how generic language might serve a role in the acquisition of knowledge about the kinds to which generic expressions refer. I turn to this question below

#### *1.4 Some Questions Regarding Generic Language and Generic Knowledge*

Much of what we know about the world can be thought of in terms of the generalities captured in generic sentences. This is an intuition expressed by theorists in the diverse realms of linguistics, philosophy, cognitive science, and developmental psychology.

Krifka et al. (1995, p. 3) state that “...much of our knowledge of the world, and many of our beliefs about the world, are couched in terms of characterizing sentences. Such sentences, we take it, are either true or false—they are not ‘indeterminate’, or ‘figurative’, or ‘metaphorical’, or ‘sloppy talk’. After all, we certainly would want to count the classic Snow is white as literally having a truth value!” Krifka and his colleagues are linguists wrestling with the question of how to encompass truth-value judgments in a coherent treatment of generics, but such considerations can be found in other literatures. Researchers in artificial intelligence, for example, grapple with the representation of “common sense knowledge” wherein generically stated facts can be ‘logically’ true and yet admit of exceptions (for example, see 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” itself. How, she asks, do we come to have beliefs about a kind as a whole based on experience with small numbers of instances? This really is the central question of abstracting away from specific experience and toward generalizations about new instances—in other words, the issue of concept formation (Medin & Rips, 2005). 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.

Short of evaluating the tenability of Prasada's cognitive model, but taking seriously the potential fruitfulness of his approach to explaining how children and adults come to have generic knowledge, the importance of generic language to the enterprise becomes clear. In an interesting variation on the more typical linguist's endeavor, Prasada's model can be seen as accounting for some of the troublesome properties of generic expressions with a formalism designed to explain the acquisition of what he terms common-sense knowledge. On his 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", and "X% of dogs are four-legged", which are claims about statistical prevalence and cannot be glossed as generics can. Indeed, on his 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. Furthermore, in contrast to traditional views on concept acquisition (e.g., exemplar-based, prototype, or even classical-definition accounts), concepts are not built up out of individual tokens, and there is therefore not the presumed inductive leap to acquire generalized beliefs.

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, she argues, 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 abstract kinds might be impossible without language; language is critically needed 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 and Markow (1995) have suggested that naming serves as an invitation to form a category. By hearing the novel label “tapir” in reference to a novel animal, the child forms an assumption that there is a category of similar things, also called tapirs. ***Analogously, I propose that generic noun phrases may serve as an invitation to link a property to a category.*** By hearing the generic statement “Tapirs have white-tipped ears” in reference to a novel animal,

the child forms 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.<sup>1</sup>

How properties and categories become connected is a central question in the study of concepts and kinds. 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? The centrality of stripes to tigers is, of course, important to distinguishing a tiger from a leopard, whether for the purposes of deciding on a course of action or for communicating with a conversational partner about them. In short, children must learn to distinguish specific reference and idiosyncratic properties from generic expression and kind-relevant properties, and how they do so has interesting ramifications for ideas about language and concept.

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

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<sup>1</sup> It seems appropriate to here address a non-trivial issue regarding terminology. I have been using the terms “kind”, “category”, and even occasionally “concept”, somewhat interchangeably. This, I believe, reflects their relatedness for the present purposes but does not preclude the potential relevance of the distinctions, even for the issues at hand; they are simply considerations beyond the scope of the current study. The notion of ‘concept’ is, despite its central place in so many theories about cognition, subject to much vague use and I continue in that vein by taking it to mean, roughly, a mental representation (of categories or of individuals). In this sense it is the most inclusive of the three terms. ‘Category’ refers to a set of two or more discriminably different things with a common attribute. Thus, a category can be “dogs,” or “green things,” or “things to take out of a burning building,” or “things I can place on my counters to keep the cat off.” As Gelman (2003) points out, categories can range from arbitrary, laboratory-created groupings, to the type of goal-derived category (Barsalou, 1985) represented in sentences like “things to take to school”, to ‘natural kind’ categories, that entail “...dense clusters of highly correlated features, and display rich inductive potential...”(Gelman 2003, p. 12), such as “kangaroo” or “gold”. I use the term “kind” to refer not only to natural kinds per se, but to any category with relatively rich inductive potential, including pigs, pencils, flags, Republicans... For the most part, kind concepts are referred to with common nouns.

inferences. For example, I might have seen only one actual tiger in my life, and therefore cannot be certain whether stripedness generalizes to other instances. Or, the evidence might favor a generalization, but I cannot be certain that my sample is representative. For example, perhaps all the cats I have encountered have been striped, but my sample is rather small. Does this mean that cats in general are striped?

It should be no surprise that I am suggesting that language is a powerful tool for conveying the scope of a property with respect to a category. Indeed, it is unclear how such generalizations could be expressed in the absence of language (Gelman, 2003). 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.

Although it is clear that generics express such property-category links for adults, what had not been studied previously was whether children are sensitive to this expressive power of generics. Do children treat properties expressed with generics to imply that a property is more tightly bound to a category? If so, does this influence not only their interpretation of generics for familiar categories and properties, but also their interpretation of novel categories and properties? That generic expressions evoke reference to kinds in their entirety makes it a language form particularly felicitous for specification of properties relevant to identifying new instances, an important function of concepts as a construct

(Medin & Rips, 2004). To the extent that children are sensitive to this implication, it would demonstrate an important means that language has for affecting children's knowledge representations.

Thus, I suggest that hearing generic language—like hearing a category name— may influence how powerfully children link a property to a category. This idea has been proposed 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. Thus, generic language may both reflect and influence important conceptual distinctions relevant to individual kind concepts, (e.g., concepts of “cat”, “shark”, “girl” ) and to larger knowledge representations (e.g., theories related to pets, predators, and people).

In this dissertation I report three studies, all of which specifically examine how generic expressions influence relationships between property and category. As detailed above, 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). I hope to have established above that genericity is an intriguing phenomenon, representing a crucial mode of referring to kinds of things, of talking abstractly, of



moving beyond the “here and now”. Mothers seem to use generic language with their children from an early age, children themselves seem to speak of things generically, and there is evidence suggesting that they are used differentially to refer to more richly-structured categories and in contexts more conducive to speaking abstractly. These findings, coupled with a general lack of other, more explicit references to kinds and categories (Gelman et al., 1998; Gelman et al., 2000; Gelman, 2004) compels us to look closely at genericity as it lies at the heart of important inductive challenges to the child, in both the realms of language acquisition and conceptual development.

### *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. In the first of the three studies, I assess how both children and adults understand generics vis-à-vis the relevant quantifier terms “all” and “some”. Each of these expressions (generic, “all”, and “some”) represents a distinctive relationship between category and predicated property. By asking when in development children begin to distinguish these forms from one another, we can discover important information about how generics are interpreted as *generally* true (unlike “some”) but not *necessarily* true (unlike “all”). The second and third studies use a word-learning paradigm to examine whether generic language establishes special links between properties and categories.

I use a multiple manuscripts format, and so each study is reported with a brief introduction and discussion. Study 1 has been published in *Developmental Psychology*, as the first study of two.

## Chapter Two

### Study 1: Children's Interpretation of Generic Noun Phrases

In Study 1, we focused directly on what generics mean to young children by using a comprehension task. As noted in Chapter One, for adults, generics are distinctive in implying broad category scope (e.g., "Birds fly" is generally true of birds) yet allowing for exceptions (e.g., penguins). Thus, generics are distinct from both "all" (e.g., "All birds fly") and "some" (e.g., "Some birds fly"). We conducted an experiment to test whether preschool children appreciate this.

The study was modeled after an experiment conducted by Smith (1980) that focused on children's interpretation of "all" and "some." In Smith's (1980) study, children ages 4 years 1 month to 7 years 6 months received a series of questions regarding properties of categories. One third of the properties were true of all members of the category in question (what we call *wide-scope properties*), one third were true of some members of the category (*narrow-scope properties*), and one third were true of no members of the category (*irrelevant*

*properties*). Children were asked about each category–property pairing with either the word *all* or the word *some* (e.g., “Do all people have blonde hair?” vs. “Do some people have blonde hair?”). Smith’s (1980) results indicated that even 4-year-olds appropriately distinguished “all” and “some” under favorable presentation conditions (i.e., the first half of the first block of questions).

We predicted that if adults were given the same task with questions presented in generic form, they would treat generics as partly like “all” and partly like “some.” In particular, we predicted that adults would accept both wide-scope properties and (to a lesser extent) narrow-scope properties as true in generic form. These predictions follow rather straightforwardly from the semantic analyses provided earlier. Nonetheless, they would constitute novel empirical demonstrations given the lack of evidence regarding what generics mean to lay adults (for an exception, see Gelman & Tardif, 1998, Study 3). Of primary interest was children’s understanding, relative to these predictions with adults.

### *Method*

*Participants.* Three-year-old children ( $N = 18$ ; age range = 3 years 0 months to 3 years 11 months; mean age = 3 years 6 months), 4-year-old children ( $N = 18$ ; age range = 4 years 0 months to 4 years 10 months; mean age = 4 years 5 months), and adults ( $N = 38$ ) participated. The adults were undergraduates at a large, midwestern university enrolled in a course in developmental psychology; the children attended local preschools in the same town as the university.

*Items.* Participants each received three blocks of questions (generic, “all,” and “some”), in one of three orders (all–some–generic, some– generic–all, or generic–all–some). For 4-year-olds and adults, each block consisted of 12 questions: 4 concerning wide-scope properties (e.g., “Are fires hot?”), 4 concerning narrow-scope properties (e.g., “Do girls have curly hair?”), and 4 concerning irrelevant properties (e.g., “Do fish have branches?”). Many of the questions were derived from Smith (1980).

Three-year-olds received half as many items as the 4-year-olds and adults. Appendix A shows the full list of items, and indicates which were used with 3-year-olds. Each property was rotated through each of the three wording conditions so that the specific content was not confounded with a particular condition (e.g., across children, a given question would be “Are fires hot?” “Are all fires hot?” or “Are some fires hot?”).

We had three reasons for presenting the items in blocks rather than intermixing the three kinds of wording over the course of the experiment. First, one benefit of blocking trials is that it minimizes carryover effects. If a question of Type A sets a particular context and a question of Type B sets a different context, then there is concern that a child may have difficulty switching from one context to another context repeatedly throughout the course of an experimental session (see Zelazo & Frye, 1998, for evidence that 3-year-old children have difficulty switching flexibly between rules). By blocking the items, the amount of switching is minimized and a more sensitive test is thus provided. Second, we wished to break up the task to maintain children’s interest. The current design

required many trials per participant (as noted above, 36 at age 4 and 18 at age 3). By chunking the task into three parts, we were able to maintain children's interest throughout the task. Third, Smith (1980), whose studies formed the basis of this study, also presented questions in blocks ("all" questions appeared in one block; "some" questions appeared in another, with order of blocks counterbalanced). In building on this work, we attempted to keep aspects of the design comparable.

### *Procedure*

Children were tested individually in a quiet room at their schools. Before the testing session, each child was told that he or she would be playing a special game. Most of the 3-year-olds (14 of 18) then received a warm-up task to introduce them generally to answering questions posed by the experimenter. The warm-up consisted of four simple yes/no questions (e.g., "Is this a spoon?" when showing a picture of a spoon; "Is this a chair?" when showing a picture of a pig); two of the correct answers were "yes" and two of the correct answers were "no." Children performed extremely well on the warm-up task. Children were then introduced to the main task. The experimenter said, "We are going to play a game with this special board [an 8 X 10 in. photo frame covered in Velcro] and these special cards [colored, laminated 3 X 5 in. index cards with Velcro on the back] that you can stick right on the board. Each card has a question on it, and you get to pick a card and stick it right on the board, and then we can talk about what it says on the card. OK?" The cards were color-coded by trial block—yellow for generic, green for "all," and purple for "some." Cards for each block were kept

in separate envelopes. The experimenter emptied an envelope of cards for a given block, laid them out face down before the child, and told the child that he or she could pick one card at a time and put it up on the board. For each trial, the child picked a card and placed it in the photo frame. Three of the 4-year-old children received the task without the Velcro frame, but all other aspects of the procedure were the same as with the other child participants. The experimenter read the question aloud and both audio-taped and wrote down the child's response.

Three-year-olds were also given a posttest task designed to test their comprehension of "all" and "some" with concrete and immediately perceptible referents (modeled on a pretest developed by Smith, 1979, p. 439). Children were told, "Now we have a new game to play for a little while. Look, I have a box and crayons." The experimenter produced a small clear container and a plastic bag containing four crayons. There were eight trials, four with "all" and four with "some." For each trial, the experimenter placed zero, two, three, or four of the crayons into the box and then asked, "Are all of the crayons in the box?" (on "all" trials) or "Are some of the crayons in the box?" (on "some" trials). The questions were presented in two blocks, an "all" block and a "some" block, with order of the blocks counterbalanced across participants. The order of the questions within a block (zero, two, three, or four crayons in the box) was randomized separately for each participant, with the constraint that the potentially ambiguous questions were presented last (zero for "all" and four for "some" were always presented last in the block). Smith (1979) had found that children as young as 4 years of age

had no difficulty with this task, and so we included only 3-year-olds on the posttest. Adults were tested in a group with a paper-and-pencil version of the task. They were told that they would be participating in an experiment that was designed for young children. They received a booklet with one question on each page. They were asked to write down their answer to each question in the space provided below the question itself.

### *Results*

Responses were scored as follows: 1 for each “yes” response, 0 for each response of “no” or “none,” and 0.5 for each response that didn’t fit into either category (when respondents did not give a yes or no answer; e.g., when asked “Do girls have curly hair?” a child might reply “some do” without responding “yes” or “no”). Such cases were relatively rare, accounting for only 4.6% of the responses of 3-year-olds, 6.6% of the responses of 4-year-olds, and 1.3% of the responses of adults. The primary reason for coding these responses as 0.5 is that they indicate a reluctance to commit to a definitive “yes” or “no” answer. A 0.5 coding reflects this, as it indicates an answer that is intermediate between “yes” and “no.” A further motivation is that this coding scheme is unbiased, weighted toward neither response. Approximately three fourths of these intermediate responses occurred in three of the nine cells of the study design: “all” questions regarding narrow-scope properties (e.g., “Do all clothes have zippers?”), generic questions regarding narrow-scope properties (e.g., “Does milk have chocolate in it?”), and “some” questions regarding wide-scope properties (e.g., “Are some fires hot?”), accounting for 22%, 30%, and 24% of the



intermediate responses, respectively. These cells can be considered anomalous in that they pair either a noun phrase typically broad in scope with a narrow-scope property or a noun phrase typically narrow in scope with a broad-scope property. The rest of the indeterminate answers were scattered fairly equally across the other six cells of the study design, each cell accounting for 0% to 6% of these responses.

For each participant, we summed the scores, separately for each of the nine cells in the study design (three forms of the question [all–generic–some] x three types of properties [wide scope, narrow scope, irrelevant]). Thus, each participant received nine scores, each of which could range from 0 to 4 (for 4-year-olds and adults) or from 0 to 2 (for 3-year-olds). The scores of the 3-year-olds were then transformed by multiplying each score by two, thereby rendering them on the same scale as the two older age groups.

These scores were then entered into a 3 (age: 3 years, 4 years, or adult) X 3 (wording: all, generic, or some) X 3 (property: wide scope, narrow scope, or irrelevant) analysis of variance (ANOVA). The results can be seen in Figure 2.1. As expected, there was a significant main effect of property,  $F(2, 142) = 845.14$ ,  $p < .0001$ . Not surprisingly, participants endorsed wide-scope properties most often ( $M = 10.63$  out of 12), narrow-scope properties less often ( $M = 6.81$  out of 12), and irrelevant properties least often ( $M = 0.53$  out of 12).

All the remaining effects involved wording. First, there was a significant effect of wording,  $F(2, 142) = 46.80$ ,  $p < .0001$ , with each of the three forms of wording significantly different from one another: “Some” questions yielded the

highest affirmations ( $M = 7.23$  out of 12), followed by generic questions ( $M = 6.34$ ), followed by “all” ( $M = 4.40$ ). To put this another way, participants were most selective as to which properties they would attribute to “all” category members and least selective as to which properties they would attribute to “some” category members, with generic statements intermediate. The wording effect interacted with age,  $F(4, 142) = 10.48, p < .001$ . However, this two-way interaction must be interpreted in light of the significant three-way interaction involving wording, property, and age,  $F(8, 284) = 12.20, p < .001$ .

To explore this three-way interaction in detail, we conducted separate Wording X Property ANOVAs within each age group separately. Doing so revealed a striking developmental change from 3 to 4 years of age. At age 3, children did display a significant effect of property,  $F(2, 34) = 113.84, p < .0001$ . However, wording exerted no significant effects. In contrast, for 4-year-olds, there were significant effects of wording,  $F(2, 34) = 9.66, p < .001$ ; property,  $F(2,34) = 217.94, p < .001$ ; and Wording X Property,  $F(4, 68) = 20.53, p < .001$ . With the wide-scope properties, 4-year-olds were more likely to answer “yes” in response to “all” questions, than in response to “some” questions ( $p < .05$ ). There was no significant difference between generic and either “all” or “some” on these items. In contrast, with narrow-scope properties, 4-year-olds were more likely to answer “yes” in response to “some” and generic questions than in response to “all” questions ( $p < .01$ ). There was no significant difference between “some” and generic on these items. Finally, for both generic and “all” questions considered separately, 4-year-olds were more likely to affirm wide-scope properties than

narrow-scope properties ( $p < .05$ ). In contrast, there was no significant difference between wide-scope and narrow-scope properties for “some” questions.

Adults showed patterns very similar to those of 4-year-olds. There were significant effects of wording,  $F(2, 74) = 177.61, p < .0001$ ; property ( $2,74) = 942.35, p < .0001$ ; and Wording X Property,  $F(4, 148) = 119.41, p < .0001$ . With the wide-scope properties, adults were more likely to answer “yes” in response to generic questions than in response to “all” questions ( $p < .01$ ). There was no significant difference between “some” and generic or between “all” and “some” on these items. In contrast, with narrow-scope properties, adults were more likely to answer “yes” in response to “some” and generic questions than in response to “all” questions ( $p < .001$ ) and were more likely to answer “yes” in response to “some” questions than in response to generic questions ( $p < .001$ ). Finally, for both generic and “all” questions considered separately, adults were more likely to affirm wide-scope properties than narrow-scope properties ( $p < .001$ ). In contrast, for “some” questions, adults showed the opposite pattern: They were more likely to affirm narrow-scope than wide-scope properties ( $p < .05$ ). When we compared the age groups with one another, using Tukey’s honestly significant difference test, we found that all of the age differences were localized in two types of questions: narrow-scope properties in the “all” condition (with 3-year-olds’ responses higher than 4-year-olds’,  $p < .001$ , which were higher than adults’,  $p < .005$ ), and narrow-scope properties in the “some” condition (with adults’ responses higher than those of either 3-year-olds or 4-year-olds,  $p < .005$ , which

did not differ from one another). There were no significant age effects in the generic wording condition.

*Order effects.* Because the order of wording was blocked (i.e., all generic questions in one block, all “all” questions in another block, all “some” questions in another block, with blocks quasi-counterbalanced), this raises the possibility that children may have developed response sets within each block that led to artificially distinguishing the three kinds of wording. Note that the task could not have created a distinction where none exists. That is, if children and adults come into the study with no a priori differentiation between generic, “all,” and “some,” then hearing such items blocked and contrasted would not impose a novel semantic interpretation on the spot. In particular, it is implausible that participants would reach a consistent interpretative distinction between the three forms simply on the basis of noticing that the blocks differed. Nonetheless, the blocking of trials may have influenced response patterns, and it is important to examine whether the results hold up when possible carryover effects are eliminated. To examine this issue, we conducted a secondary analysis that reran the study as a between-subjects design, by including only the data from the first block of trials. Figure 2.2 presents the results of this analysis. Keep in mind that this is a highly stringent test, as for the 3- and 4-year-olds there were only 6 participants per wording condition on this analysis. Specifically, we conducted a 3 (age: 3-year-olds, 4-year-olds, or adults) X 3 (wording condition: all, generic, or some) X 3 property scope (wide scope, narrow scope, or irrelevant) ANOVA, with age and wording condition as between-subjects variables and property scope as a

repeated-measures variable. From this analysis, we again obtained the expected main effect of property,  $F(2, 130) = 329.91, p < .001$ , and a Property X Age interaction,  $F(4, 130) = 2.69, p < .05$ . All remaining effects involved wording. There was a main effect of wording,  $F(2, 65) = 11.79, p < .001$ ; a Wording X Age interaction,  $F(4, 65) = 3.37, p < .02$ ; and a three-way interaction involving wording, age, and property type,  $F(8, 130) = 4.78, p < .001$ . To explore this three-way interaction in detail, we conducted separate Wording X Property ANOVAs within each age group separately. As in the overall ANOVA reported earlier, 3-year-old children displayed a significant effect of property,  $F(2, 30) = 56.00, p < .001$ , but no significant effects involving wording. In contrast, for 4-year-olds, there were significant effects of wording,  $F(2, 15) = 3.47, p = .06$ ; property,  $F(2, 30) = 65.58, p < .001$ ; and Wording X Property,  $F(4, 30) = 7.81, p < .001$ . With the narrow-scope properties, 4-year-olds were most likely to answer “yes” in response to “some” questions, least likely to answer “yes” in response to “all” questions, and responses to generic questions were intermediate ( $p < .05$ ). Finally, for both generic and “all” questions considered separately, 4-year-olds were more likely to affirm wide-scope properties than narrow-scope properties ( $p < .05$ ). In contrast, there was no significant difference between wide-scope and narrow-scope properties for “some” questions.

Adults showed patterns very similar to those of 4-year-olds. There were significant effects of wording,  $F(2, 35) = 80.95, p < .001$ ; property,  $F(2, 70) = 340.01, p < .001$ ; and Wording X Property,  $F(4, 70) = 46.74, p < .001$ . With narrow-scope properties, adults were more likely to answer “yes” in response to

“some” and generic questions than in response to “all” questions ( $p < .001$ ) and were more likely to answer “yes” in response to “some” questions than in response to generic questions ( $p < .001$ ). Finally, for both generic and “all” questions considered separately, adults were more likely to affirm wide-scope properties than narrow-scope properties ( $p < .02$ ). In contrast, for “some” questions, there was no significant difference between wide-scope and narrow-scope properties.

Thus, the results of this reanalysis largely replicate those of the overall study, with 3-year-olds demonstrating only a main effect of property type and no effects of wording but 4-year-olds and adults each showing a main effect of property type, a main effect of wording, and a Property Type X Wording interaction. Furthermore, just as in the overall analysis, this analysis demonstrated that 4-year-olds and adults (but not 3-year-olds) treat generics as partly like “all” and partly like “some.” On the narrow-scope properties, 4-year-olds and adults say “yes” to generic questions significantly more often than to “all” questions but significantly less often than to “some” questions. In other words, responses to questions like “Do girls have curly hair?” are intermediate between “Do all girls have curly hair?” and “Do some girls have curly hair?” Altogether, these subsidiary analyses render it implausible that blocking introduced artificial response sets.

*Qualifying responses.* We then examined how often participants qualified their response with “some” (e.g., in response to “Do girls have curly hair?” a child might say “Some girls do” or “Yes, some girls do”) or with “all” (e.g., in response

to “Are fires hot?” a child might say “All fires are” or “Yes, all fires are”). We did not include as qualifications those cases in which a participant simply repeated information in the question (e.g., “Are all fires hot?” “Yes, they’re all hot.”). Thus, qualifications, by definition, supplied information that could not be assumed in the question.

As expected, most “some” qualifications were given in response to narrow-scope properties (90%), and most “all” qualifications were given in response to wide-scope properties (96%). We therefore included only those qualifications that were provided for the expected scope (i.e., “some” for narrow-scope properties and “all” for wide-scope properties). However, it is important to note that the patterns of results reported below are largely equivalent when all qualifications are analyzed. Our main question is what sorts of qualifications children and adults provided for generics and how these compared to their qualifications for the other wording conditions. Because the different wording conditions differed in terms of which qualifications were possible (see above), we conducted a series of paired *t* tests comparing qualifications of generic responses with qualifications of either “all” or “some” responses, within each age group separately (see Table 2.1). As can be seen, 3-year-olds did not distinguish between generics and either “all” or “some” in the qualifications they provided. Both 4-year-olds and adults, however, showed distinct patterns of response: more “some” qualifications for generic questions than for “all” questions, and more “all” qualifications for “some” questions than for generic questions. The fact that generic questions are more often qualified with “some” indicates that

generics do not themselves imply “some.” Overall, this pattern suggests that generics are distinct from both “all” and “some.”

*Individual response patterns.* The finding that generics were in-between “some” and “all” raises the question of whether individual participants consistently treated generics as intermediate or whether instead this finding is the result of averaging across participants. To address the issue, we examined the response patterns of individual participants. Because the data were complex, and because the wording effects were most pronounced on the narrow-scope properties, we focused specifically on this subset of the data. (Wide-scope properties tended to yield ceiling effects, and irrelevant properties yielded floor effects.) We coded each participant’s responses to the narrow-scope properties into one of four categories: (a) Generic = intermediate. These participants had higher scores for “some” than for generic and higher scores for generic than for “all” (“some” > generic > “all”). In other words, they treated generic as intermediate between “some” and “all.” (b) Generic = “all.” These participants had higher scores for “some” than for generic and “all” and had equivalent scores for generic and “all” (“some” > generic, “all”). In other words, they differentiated “some” from “all” and treated generic as equivalent to “all.” (c) Generic = “some.” These participants had higher scores for “some” and generic than for “all” and had equivalent scores for “some” and generic (“some,” generic > “all”). In other words, they differentiated “some” from “all,” and treated generic as equivalent to “some.” (d) Other. This included all other response patterns. Results are shown in Table 2.2. For both 4-year-olds and adults, the most frequent response pattern was to treat



generics as intermediate between “all” and “some.” Among those who did not, some participants treated generics as equivalent to “some,” and some treated generics as equivalent to “all,” though the former was slightly more common. Most of the 3-year-olds showed “other” response patterns, primarily because most of them did not differentiate “all” and “some.”

*Item analyses.* We also examined the results for items considered individually to determine the generalizability of the results across items. As we did in the individual response analysis, we focused solely on the narrow-scope property items. There were 12 narrow-scope items for 4-year-olds and adults and 6 narrow-scope items for 3-year-olds. We coded responses to each of these items into the same categories as those described above for the individual response patterns: (a) generic = intermediate (“some” > generic > “all”), (b) generic = “all” (“some” > generic, “all”), (c) generic = “some” (“some,” generic > “all”), and (d) “other.” Three-year-olds showed little consistency: 1 item showed Pattern a, 2 showed Pattern b, 1 showed Pattern c, and 2 showed no pattern (i.e., Pattern d). For 4-year-olds, however, the items showed much greater consistency: Fully half the items (6 out of 12) showed Pattern a, whereby generics are intermediate in scope between “all” and “some.” Three of the items showed generics as equivalent to “some,” and the remaining 3 items showed no consistent pattern. Among the adults, all 12 items showed Pattern a, in which generics were intermediate in scope between “all” and “some.”

*Posttest.* The posttest was given to 3-year-olds only, to test their understanding of “all” and “some” in a concrete context with immediately

perceptible referents. Because of experimenter error, 2 of the 3-year-olds did not receive the posttest, so a total of 16 children were included in the analyses. For each participant, we scored a response of “yes” as 1 and a response of “no” as 0 (see Figure 2.5 for results). Overall, children performed extremely well on this task. Children typically applied “all” just to the situation in which four of the four crayons were in the box. In contrast, they typically applied “some” to the situations in which two, three, or (less often) four crayons were in the box.

We entered the scores into a 2 (wording: all or some) X 4 (number: zero, two, three, or four) ANOVA. Results indicated clear effects of wording,  $F(1, 15) = 45.00, p < .001$ ; number,  $F(3, 45) = 30.80, p < .001$ ; and Wording X Number,  $F(3, 45) = 24.45, p < .001$ . When comparing “all” and “some” trials directly with paired  $t$  tests, we found that children significantly distinguished the two kinds of questions on trials asking about two out of four crayons ( $p < .001$ ), three out of four crayons ( $p < .01$ ), and four out of four crayons ( $p < .05$ ). Furthermore, individual children’s response patterns also suggested that these children had consistent understanding. Eleven out of the 16 children showed the correct pattern on “all” (i.e., “yes” to four out of four only), and 12 out of the 16 children showed the correct pattern on “some” (i.e., “no” to zero out of four and “yes” to two out of four and three out of four; for the purposes of this analysis, we did not include responses to the four out of four trials, given the ambiguity of “some” on these questions).

### *Discussion*

Overall, these results are consistent with a semantic analysis in which by the time children are 4 years of age, generics imply broad generalizations but also allow for exceptions. In other words, 4-year-olds and adults interpret generics as being reducible to neither “all” nor “some.” Like “all,” generics are more appropriate for wide-scope generalizations (e.g., “Fires are hot”) than for narrow-scope properties (e.g., “Girls have curly hair”). Yet like “some,” generics are nonetheless endorsed above chance for narrow-scope properties (e.g., “Girls have curly hair”). Individual response patterns further reveal that most 4-year-olds and adults consistently treat generics as intermediate between “all” and “some” in meaning. However, in their spontaneous qualifications, 4-year-olds and adults treat generics as more like the quantifier “all.”

These distinctions (between generic and “all” and between generic and “some”) are subtle and so provide a powerful test of children’s grasp of generic implications. First, the distinction between “all” and generics emerges despite the fact that both noun phrase types imply the category as a whole, differing only in their commitment to every instance. At times generics are indistinguishable from “all,” being used to convey properties true of every category member (e.g., “Dogs are mammals”). Nonetheless, generics allow for the possibility of counterexamples in a way that “all” does not (e.g., “Dogs have four legs” is not invalidated by the existence of three-legged dogs). Second, the distinction between generics and “some” is subtle in that the bare plural form has dual functions, at times referring to generics (e.g., “Bears like to eat ants”) and at times referring to an indefinite plural (e.g., “I saw bears in the park yesterday”).

Note that the indefinite plural is comparable to a noun phrase with “some” (i.e., “I saw bears in the park yesterday” is comparable in meaning to “I saw some bears in the park yesterday”). Given these potential confusions—on the one hand between generics and “all,” and on the other hand between generics and “some”—it is all the more impressive that 4-year-olds distinguish among the three forms.

We found that, in striking contrast to the data from 4-year-olds and adults, 3-year-olds did not distinguish “all,” generic, and “some.” Their difficulty cannot be attributed to lack of knowledge (e.g., not knowing that fires are hot or that girls can have either curly hair or straight hair), because they did consistently distinguish wide from narrow from irrelevant properties. For example, they were more likely to endorse the proposition that fires are hot than that girls have curly hair. Instead, the problem is specifically with differentiating among the three types of wording. For example, they were statistically as likely to accept that all girls have curly hair as they were to accept that some girls have curly hair. However, it is also not the case that 3-year-olds know nothing about the meanings of “all” and “some,” because they performed extremely well on the all–some posttest, which used a small set of concrete, available objects. Instead, 3-year-olds had difficulty extending this knowledge beyond the realm of instances that were immediately present to a consideration of categories in the abstract.

In summary, the results are clear: 4-year-old children and adults distinguish between generics and statements using “all” or “some.” In both cases (generic vs. “all” and generic vs. “some”) the distinction is a subtle one. Generics

are often characterized as being generally true, yet even so children honor a distinction between generics and the more inclusive “all.” On the other hand, the distinction between generics and “some” is upheld despite the fact that the same form of the noun phrase (bare plural) is used in both generic utterances (e.g., “Bears are ferocious”) and indefinite utterances (e.g., “I saw bears at the zoo yesterday”). Thus, the semantic features of generics presented in the introduction to this article (neither reducible to “all” nor reducible to indefinite “some”) are appreciated by adults and preschool children alike.

One important interpretive issue needs to be addressed. Namely, it is possible that the intermediate pattern of responses (with generics receiving a number of “yes” responses, that is, in between their responses to “all” and their responses to “some”) could indicate confusion or mixed responses rather than a consistent generic interpretation. However, several additional pieces of information argue against this alternative account. First, the 4-year-olds show a response pattern that is in all respects quite similar to that of adults on the same task. Second, children’s spontaneous qualifications likewise are consistent with the construal that children distinguish generics from “all” and “some.” Third, the findings from other published reports using different research methods (Gelman & Raman, 2003; Gelman et al., 2002) are consistent with the interpretation provided for the present results. Finally, the data from a production task reported along with the present comprehension task in Hollander, Gelman, and Star (2002) further bolster the idea that children treat generics as distinct from “some’.

Importantly, the present study indicates that generics are understood early in development, by 4 years of age. This is a surprising finding given the subtlety of the semantic distinctions under consideration. However, there is a second finding as well, namely, that performance changes rather abruptly between 3 and 4 years of age. Three-year-olds displayed no sensitivity to the distinction between “all,” generics, and “some” wording, whereas 4-year-olds were notably adult-like in their responses. However, children’s failure to differentiate among the linguistic cues provided does not demonstrate that 3-year-olds lack generic understanding. Indeed, the overall means for generics do not change significantly with age (see Figure 2.1). Three-year olds’ response patterns on the generic questions are statistically indistinguishable from those of 4-year-olds and adults. All of the significant age changes are with “all” and “some.” We therefore propose the following interpretation: Under certain conditions (e.g., when the information-processing load of the task becomes too high), children ignore the quantifiers “all” and “some” and treat all three versions of the questions as generic. These result patterns lead to the intriguing implication that generics may be a kind of default for young children. When information-processing demands are high, children may ignore quantifiers and interpret a wide range of utterances as generic.

This interpretation remains speculative at the present time. In future research, it would be important to test the generics-as-default hypothesis more directly. For example, one could place older children under increased processing demands to determine if generic interpretations increase in such contexts.

Alternative interpretations would also need to be tested more directly. For example, it is also possible that 3-year-olds are ignoring the form of the questions entirely and simply answering “yes” on the basis of how readily they can retrieve examples of the property being linked to the kind mentioned. One way to begin to address this question would be to examine 3-year-olds’ understanding with properties that are highly available in context but not true of the generic kind. For example, 3-year-olds could be shown a picture of a dozen glasses of chocolate milk and then asked, “Does milk have chocolate in it?” If their responses to this narrow-scope question are influenced simply by the availability of instances that match the predicate, then they should tend to answer “yes.” In contrast, if their responses indicate a true generic response, then they should give a response intermediate between “yes” and “no” (as they have done in the present study).

It is also intriguing that 3-year-olds succeeded on the all–some posttest, which used a small set of concrete, available objects. The reasons why 3-year-olds have difficulty applying “all” and “some” to categories considered more broadly remain unknown at the present time. Perhaps the task poses insurmountable information processing demands by requiring the child to hold in mind abstract sets and subsets (e.g., the set of girls and the subset of girls with curly hair) as well as the scope of the quantifier. A similar argument has been made with regard to young children’s understanding of basic–subordinate level inclusion relations (Johnson, Scott, & Mervis, 1997). Perhaps 3-year-old children would have performed better on all three forms of the question in the main task

("all," "some," and generic) if we had provided pictures depicting accurate samples of the categories in question, such as a set of girls, some with curly hair and some with straight hair. More generally, an important task for future research will be to determine what underlies the developmental changes identified in this study.

We conclude that preschool children readily grasp the semantics of generic sentences even though generic noun phrases are neither overtly marked in language (i.e., there is no single linguistic form for conveying them) and even though their meaning could be characterized as less clear-cut compared to the logical precision of "all" and "some." Taken together, these findings suggest that generic concepts are readily available in young children's category representations. Just as children are capable of reasoning about everyday objects in their world, so too can they construct and reason about generalized kinds.



## Chapter Three

### Study 2: Generic Language and Extending Novel Words

Study 1 of this dissertation demonstrated that adults and children as young as 4 years old are sensitive to generic wording. They appropriately distinguished generics from the quantifier ‘all’ on the one hand, and from ‘some’ on the other, when asked questions about familiar categories and properties. In Studies 2 and 3, I ask whether adults and children can use generic language in the service of learning new words. In particular, I am concerned with how generics specially link properties to categories. Generic utterances, such as “Snakes have scales,” seem to imply that the property predicated of the category is relatively central (Krifka et al., 1995; Lyons, 1977), particularly compared to non-generic utterances, such as “This snake has scales.”

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. For example, if children did

not know that bears climb trees, then one could examine whether “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”). One way to test this first consequence would be to teach children a novel fact (either generic or specific) about a *familiar* category, test how widely children generalize that fact to other instances. This is in fact what Gelman, Star, and Flukes (2002) did, finding evidence that preschool children extend novel properties more broadly within the target familiar category (e.g., bears), when the novel property is expressed generically vs. non-generically.

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 novel fact (either generic or specific) about a *novel* category, then test which features children use to identify new instances of the category. As I detail later in Chapters 3 and 4, this is the approach taken in the present studies.

### *3.1 Do Generics Highlight Properties as Central to a Category?*

Prasada and his colleagues (Prasada, 2000; Prasada & Dillingham, 2006) have recently considered how generic language might convey information about

the relationship between properties and categories. In creating a model for the acquisition of “commonsense”, or “generic” knowledge about the world, Prasada emphasizes the importance of generic language. Generic sentences, on this view, can be interpreted to indicate a “principled connection” between the category and predicated property. For example, “Dogs have four legs” may be interpreted as “By virtue of what they are, dogs have four legs”. Indeed, Prasada and Dillingham (2006) found that adults endorse this gloss as true. They 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.

Indeed, Prasada (2000) and Gelman (2004) suggest that generic language may be critical to the acquisition of generic knowledge. Prasada outlines a formal system for learning new facts about kinds of things that bypasses the need for extensive experience of instances. Such a formal system, he argues, can allow for the development of kind-concepts without the involvement of inductive processes that, for instance, are required in prototype-

or exemplar-based models of concept acquisition and representation. Prasada posits that single instances of a kind can serve as input to a representational system for “commonsense conception”, and that one potentially important method whereby young children in particular may glean generic knowledge in short order is from the generic language to which they are exposed. Similarly, Gelman (2004) points out that without language in general it would be impossible to predicate properties of a kind as a whole: “...no process of enumerating and displaying examples can unambiguously convey that birds (as a kind) have hollow bones, whereas this is an uncomplicated linguistic effort” (p. 32). Gelman further suggests that generic language is important to teaching children specific category-wide generalizations.

In the present study I ask how children and adults interpret generics in support of the judgments about category membership inherent to extending novel words. Before turning to the study, I first review some recent issues regarding novel word extensions in young children.

### *3.2 Linking Word and World*

In recent chapters on early word learning, Waxman (2004, Waxman & Lidz, 2006) summarizes evidence about words and how they appear to be intimately tied to category-based reasoning. Much debate swirls around this work, questions central to controversies in cognitive science and developmental psychology—the primacy of perceptual or conceptual processes (Booth & Waxman, 2006; Smith & Samuelson, 2006), whether acquisition is guided by

domain-specific or domain-general principles and processes (Bloom, 2001; Bloom & Markson, 2000; Waxman & Booth, 2000), and the particulars of the relationship between language and concept, to name a few. The central question is really the classic problem of induction laid out by Quine (1960) asking how the child comes to diagnose what, of the myriad possibilities in any given scenario, a word she hears might refer to. That is, there are things one might talk about, and there are words in the speech stream that native speakers seem to use effortlessly to talk about them. The child's task is to hook the two up, and the researcher's task is to discover how this process might happen. Research into the particulars of the process has come at the problem from both the world end and the word end of it. There are important concerns on both ends—which relevant aspects of the world, and of the speech stream, do learners attend to and under what circumstances?

One especially prominent sort of experimental paradigm used to investigate the connections between word and concept is the “novel word extension” task. Much can be varied, but the basic frame is for the researcher to introduce a new word and to note how that word is thereafter extended to new objects. The participant's willingness to extend the novel label to a new object is taken as evidence of her diagnosis regarding its category identity—i.e., her decision that the object counts as another member of the category initially labeled with the novel word. In other words, the researcher establishes an initial word-to-world mapping with the initial labeling of the target object, and the participant is asked to extend the word to new instances. Researchers thus

investigate in the lab the constraints on these mapping processes hypothesized to exist in the 'real' world of acquiring words and knowledge.

Using a novel word extension paradigm, Markman and Hutchinson (1984) asked whether preschoolers could demonstrate knowledge of taxonomic kinds, moving beyond the thematic relations thought to dominate their early sorting and classification behaviors, and whether situating a task in the realm of word-learning would bring such competence to the fore. The authors reasoned that when children hear a new word, they make a "taxonomic assumption" about its meaning, and would extend the label to objects of the same *kind*. And they found that preschoolers who were given a novel label for a familiar kind—e.g., a cow labeled a 'dax' in puppet language—were more likely to chose the taxonomic alternative (e.g., a pig) than those participants who were not taught a novel label and were instead asked for another 'one'. Conversely, children who heard a novel label were less likely to make thematic choices (a pail of milk) than children in a no-word control condition. The presence of a label seemed to affect how preschool-aged children thought about what goes together.

Language appears to influence categorical reasoning from very early in life. At first, the child does not distinguish among types of words. Waxman and Booth (2003) found that for 11 month-old infants, participants hearing either a noun or an adjective were more likely to extract the commonality provided (either color or taxonomic kind) in an array of objects. By just a few months of age later, however, children are coming to a more differentiated set of expectations regarding words and the specific kinds of commonalities to which they refer.

Waxman and Lidz (2006) review evidence that by about 14 months of age, children demonstrate a specific noun-object category link, and that by about 21 months of age, children demonstrate a distinct adjective-property link (Waxman & Markow, 1998). There is also evidence that by about 18 months of age they seem to distinguish verbs from nouns (Echols and Marti, 2004). Thus, initially broad connections between words and commonalities among objects are honed into the kinds of specific connections between linguistic form classes and the relevant dimensions of the world they capture. The infant studies used preferential looking and related infant-research paradigms, but the abilities of children as young as 2 years to make use of formal cues in determining the extensions of novel words, and the conceptual apparatus apparently also engaged in such demonstrations, has been well established empirically. Preschool-aged children have been shown to be sensitive to the distinctions between and among count nouns, mass nouns, proper nouns, and adjectives (Gleitman et al., 1987; Hall, 1994; Hall et al., 1993, 2003; Soja et al., 1991; Waxman & Kosowski, 1991) when learning new words.

### *3.3 Linking Category and Property with Generic Expressions*

In the “cascading” developmental process of language development (Waxman, 2004), as rudimentary lexicons become more well established, might the connections between words and concepts include the fleshing out of kind concepts via generic language? If nouns serve as invitations to form object categories, then might generic language, for older children, be invitations to

associate properties with categories? Just as words serve to focus infants' attention toward commonalities among objects, and later specific form classes—noun or adjective, for instance—serve to differentially direct children's attention to the relevant, specific kinds of commonalities among objects, we might expect generic language to highlight properties that are relatively “essential” (Gelman, 2003) to membership in a kind.

In some ways, the novel word extension study can be considered an experimental re-creation of the “dubbing ceremony” (Putnam, 1975; Waxman, 1999). That children are willing to apply the label beyond the individual object named indicates that the mapping is not a word-object connection, but rather a word-*category* link (Waxman 1999), and therefore a window onto the dimensions along which learners' categories may be built. There is some controversy in this regard over how much more than perceptual processing we should attribute to the language-learner as she extends a novel word (see, for example, Gelman, 2004; Smith & Samuelson, 2006; Smith et al., 2003; Waxman & Booth, 2006).

A number of important studies have found that children, and in some cases adults, exhibit a “shape bias” in learning new words, picking out similarly shaped objects (e.g., choosing a ‘nail’ as a match to a target of a similarly shaped ‘carrot’) instead of category matches (e.g., choosing a ‘potato’) (Baldwin, 1992; Imai et al., 1994). Some theorists have posited that “dumb” attentional mechanisms can account for language acquisition (Smith et al., 1996; Smith et al., 2003). Similarity in shape is surely a factor in decisions about category membership, but in numerous instances its importance is overridden by other



considerations, including sharing a label in studies of inductive inference (e.g., Gelman & Coley, 1990), having the same function (e.g., Kemler Nelson et al., 2000), or having other critical similarities (e.g., Booth & Waxman, 2002; Diesendruck et al., 2003).

In the current study, I ask whether children can make use of generic language to highlight the centrality of a property to a category. Furthermore, the current study provides converging evidence concerning children's (and adults') capacity to distinguish the semantic implications of generic versus non-generic sentences.

### *3.4 The Current Study*

In Study 2, I ask whether predicating properties of a depicted object using generic language serves to highlight the importance of that property when making judgments of category identity. For each of a series of novel items, I present an item, label it, and describe 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.

In this way, my task is analogous to other investigations into the expectations children may demonstrate about the connections between language and categorization. Also, as in other such studies, the conceptual is pitted against the perceptual. Gelman and colleagues (e.g., Gelman & Coley, 1990) have conducted a number of experiments showing that when children are led via labeling to believe that two depicted animals are the same kind of thing (because they share a name) they overcome a baseline reliance on perceptual similarity cues when reasoning inductively about unseen properties. In the present study, I ask whether use of a generic expression permits children to extend a label to instances that are less similar overall to the initially named instance. Can generic language, potentially an important means for conveying information about kinds, also be the kind of clue regarding category membership that allows perceptual similarity to be overridden in name extension?

I 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, Mylander, & Gelman, 2005; Tardif & Gelman, 1998).

## *Methods*

### *Participants*

All participants were native speakers of English. There were 33 children, aged 4 years 8 months to 6 years 1 month, with a mean age of 5 years 2 months. Sixteen children were included in the control condition and 17 in the experimental condition. All child participants attended preschool centers affiliated with the same university from which adult participants were drawn. There were 36 adults, 12 in the control condition and 24 in the experimental 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.

### *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. Appendix D shows the item-sets. 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 two or three 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 types 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 B.

### *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 kevtā". 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 kevtā. This kevtā has two humps". 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 kevtā?"

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.

### *Predictions*

I hypothesized that children and adults would be more likely to choose the predicated-property match in the Generic condition than in the Non-Generic condition. I expected that the generic phrasing would be interpreted by participants as a reference to the *kind* this novel name picks out, and that the property therefore would be taken as more central to category identity than when it is presented in specific terms. I argue that associating a property with an object using generic sentences highlights the importance of that property to membership in the category.

It could be else-wise. For one, it could be that preschool-age children in particular are not sensitive to the subtle language differences between the generic and the non-generic wording conditions. It could be that they would

simply ignore the differences between the sentences “This plog is green” and “Plogs are green”. In this case, when faced with a forced-choice and all three options (the labeled-instance, the overall-similarity match, and the predicated-property match), they may be more likely to choose the picture that they decided most closely resembles the target instance, presumably the overall-similarity match. Or, also a possibility, they may be more likely to choose the property-match regardless of the wording-condition, because they heard in both cases the property ‘green’ associated with the novel name ‘plog’ and latched onto this property as a basis for making decisions about how to extend the novel word.

The control condition was included to help establish what baseline responding would be. I expected that in the control condition participants would be more likely to choose the overall-similarity match than in either of the experimental conditions (generic or non-generic wording). In other words, I expected that the control condition, in which the property shared by the labeled-instance and the predicated-property choice was not highlighted with language of any sort, would result in fewer predicated-property choices than in either of the experimental conditions.

### *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).

These scores were entered into a 2 (age: adult, child) X 2 (wording: generic, non-generic) X 2 (order: generic-first, nongeneric-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 X Wording interaction,  $F(1,37) = 8.22, p < .05$ .

In order to determine whether the condition effect held up within each age group separately, I also conducted separate 2 (wording: generic, non-generic) x 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 X 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 nongeneric-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*

I set out to ask whether adults and preschool-aged children distinguish between information provided about a category generically and specifically. I 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 indicated that this expectation was borne out. Analyses indicated that 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 age groups. 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 by means of language. 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, I 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 (Landau et al. 1998; Smith et al. 1996; Diesendruck & Bloom, 2003). 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 shape 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 pattern of choices (generic wording leading to increased

choosing 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 not be 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 sway. Indeed, Davidson and Gelman (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.

Whether these patterns reflect differences between adults' and children's interpretation of overall shape, of the similarity space created within a set of items which were drawn to be plausibly of the same kind, or variation in conceptions of perceptual similarities relevant to labeling specifically, is unclear,

and requires further exploration. Therefore, a follow-up study was conducted. This is presented in the next chapter, as Study 3.

## Chapter Four

### Study 3: Generic Language and Novel Word Extension—The Role of Shape

Reference to kinds of things, as opposed to individuals, is readily established via generic expressions. The sentence “Snakes have scales” seems a straightforward and natural way to speak about snakes as a kind of animal generally, as a category. This stands in contrast to the sentence “This snake has scales”, for example, which picks out a specific one. If, for example, each sentence was uttered in the presence of a single snake, real (and, presumably, a safe distance away) or depicted, would the hearer make different assumptions about the relationship between being a snake and having scales? Intuition tells us that if we are told about *snakes* as in the first case, with the bare plural noun phrase, we might expect the possession of scales to be relatively widespread among snakes. We might even decide that snakes *must* possess scales in order to be categorized as snakes and not some other, related creature. But upon

hearing the non-generic sentence, our judgments about the relevance of the property stipulated of the category in question might be different.

While the subtlety involved in distinguishing between generic and non-generic utterances necessitates consideration of a wide range of formal and pragmatic factors (Gelman & Raman, 2003; Gelman & Bloom, in press; Gelman, 2004), until recently we knew very little about how adults and, especially, children, interpret generic language at all. In the general introduction to this dissertation, I review a growing body of research on children's exposure to generic expressions in the speech of their caretakers (Gelman et al., 1998; Gelman & Tardif, 1998; Gelman et al., in press), and on their use of the forms in spontaneous speech (Goldin-Meadow et al., 2005; Gelman et al., in press). Further, I argue that generic language, as it entails reference to kinds of things, rather than individuals, represents an interesting nexus among related domains of inquiry.

Study 1 demonstrated that children are capable of interpreting generics as referring to a broad class of entities (i.e., more than "some"), but also permitting of exceptions (i.e., less than "all"), at least by 4 years of age.

Study 2 examined whether stipulating a property of an animal generically can modify children's judgments about category membership. In particular, in Study 2 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 3 follows up on this finding by providing a

more stringent test of the effect of wording. Specifically, in Study 3, 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., 1988; 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 2), 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 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. 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 had participated in the earlier studies.

### *Pre-test of Items*

Items from Study 2 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.

Sixteen children, aged 4 years 0 months to 4 years 11 months (mean age 4 years 6 months), participated in the pre-test. The pretesting 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 3 were modifications of those used in Study 2, 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 2. Item-sets appear in Appendix E.

### *Procedure*

All procedures for Study 3 were the same as for Study 2.

### *Predictions for Study 3*

I predicted that Study 3 would replicate the findings of Study 2. As in Study 2, I expected that participants would show a significantly higher rate of choosing the property-match on trials in which generic wording was used than on those in which non-generic wording was used. I also expected that the control condition, in which only labels and no further information were provided, would have a significantly lower rate of property-match responses than both the generic-wording and the nongeneric-wording conditions, and be significantly lower than would be expected by chance, indicating a baseline tendency to choose the shape-match.

### *Results*

As for Study 2, 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. These scores were

entered into a 2 (age: adult, child) X 2 (wording: generic, non-generic) X 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 X Wording interaction,  $F(1,42) = 35.22, p < .001$ , and a non-significant 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 X Order interaction in Study 2, 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) X 2 (wording: generic, non-generic) ANOVA, there was a significant effect of wording,  $F(1,42) = 34.97, p < .001$ , and a significant Age X 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 ( $M(\text{generic}) = 5.00, M(\text{non-generic}) = 1.25, p < .001$ ) and children ( $M(\text{generic}) = 3.87, M(\text{non-generic}) = 2.53, p < .05$ ).

Comparisons by t-test to chance levels (50%, or 2.5 out of 5) 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 ( $M = 4.75$  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.* Analysis of the children tested in the control condition shows that property-match responses were given significantly less often than would be expected by chance ( $M = 2.6$  out of 10,  $p < .001$ ). Indeed, the vast majority of the time (nearly 75% of the time), children select 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, children selected the predicated-property choice significantly more often in the generic condition than the control condition,  $t(44) = 6.07, p < .001$ . 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 is available (i.e., the control condition), children switched

to selecting the property-choice match more often in both the generic and non-generic conditions.

### *Item analyses*

As in Study 2, 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 property-match responding on the generic wording trials.

### *Discussion*

The current study replicates and extends Study 2. As in Study 2, in Study 3 I asked whether children and adults are sensitive to the subtle distinctions in the language (generic vs. non-generic) when providing property-relevant information. Specifically, I examined whether providing property-highlighting information about a novel animal, after first providing a novel label for it, would influence children's naming extensions. Study 2 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. The current study 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 3 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 2, in that children were now significantly more likely to choose the shape-match, 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 3 was that 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 nonetheless 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 verbally state (and therefore emphasize) the predicated property. Nonetheless, there may be a developmental change in the *non-generic* wording condition. We would expect adults to interpret the non-generic statements as implying *lack* of generality. For example, “This bant has stripes” should indicate that the property of stripedness is likely to be idiosyncratic and particular to this individual bant. In contrast, children seem not to understand that the non-generic statement implies

*less* generality than a neutral control condition. Perhaps this is a pragmatic implication that is too subtle for preschool-aged children. In the future, it would be intriguing to examine interpretation of this linguistic form more directly, from a developmental perspective.

In any case, one very interesting potential suggestion that emerges from this finding is that (as was also found in Study 1), developmental change may take place more in how children interpret *non*-generics than in how children interpret *generics*. Although speculative, this result may again 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 more linguistic experience to attain.



## Chapter Five

### Conclusion

Generic language is a topic of increasing interest to researchers in diverse fields (Gelman, 2003, 2004; Leslie, 2005; Prasada, 2006; Prasada et al., in press). As it stands at the intersection of core concerns for linguists, philosophers, cognitive scientists, and developmental psychologists, there is the potential for the kind of cross-fertilization of ideas that leads to novel approaches and increased insight into processes of interest to all. I aimed in the studies presented in this dissertation to advance our understanding of how generic language is comprehended, in tasks that touch on broad theoretical issues but which are grounded firmly in research in early cognitive development.

In this concluding chapter, I will summarize the findings of the three dissertation studies, and discuss in turn how the present results speak to the puzzle of generic language (including treatments of generics in linguistics), as well as the puzzle of generic knowledge. I will also address the limitations of the present studies and consider future directions.

### *Summary and Overview of Main Findings*

The current studies provide strong evidence that children appropriately distinguish generic forms from non-generic ones. In that regard, they stand with several recent studies (Gelman & Raman, 2003; Gelman & Bloom, in press), part of a new and growing body of research that addresses the crucial question theorists (Gelman, 2004; Leslie, 2005) are beginning to ask about generic language: how do children acquire a form that poses such a difficult problem of induction? In the present studies specifically, I compare children's and adults' comprehension of generic language to other importantly related forms, and thereby aim to address this acquisition dilemma.

In Study 1, I found that adults and 4-year-old children appropriately distinguish generic language from overt quantifiers ("all", "some") that are importantly related to generics in their implied scope. Four-year-olds and adults do not treat generics as equivalent to the universal quantifier 'all' in their replies to yes/no questions about properties of varying scope; thus, generics do not imply universal scope. Nor do children treat generics as equivalent to the indefinite set-theoretic term 'some'. The pattern of responses and of justifications for adults and 4-year-olds in Study 1 can be taken as indication that generic noun phrases are appreciated as *kind*-referring, and, importantly, not confounded with the set-theoretic terms 'all' and 'some'.

These findings are echoed in the results of an elicited production task reported along with Study 1 in Hollander et al. (2002). Study 2 of that paper found that children distinguished appropriately the implied scope of ‘all’, ‘some’ and generic phrasings when listing properties of familiar kinds. It would be interesting to conduct further work in this vein, to establish the course of development of abilities to distinguish generic expressions from other related forms, to get a fuller picture of the semantic landscape in this regard. Work such as the analysis of the spontaneous speech archived in the CHILDES database (MacWhinney & Snow, 1990) done by Gelman et al. (in press) provides persuasive evidence that even very young children (their database included children as young as 2 years) can use multiple forms to express generics.

Study 1 not only provides an interesting demonstration that by 4 years old children appreciate the distinctive semantic aspect of generics which makes them so hard for linguists to explain—broad scope but admitting of exceptions—but also suggests development in this regard. Three-year-old participants did *not* distinguish generic, “all”, and “some”, but rather seemed to treat all three forms (generic, “all”, and “some”) as generic. The data from the 3-year-olds looked very much like the response patterns from the older participants in the generic-wording conditions. In other words, the generic interpretation appeared to be relatively straightforward and transparent for the youngest participants, despite claims in the literature that generics should be difficult to acquire according to the traditional quantificational account of genericity. Simply put, generics seemed easier to learn and use than set-theoretic quantifier terms!

Nor is it the case that the quantifiers “all” and “some” were simply unfamiliar to the youngest children, as even 3-year-olds had little difficulty interpreting them appropriately when they were applied to concrete sets used in the post-test (e.g., indicating that when 3 out of 4 crayons are in the box, “some” are in the box, but not “all”). It was only when we asked children to apply these quantifiers abstractly to familiar categories that their interpretations fell apart.

The finding that 3-year-olds seemed to treat both quantified and generic expressions as generic, has implications for models of learning, which I will return to in a later section (“The puzzle of generic language”).

Studies 2 and 3 indicated that 4- to 5-year-old children and adults distinguished between generic and non-generic sentences in guiding their extension of novel labels for animals. As far as I know this is the first demonstration of the effect of generic language on word extension. Although there has been research into how specific and generic language are used in different contexts (e.g., Goldin-Meadow, et al., 2005; Gelman, Chesnick, & Waxman, 2005; Gelman & Pappas, 1998; Gelman & Tardif, 1998), and studies showing how adults and children differentiate generics from quantifier terms such as ‘all’ and ‘some’ in induction tasks (Gelman et al., 2002), such studies focused on children’s comprehension of familiar generics for familiar categories. The present Studies 2 and 3 were notable for examining how preschool children interpret generics for novel categories, and make use of generic expressions in the service of word learning.

Studies 2 and 3 indicate that children can make use of 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 et al., 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-nongeneric distinction. Whereas the semantic distinction 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.

As in Study 1, however, there is clearly some development occurring. Although the effect of generic wording holds in both Studies 2 and 3, for both adults and children, the effect is notably 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 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). Once again, 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 2 and 3—“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 2, they extended the labeled property significantly *below* chance in Study 3 (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.

Another finding of interest in Studies 2 and 3 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.

Despite these differences in performance between adults and children, Studies 2 and 3 show that preschool-aged children do distinguish generic from specific language as sources of information about how to extend a novel label, and therefore adds to the growing body of evidence about children's abilities to analyze and understand generic utterances. Gelman and Raman (2003) likewise show that children as young as 2-1/2 years old can appropriately read generic and specific meaning in sentences that vary only slightly (e.g., "What color are dogs?" versus "What color are the dogs?"). They find that formal cues like the presence (versus absence) of the determiner "the" can be used by children as young as 2-1/2 years of age, and that children as young as 3 years can exploit pragmatic cues relevant to the resolution of anaphoric reference. The current studies similarly suggest that children comprehend the bare plural noun phrase in the generic-wording trials as establishing a generic-meaning—i.e., that it implies the predicated property is relatively central to category identity. This is just what we would want to have demonstrated if we want to theorize about a possible role for generic language in the acquisition of generic knowledge, a point to which I will return.

*The Puzzle of Generic Language*

Generic language poses a puzzle in two distinct yet related ways. First, and most directly for our purposes, it poses a puzzle to young children as they attempt to figure out the devices available in English for expressing generics. As noted earlier, although all of language development poses such a problem of induction, the issue is particularly severe in the case of generics, because the referents are not directly available in the environment, and the formal means of expression are varied and lack one-to-one correspondence with meaning. For example, bare plural noun phrases are used both for generics (“Tigers are striped”) and indefinite expressions (“Tigers escaped from the zoo”).

The second puzzle posed by generic language concerns linguistic theory. Although generic language has been a topic of debate among linguists and philosophers for some time, there has been a recent spate of challenges to the traditionally accepted accounts (Leslie, 2005; Prasada, in press; Prasada & Dillingham, 2006). Indeed, as I touch on in Chapter 1, genericity as a phenomenon has been problematic for ‘precise semantic frameworks’ (Krifka et al., 1995), in particular because generic sentences are deemed generally true while admitting of exceptions.

Krifka et al. (1995) describe the dominant approach, in which genericity is treated within the confines of a traditional linguistic treatment of extension and quantification, and with the formalism based on considerations of English in particular. Heim (1982) extends Lewis’s work (1975) on adverbial quantification to account for generics, proposing that a sentence such as “Tigers have stripes” be thought of as a special case of adverbial quantification, with an operator



analogous to other quantifier terms. This unarticulated operator—“Gen”—comes to bear just in case there are unbound variables and no explicit adverbs of quantification. Thus, it can be thought of as a sort of null operator, represented logically as a variant on the workings of other quantificational adverbs, such as “mostly” or “usually”. But consideration of words such as “generally,” “typically,” and “usually” shows that although they might be acceptable glosses for some generic sentences (e.g., “Tigers typically have stripes”), they do not work very well for others. For example, “Ticks carry Lyme Disease” seems true, whereas “Usually, ticks carry Lyme Disease” does not (Leslie, 2005).

Leslie reviews alternate analyses of generic expressions, and finds them lacking (Carlson, 1977; Carlson & Pelletier, 1995; Cohen, 1996; Pelletier & Asher, 1997). She considers in turn proposals wherein generics are counted as a restricted universal quantifier meaning something like “all normal” (Asher & Morreau, 1995), analyses which add domain restrictions to such ‘modal’ accounts (Pelletier & Asher, 1997), and theories that do not entail a modal treatment of generics but that do depend on domain restrictions and partitioning (Cohen, 1996). Although she credits some frameworks with greater success than others, she argues that none can properly account for what she terms “troublesome generics”, e.g. “Mosquitoes carry West Nile virus.”

Leslie argues for a re-consideration of existing approaches to capturing the linguistic and truth-value attributes of generic sentences, and suggests that evidence about how generics are produced and comprehended in the course of development might be critically important to that enterprise. In that vein, if we

accept the characterization of the generic as a null operator, coming to bear only in the absence of articulated quantifiers, it would seem a particularly difficult form to acquire. How might a child come to understand a form whose semantics keep linguists and philosophers busy and which has no phonological correlate to boot?

The data from the current experiments speak to both inductive problems. First, that generics are readily interpreted at preschool age suggests that the learning problem is such that children have no difficulty accessing generic concepts during language acquisition. It does not seem to be the case, for example, that children are limited to concrete reference in the preschool years, as suggested by some scholars (Sloutsky, Kloos & Fisher, 2007).

Second, the patterns of results suggest that generics may in fact be a default interpretation for young children. Recall that in Study 1, 3-year-olds' responses showed significant differences as a function of the property type (e.g., "fires are hot" was treated as broader in scope than "flowers are yellow"), but *not* as a function of the noun-phrase wording condition (e.g., "all flowers are yellow", "some flowers are yellow", and "flowers are yellow" were all treated as equivalent). I argue that these findings are problematic for any semantic analysis of generics as a special case of quantifier term requiring some kind of calculation or mental summary over tokens to get at meaning from a generic sentence.

Similarly, in Studies 2 and 3, the developmental changes between children and adults appeared to be in the interpretation of *non-generic* utterances rather than in the interpretation of generic utterances. Again this suggests that generics

are rather straightforward and transparent to acquire, in distinction from non-generics. Similarly, Gelman et al. (in press) provides evidence that from children's initial uses of generics (at about age 2-1/2 years), they use multiple forms to express them (including bare plural, indefinite singular, and mass nouns). They argue that it would be exceedingly difficult for children to learn how to express generics as they do by some process of mapping the multiple language forms onto generic concepts, and suggest instead that generics count as the default interpretation for noun phrases. In acquisition, then, children must learn the various ways that *specific* reference is expressed.

### *The Puzzle of Generic Knowledge*

I outlined in Chapter 1 how generic language presents not only 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., in press; Gelman & Tardif, 1998; Goldin-Meadow et al. 2005). The current studies can be seen as speaking to these concerns about the development and accessing of knowledge about kinds of things, in commonsense conception.

In Study 1 we assessed generic knowledge, knowledge our participants had about familiar kinds of things: fires and elephants and frogs and girls and garages and milk. It can be argued that the pattern of participants' replies tells us something about how they access and reason about kinds. Four-year-olds

are very much like adults in this regard. They can access their real-world knowledge about dogs in response to queries made with set-theoretic quantifiers *and* with generics, and interpret appropriately the scope of the question, as it combines with the scope of the property relative to the category of which it is predicated. As noted earlier, 3-year-olds succeed only when the wording is generic. This intriguing finding can be taken as relevant to categories themselves perhaps, to the way in which we think of concepts. One interesting difference between Study 1 and the traditional truth-value judgment task, sometimes conducted as thought exercise and sometimes systematically evaluated (Prasada & Dillingham, 2006), is that I made use of questions rather than declarative sentences. It is interesting to speculate that sentences such as “Girls have curly hair” might be judged as ‘false’, whereas the sentence “Do girls have curly hair?” was often endorsed with a ‘yes’, albeit possibly with an accompanying qualification.

Most relevant to the question of generic knowledge are Studies 2 and 3, where we manipulated the information provided to children about kinds, using generic or nongeneric language. As we found, generic wording increases children’s tendency to link a property to a kind. This result shows that the generic-nongeneric distinction has important conceptual implications as children build knowledge and theories 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 kinds 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, Studies 2 and 3 constitute a demonstration 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, Studies 2 and 3 also indicate that generic language can serve to stipulate kind-relevant properties. Importantly, generically phrased property predication was shown to 'trump' the cue to kind-status typically evidenced by shared shape (Bloom, 2000; Smith et al., 2006). Thus, adults and children in these studies seemed to appreciate that generics are importantly 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; Prasada, in press).

Of course one issue that demands further investigation is whether kinds are equivalent in their accessibility to young children. Studies 2 and 3 included only animals, and it may be that certain categories are more likely to foster the

sort of extension-from-the-individual-instance as we have seen here (with animals being a particularly good example). In this regard, we must consider the potential importance of content domains (e.g., living kinds, social kinds, artifacts) to determining what counts as a kind, expressible via generic language.

Characterizing knowledge as being organized into domains has been a fruitful approach to questions about the nature of early concepts and their development (Gelman & Hirschfeld, 1999; Wellman & Gelman, 1998). Insofar as the current studies are concerned with the connections between properties and categories, we can consider the important issue of what sorts of properties can be thought of as relatively 'essential' to kind-identity.

Relatedly, another important issue concerns property type. Although we included both physical attributes ("Do elephants have trunks?") and actions ("Do animals eat?") in Study 1, most of the questions were about parts or attributes rather than behaviors. It would have been interesting to be able to compare these, especially as broken down by category type, particularly because the elicited production task also reported in Hollander et al. (2002) shows interesting distinctions. In the content analysis for that task, actions appeared relatively more often in response to generic language questions and physical properties appeared relatively less often in response to generic prompts.

### *Limitations and Further Directions*

As with any investigation, this research leaves certain issues unresolved and raises questions for the future. I mention some of the more central issues in this final section.

The above consideration of domains of thought brings up one important limitation of the current study: the current studies did not permit an analysis of responses as a function of category (e.g., animals, artifacts). Specifically, although Study 1 included items from a range of domains, domains were not systematically varied within conditions. Furthermore, I included only animals as stimulus categories in Studies 2 and 3. Therefore, the studies do not permit an analysis of responses by domain.

The extent to which this limits the conclusions from the current studies is unclear. One possibility is that domain may yield no effects on these results. For one thing, there are no semantic restrictions on which domains can be expressed with generics, so that generics are readily expressible for both animals and artifact categories, for example (“Tigers have stripes”; “Pencils are skinny”). Furthermore, Prasada and Dillingham (2006) found no differences between animals and artifacts in their studies of adults’ interpretation of generic sentences.

Nonetheless, there is also reason to believe that domain may play an important role in the development or expression of generic language. As repeatedly noted, generics express kind concepts, and there is a vast literature suggesting that kind concepts differ as a function of domain (Hirschfeld & Gelman, 1994; Keil, 1991; Wellman & Gelman, 1998). Indeed, we chose animal categories in these studies precisely because prior research indicated that generic language is used more often in talk about animals (Gelman et al., 1998;

Gelman et al., in press) and we wanted to examine generic language in a domain to which it seems most naturally connected.

Two issues are relevant to the limitations imposed by this choice. First, the use of animals may 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). Second, the question of how generic language relates to generic knowledge could have been addressed in ways relevant to important open questions if we had been able to compare animal and artifact kinds. Would generic language have the same effect on word extensions for novel animals and novel artifacts? Would children's grasp of the pragmatics of the situation been different if we hadn't given them the potentially more complex task of judging the category membership of animals?

A further limitation of the current work concerns the nature of the predicates used in all three studies. As touched on earlier, we did not systematically vary the content of the properties that were included. In Study 1, the properties ranged broadly, including behaviors, perceptual properties, parts, functions, etc. In Studies 2 and 3, 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, Study 2 in 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 queried (as in Study 1) or taught (as in Studies 2 and 3), 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 indirect insight into the nature of young children's conceptual representations.

A final limitation concerning the properties and categories employed in these studies is that we did not predetermine how familiar both the categories (e.g., fires, girls) and the properties (e.g., “are hot”, “have curly hair”) would be to our youngest participants in particular. Perhaps three-year-olds' misunderstanding of the quantifier terms we examine would be affected by how familiar they were with the categories and properties presented. However, we do not believe that this is a serious problem, because (as noted earlier), 3-year-olds in Study 1 were in fact highly sensitive to the scope of the properties provided (judging “fires are hot” as more generalizable than “girls have curly hair”, for

example), thereby demonstrating that they were sufficiently familiar with these category-property pairings, for the purposes of this task.

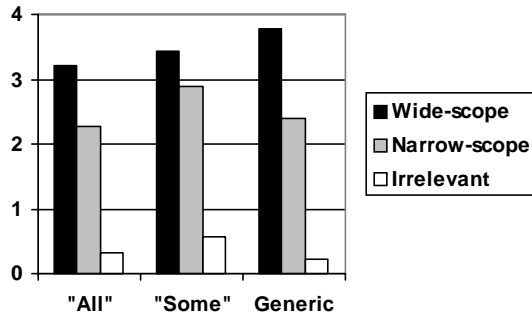
I end with one further, very speculative point about the relationship between generic knowledge and generic language. Although models of how the two are connected vis-a-vis conceptual structure and knowledge organization are being developed (Prasada, in press; Prasada, Salajegheh, Bowles, & Poeppel, in press), and it is beyond the scope of this dissertation to address them, I am mindful that questions about domains of knowledge, the ways in which individual kind concepts are initially acquired, fleshed out, and accessed, and how language affects and is affected by knowledge about kinds of things can be productively examined through the lens of studying generics.

In sum, the current studies indicate that generic language is understood to be genuinely kind-referring by preschool-aged children, and that generic language is understood to link property to category in kind-relevant ways. The current work therefore sets forward as procedurally valid, as it were, all sorts of further explorations into relevant kind-related knowledge acquisition processes.

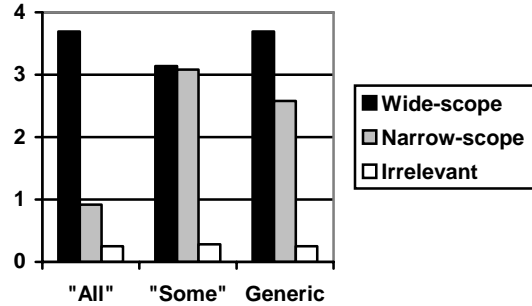
Figure 2.1 Study 1 Results: Mean number of “yes” responses (out of 4 possible).

Top: results for 3-year-olds ( $N = 18$ ). These scores were doubled to be on the same scale as those of the 4-year-olds and adults. Middle: results for 4-year-olds ( $N = 18$ ). Bottom: results for adults ( $N = 38$ ).

(A) 3-year-olds ( $N=18$ ). Note: These scores were doubled to be on the same scale as those of the 4-year-olds and adults.



(B) 4-year-olds ( $N=18$ )



(C) Adults ( $N=38$ )

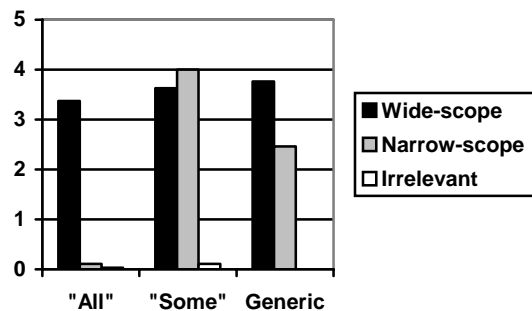
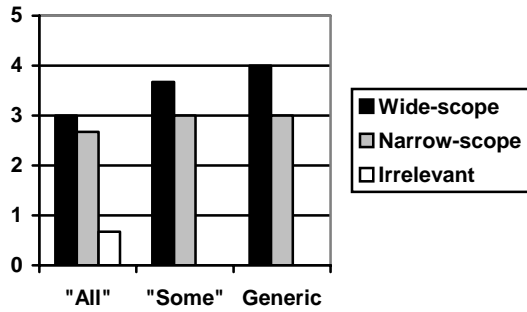
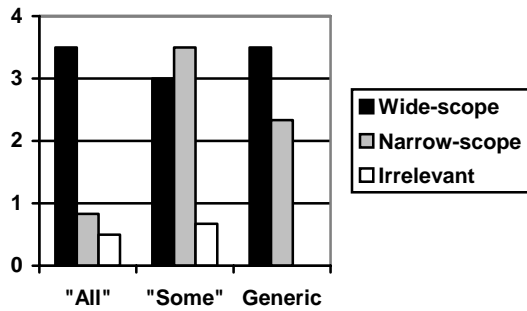


Figure 2.2 Reanalysis of Study 1 results, including only the first block of trials. Dependent measure is the mean # “yes” responses, out of 4 possible.

(A) 3-year-olds ( $N=18$ ). Note: These scores were doubled to be on the same scale as those of the 4-year-olds and adults.



(B) 4-year-olds ( $N=18$ )



(C) Adults ( $N=38$ )

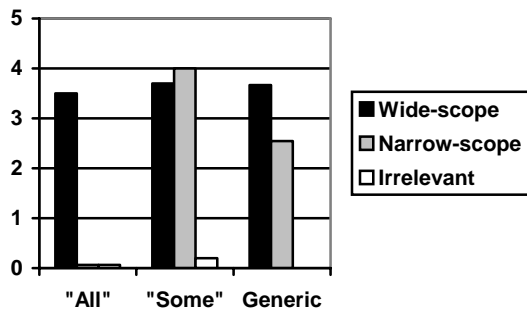


Table 2.1 Study 1, mean number of qualifications using “some” or “all” (out of 12 possible).

	3 years [a]	4 years	Adults
“Some” qualifications			
“All” questions	1.11	0.83	0.11
Generic questions	0.78	1.56	1.71
	n.s.	+	**
“All” qualifications			
“Some” questions	0.00	1.61	0.37
Generic questions	0.00	0.33	0.00
	n.s.	**	*

[a] These scores were doubled to be on the same scale as those of the 4-year-olds and adults.

+ significant difference between question type,  $p < .05$ , one-tailed

\* significant difference between question type,  $p < .05$

\*\* significant difference between question type,  $p < .01$

Table 2.2 Study 1, individual response patterns. Scores indicate the percentage of participants in each age group adhering to one of three response patterns or falling within no consistent response pattern (other). The numbers of participants are provided in parentheses.

	<u>3 years</u>	<u>4 years</u>	<u>Adults</u>
Generic = intermediate	6% (1)	56% (10)	68% (26)
Generic = some	17% (3)	17% (3)	24% (9)
Generic = all	11% (2)	6% (1)	8% (3)
Other	67% (12)	22% (4)	0% (0)

Table 3.1 Study 2, Mean number of trials (out of 6) on which the predicated-property choice is selected, as a function of age group.

	<b>Generic</b>	<b>Non-Generic</b>	<b>Control</b>
<b><u>Adults</u></b>			
Overall Mean	5.50 *	2.29	1.00 ^
Generic First	5.50 *	2.58	--
Non-Generic First	5.50 *	2.00	--
<b><u>Children</u></b>			
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 4.1 Study 3, Mean number of trials (out of 5) on which the predicated-property choice is selected, as a function of age group.

	<b>Generic</b>	<b>Non-Generic</b>	<b>Control</b>
<b><u>Adults</u></b>			
Overall Mean	4.75**	0.94^	--
Generic First	5.00	0.63	--
Non-Generic First	4.50	1.25	--
<b><u>Children</u></b>			
Overall Mean	3.70**	3.13*	1.31^
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),  $p < .001$

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



Appendix A Study 1 items (listed here in generic form only). All items were presented to 4-year-olds and adults. Those that are starred (\*) were presented to 3-year-olds.

Wide-scope questions:

- \* Do animals eat?
- \* Do elephants have trunks?
- \* Are fires hot?
- \* Do frogs have eyes?
- \* Do ice creams melt in the sun?
- \* Do refrigerators have doors?
- Do alligators have mouths?
- Is candy sweet?
- Do cars have engines?
- Do giraffes have long necks?
- Do hammers have handles?
- Do plants grow?

Narrow-scope questions

- \* Do bears have white fur?
- \* Do books have color pictures?
- \* Do clothes have zippers?
- \* Do dogs have brown spots?
- \* Do girls have curly hair?
- \* Do shirts have stripes?
- Do birds live in cages?
- Do dresses have pockets?
- Are flowers yellow?
- Does milk have chocolate in it?
- Do people have blonde hair?
- Are tools made of wood?

Irrelevant questions:

- \* Are children made of feathers?
- \* Do fish have branches?
- \* Do fruits have gas tanks?
- \* Do garages sing?
- \* Do magazines blow bubbles?
- \* Do monkeys have beaks?
- Do couches have windows?
- Do pencils have noses?
- Do penguins have telephones?
- Do pigs fly?
- Do saws have toothaches?
- Do zebras wear watches?

Appendix B Study 2 Items. Trials shown as divided into A- and B- groups and assigned to generic- and non-generic wording blocks.

### A-group

1. This is a **TEPIN**. Let me tell you something about this tepin. This tepin has whiskers.
2. This is a **FEBBIT**. Let me tell you something about this febbit. This febbit is spiky.
3. This is a **BLEEN**. Let me tell you something about this bleen. This bleen has a long neck.
4. This is a **BANT**. Let me tell you something about this bant. This bant has stripes.
5. This is a **DORN**. Let me tell you something about this dorn. This dorn has two humps.
6. This is a **VORZYD**. Let me tell you something about this vorzyd. This vorzyd is red.

### B-group

1. This is a **FEP**. Let me tell you something about feps. Feps are spotted.
2. This is a **PLOG**. Let me tell you something about plogs. Plogs are green.
3. This is a **BACTRA**. Let me tell you something about bactras. Bactras have three legs.
4. This is a **YANCI**. Let me tell you something about yancis. Yancis have a crest.
5. This is a **SCRED**. Let me tell you something about screcs. Screcs have a long tail.
6. This is a **KEVTA**. Let me tell you something about kevtas. Kevtas are wooly.

Appendix C Study 3 Items. Trials shown as divided into A- and B- groups and assigned to generic- and non-generic wording blocks.

A-group

1. This is a **TEPIN**. Let me tell you something about this tepin. This tepin has big ears.
2. This is a **FEBBIT**. Let me tell you something about this febbit. This febbit is spiky.
3. This is a **BANT**. Let me tell you something about this bant. This bant has stripes.
4. This is a **DORN**. Let me tell you something about this dorn. This dorn has long hair.
5. This is a **VORZYD**. Let me tell you something about this vorzyd. This vorzyd is red.

B-group

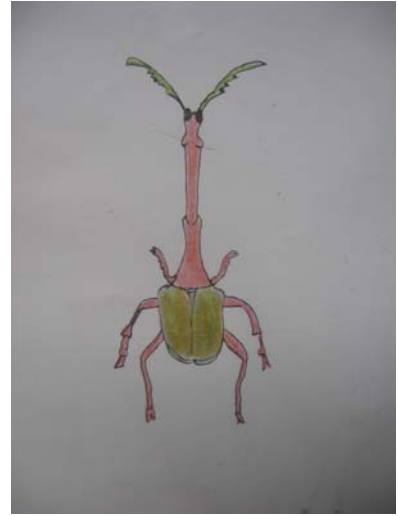
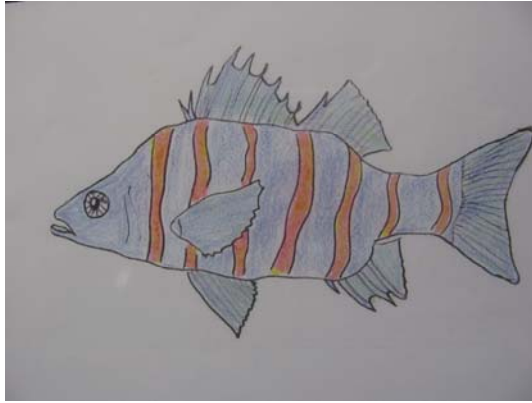
1. This is a **FEP**. Let me tell you something about feps. Feps are spotted.
2. This is a **PLOG**. Let me tell you something about plogs. Plogs are green.
3. This is a **YANCI**. Let me tell you something about yancis. Yancis have stars.
4. This is a **BACTRA**. Let me tell you something about bactras. Bactras have three legs.
5. This is a **KEVTA**. Let me tell you something about kevtas. Kevtas are wooly.

Appendix D Study 2 Item Sets, Group A

**Bant**

**Bleen**

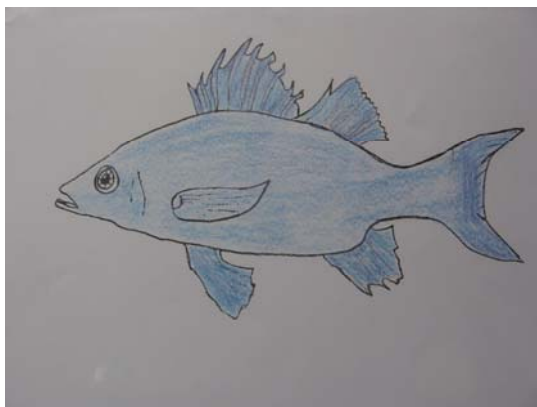
*Labeled*



*Property*



*Similarity*

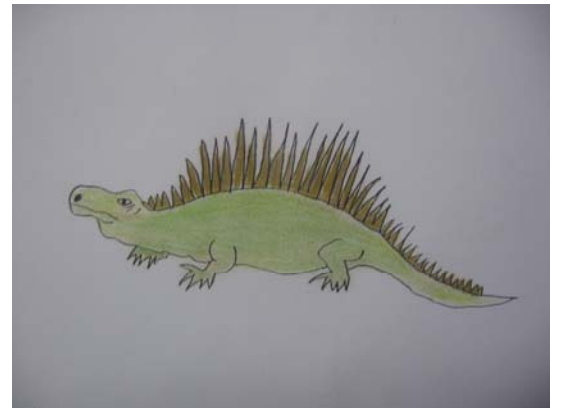


Appendix D Study 2 Item Sets, Group A, Continued

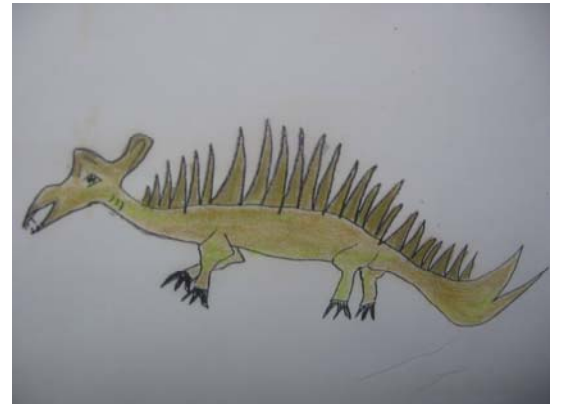
**Dorn**

**Febbit**

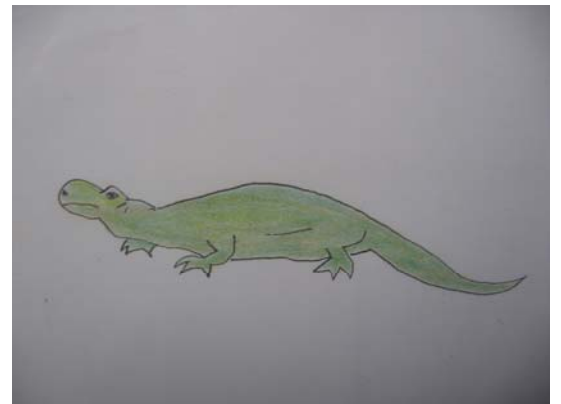
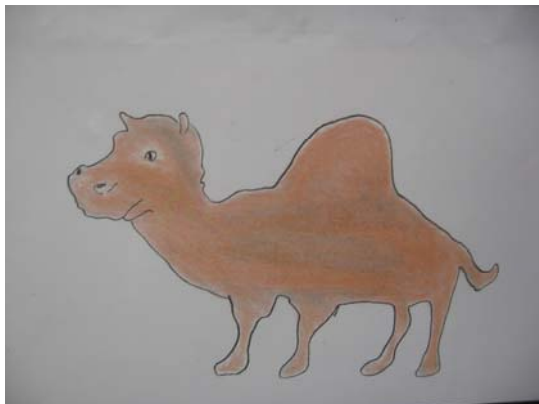
*Labeled*



*Property*



*Similarity*



Appendix D Study 2 Item Sets, Group A, Continued

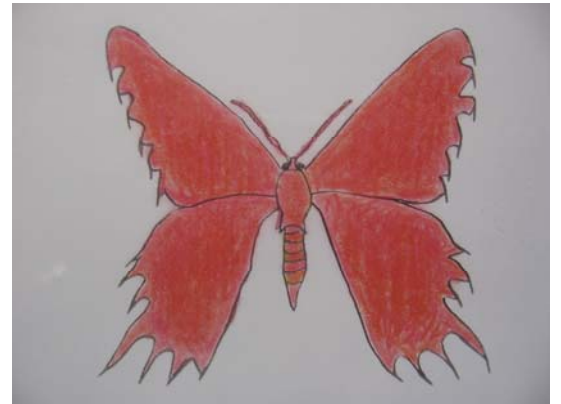
**Tepin**

**Vorzyd**

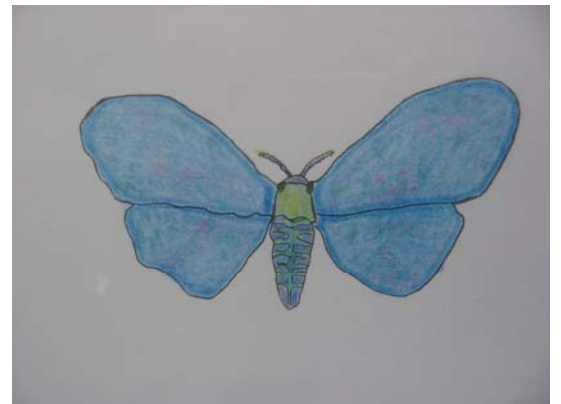
*Labeled*



*Property*



*Similarity*

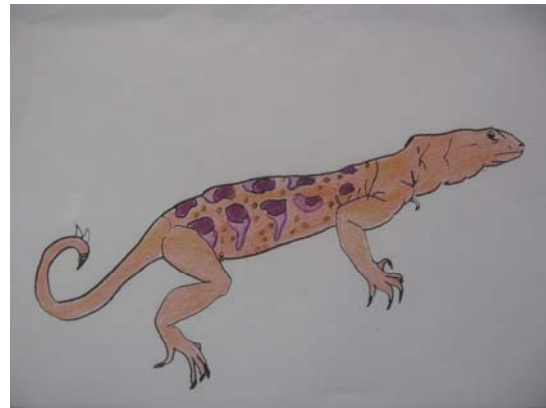


Appendix D Study 2 Item Sets, Group B

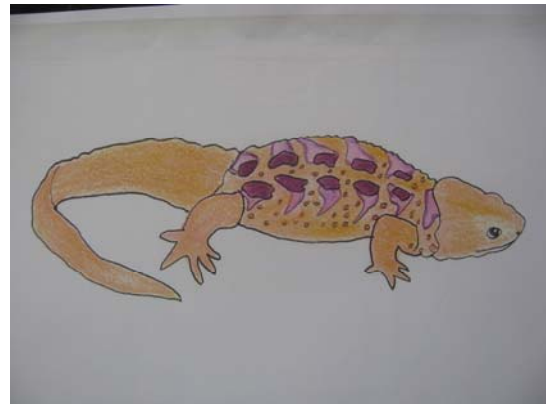
**Bactra**

**Fep**

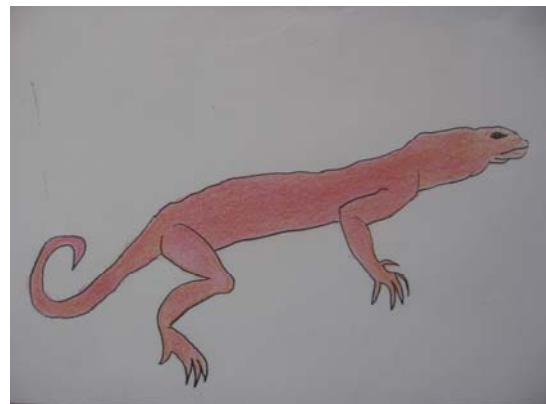
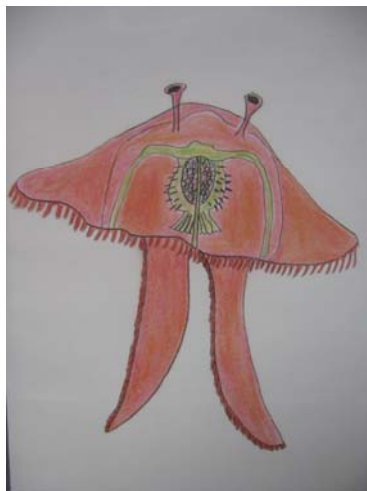
*Labeled*



*Property*



*Similarity*

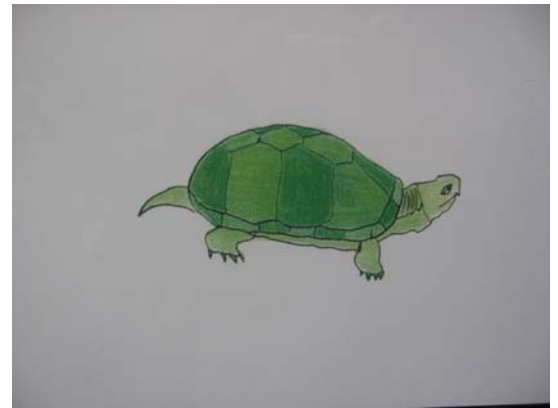


Appendix D Study 2 Item Sets, Group B, Continued

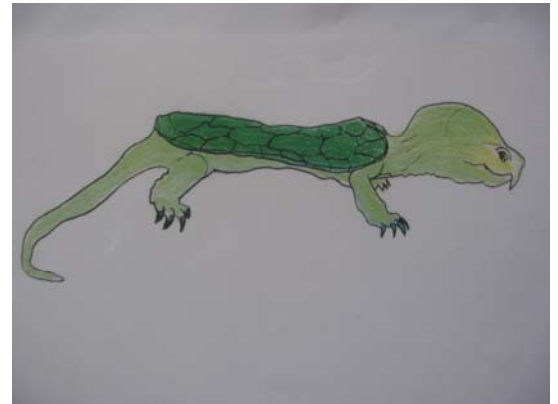
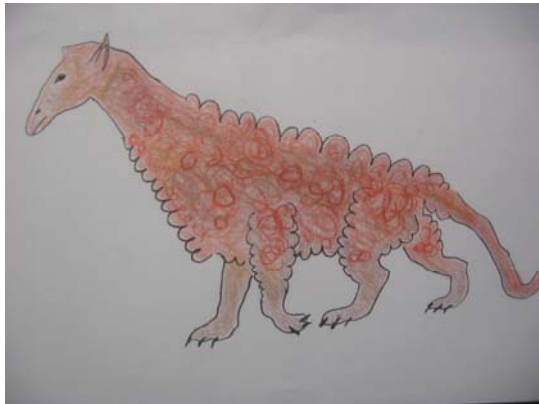
**Kevta**

**Plog**

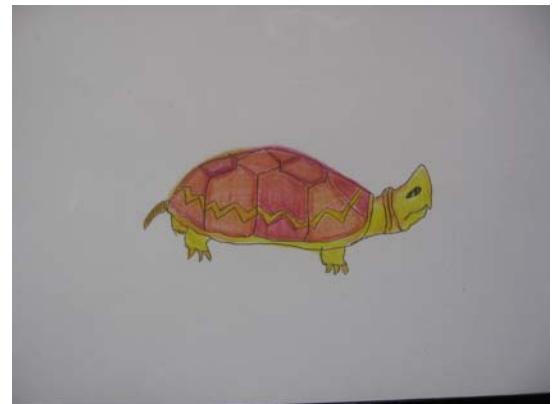
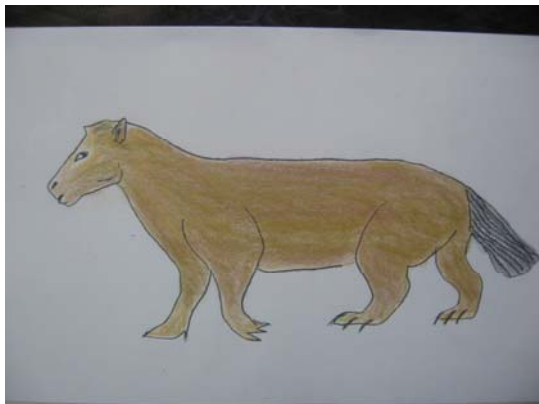
*Labeled*



*Property*



*Similarity*





Appendix D Study 2 Item Sets, Group B, Continued

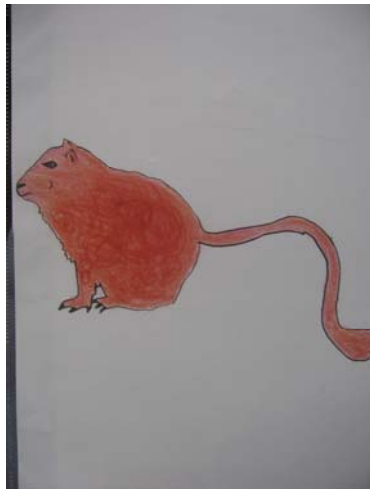
**Scred**

**Yanci**

*Labeled*



*Property*



*Similarity*



Appendix E Study 3 Item Sets

**Bactra**

**Dorn**

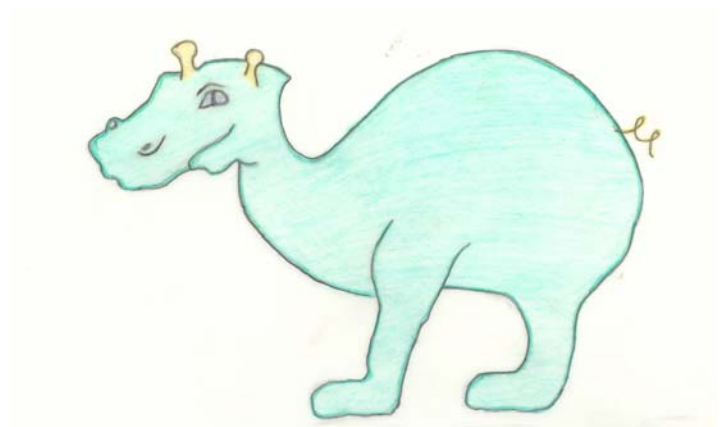
*Labeled*



*Property*



*Shape*

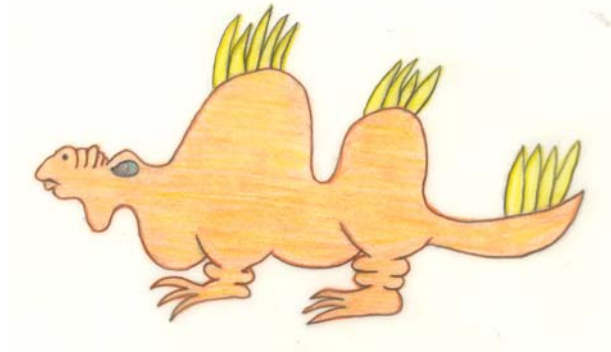


Appendix E Study 3 Item Sets, Continued

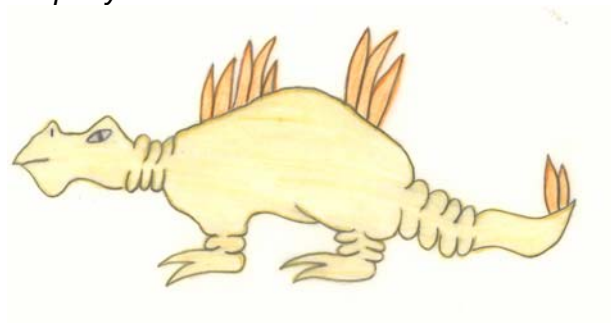
**Febbit**

**Fep**

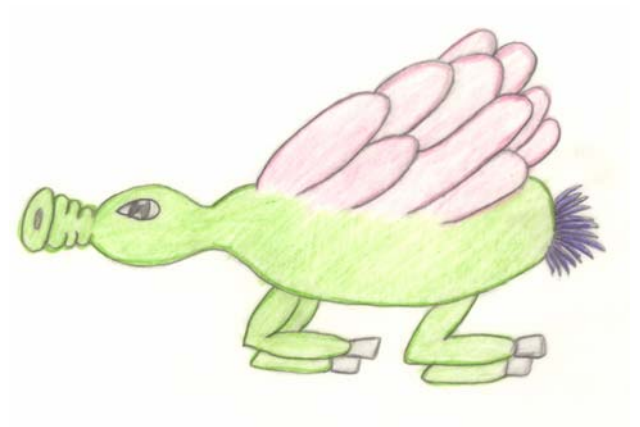
*Labeled*



*Property*



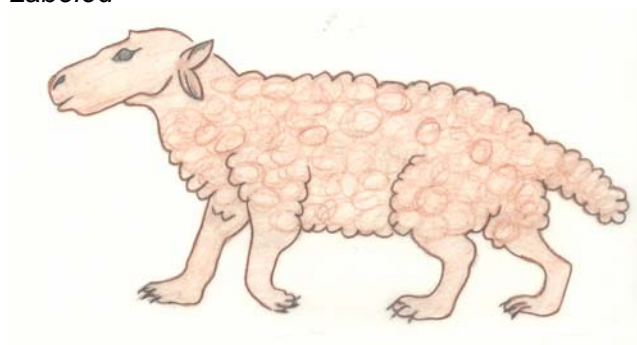
*Shape*



Appendix E Study 3 Item Sets, Continued

**Kevta**

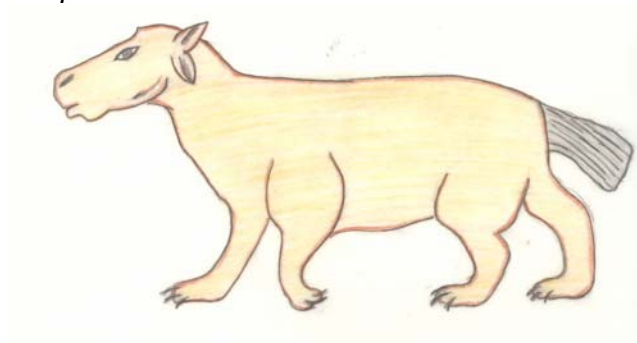
*Labeled*



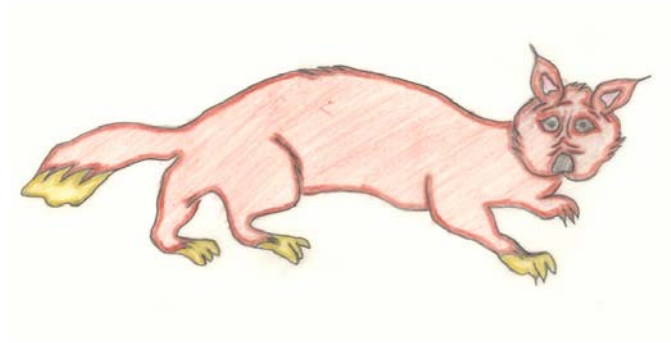
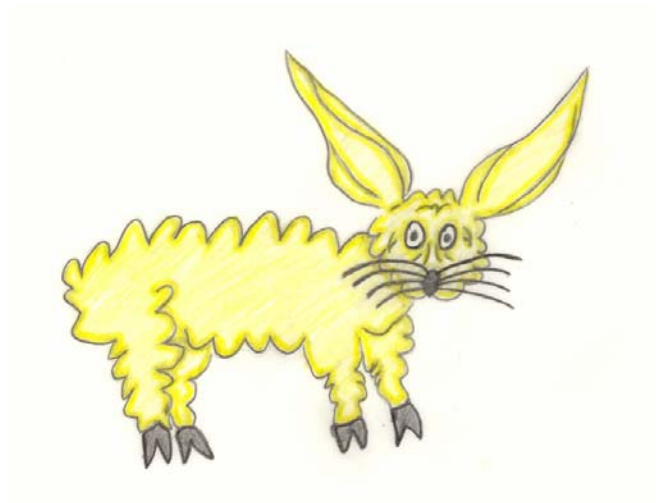
*Property*



*Shape*



**Tepin**



## References

Abecassis, M., Sera, M. D., Yonas, A, & Schwade, J. (2001). What's in a shape? Children represent shape variability differently than adults when naming objects. *Journal of Experimental Child Psychology, 78*, 213-239.

Anglin, J. M. (1977). *Word, object, and conceptual development*. New York: Norton.

Balaban, Marie T., & Waxman, Sandra R. (1997). Do word labels facilitate object categorization in 9-month-old infants? *Journal of Experimental Child Psychology, 64*, 3-26.

Baldwin, D.A. (1992). Clarifying the role of shape in children's taxonomic assumption. *Journal of Experimental Psychology, 54*, 392–416.

Barsalou, L. W. (1985). Ideals, central tendency, and frequency of instantiation as determinants of graded structure in categories. *Journal of Experimental Psychology: Learning, Memory and Cognition, 11*, 629-654.

Bartsch, K., & Wellman, H. M. (1995). *Children talk about the mind*. New York: Oxford University Press.

Bloom, P. (2000). *How Children Learn the Meanings of Words*. Cambridge, MA: MIT Press.

Bloom, P. (2001), Controversies in the study of word learning. *Behavioral and Brain Sciences, 24*, 1124-1134.

Bloom, P., & Markson, L. (2000). Are there principles that apply only to the acquisition of words? A reply to Waxman and Booth. *Cognition, 78*, 89–90.

Booth, A. E., & Waxman, S. R. (2006). De´ja` vu all over again: Revisiting the conceptual status of early word learning: Comment on Smith and Samuelson (2006). *Developmental Psychology, 42*, 1344–1346

Brown, R. (1958). *Words and Things*. New York: Free Press.

Brown, R. (1973). *A first language: The early stages*. Cambridge, MA: Harvard University Press.

Carlson, G. N., & Pelletier, F. J. (Eds.) (1995). *The generic book*. Chicago: University of Chicago Press.

Carlson, G. N. (1977). A unified analysis of the English bare plural. *Linguistics and Philosophy, 1*, 413-456.

Chierchia, G. (1998) Reference to kinds across language. *Natural Language Semantics, 6*, 339-405.

Cohen, A. (2004). Generics and mental representation. *Linguistics and Philosophy, 27*, 529-556.

Dahl, O. (1995). The marking of the episodic/generic distinction in tense-aspect systems. *The generic book*. Chicago: University of Chicago Press.

Davidson, N. S., & Gelman, S. A. (1990). Inductions from novel categories: The role of language and conceptual structure. *Cognitive Development, 5*, 151-176.

Diesendruck, G., & Bloom, P. (2003). How specific is the shape bias? *Child Development, 74*, 168–178.

Diesendruck, G., Markson, L., & Bloom, P. (2003). Children’s reliance on creator’s intent when naming artifacts. *Psychological Science, 14*, 164–168.

Echols, C., & Marti, C. N. (2004). The identification of words and their meaning: From perceptual biases to language-specific cues. In D. G. Hall & S. R. Waxman (Eds.), *Weaving a lexicon*. Cambridge: MIT Press.

Gelman, S. A. (2004). Learning words for kinds: Generic noun phrases in acquisition. In D. G. Hall & S. R. Waxman (Eds.), *Weaving a lexicon*. Cambridge, MA: MIT Press.

Gelman, S. A. (2003) *The Essential child: Origins of essentialism in everyday thought*. London: Oxford University Press.

Gelman, S. A., Chesnick, R. J., & Waxman, S. R. (2005). Mother-Child conversations about pictures and objects: Referring to categories and individuals. *Child Development, 76, 6*, 1129-1143.

Gelman, S. A., & Coley, J.D. (1990). The importance of knowing a dodo is a bird: Categories and inferences in two-year-old children. *Developmental Psychology, 26*, 796-804.

Gelman, S. A., Coley, J. D., Rosengren, K., Hartman, E., & Pappas, T. (1998). Beyond labeling: The role of maternal input in the acquisition of richly-structured categories. *Monographs of the Society for Research in Child Development. Serial No. 253, Vol. 63, No. 1*.

Gelman, S. A., Goetz, P., Sarnecka, B., & Flukes, J. (in press). *Language Learning and Development*.

Gelman, S. A. & Hirschfeld, L. A (1999). . How biological is essentialism?. In: D.L. Medin and S. Atran, Editors, *Folkbiology*, MIT Press, p. 403–446.

Gelman, S. A., Hollander, M., Star, J., & Heyman, G. D. (2000). The role of language in the construction of kinds. In D. Medin (Ed.), *Psychology of learning and motivation, Vol. 39* (pp. 201-263). New York: Academic Press.

Gelman, S. A., & Markman, E. M. (1986). Categories and induction in young children. *Cognition, 23*, 183-209.

Gelman, S. A., & Raman, L. (2003). Preschool children use linguistic form class and pragmatic cues to interpret generics. *Child Development, 74*, 308–325.

Gelman, S. A., Star, J., & Flukes, J. (2002). Children's use of generics in inductive inferences. *Journal of Cognition and Development, 3*, 179–199.

Gelman, S.A., & Taylor, M. (1984). How two-year-old children interpret proper and common nouns for unfamiliar objects. *Child Development, 55*, 1535–1540.

Gelman, S. A., & Tardif, T. Z. (1998). Generic noun phrases in English and Mandarin: An examination of child-directed speech. *Cognition, 66*, 215-248.

Gelman, S. A., & Wellman, H. M. (1991). Insides and essences: Early understandings of the nonobvious. *Cognition, 38*, 213–244.

Gleitman, L. (1990). The structural sources of verb meanings. *Language Acquisition: A Journal of Developmental Linguistics, 1(1)*, 3-55.

Goldin-Meadow, S., Gelman, S. A., & Mylander, C. (2005), Expressing generic concepts with and without a language model. *Cognition, 96*, 109-126.

Hall, D.G., & Waxman, S. R. (1993). Assumptions about word meanings: Individuation and basic-level kinds. *Child Development, 64*, 1550–1570.



Hall, D.G., Waxman, S. R., & Hurwitz, W. R. (1993). The development of sensitivity to syntactic cues: Evidence from preschoolers learning property terms for familiar and unfamiliar objects. *Child Development, 64*, 1651–1664.

Hall, D.G. (2004). How children learn common nouns and proper names. In: J. Macnamara & G. Reyes (Eds.), *The logical foundations of cognition*. Oxford: Oxford University Press.

Hall, D. G., Waxman, S. R., Bredart, S., & Nicolay, A. (2003). Preschoolers' use of form class cues to learn descriptive proper names. *Child Development, 74*, 1547-1560.

Heim, I. (1982). *The Semantics of Definite and Indefinite Noun Phrases*. Ph. D. dissertation, University of Massachusetts, Amherst, and SFB-Papier 73, University of Konstanz.

Hirschfeld, L. A. & Gelman, S. A. (1994). *Mapping the Mind: Domain specificity in Cognition and Culture*. Cambridge: Cambridge University Press.

Hollander, M. A., Gelman, S. A., & Star, J. (2002). Children's interpretations of generic noun phrases. *Developmental Psychology, 38*, 883–894.

Imai, M., Gentner, D., & Uchida, N. (1994). Children's theories of word meaning: The role of shape similarity in early acquisition. *Cognitive Development, 9*, 45–75.

Inhelder, B., & Piaget, J. (1964). *The early growth of logic in the child*. New York: Norton.

Johnson, K. E., Scott, P., & Mervis, C. B. (1997). Development of

children's understanding of basic-subordinate inclusion relations. *Developmental Psychology*, 33, 745–763.

Keil, F.C. (1991). Theories, concepts, and the acquisition of word meaning. In J. P. Byrnes and S.A. Gelman (Eds.), *Perspectives on Language and Cognition: Interrelations in Development*, 197-224. Cambridge: Cambridge University Press

Keil, F. C. 1994. The birth and nurturance of concepts by domains: The origins of concepts of living things. In L. A. Hirschfeld and S. A. Gelman, eds., *Mapping the mind: Domain specificity in cognition and culture*, 234–254. New York:Cambridge University Press.

Kemler Nelson, D.G., Frankenfield, A., Morris, C., & Blair, E. (2000). Young children's use of functional information to recognize artifacts: Three factors that matter. *Cognition*, 77, 133–168.

Kratzer, A. (1995). Stage-level and individual-level predicates. In G. Carlson & F. J. Pelletier (Eds.), *The Generic Book* (pp. 125-176). Chicago: Chicago University Press.

Krifka, M. (1995). Focus and the interpretation of generic sentences. In G. Carlson & F. J. Pelletier (Eds.), *The generic book* (pp. 238-265). Chicago: Chicago University Press.

Krifka, M. (2004). Bare NPs: kind-referring, indefinites, both, or neither? *Empirical Issues in Syntax and Semantics*, 5, 111-132.

Krifka, M., Pelletier, F., Carlson, G., ter Meulen, A., Chierchia, G., & Link, G. (1995). Genericity: An introduction. In G. Carlson & F. J. Pelletier (Eds.), *The Generic Book* (pp. 1-125). Chicago: Chicago University Press.

Landau, B., Smith, L., & Jones, S. (1998). Object shape, object function, and object name. *Journal of Memory and Language*, 38, 1–27.

Leslie, S. J. (2005). *Generics: Acquisition and cognition*. Unpublished ms., Princeton University.

Lewis, D. (1975). Adverbs of quantification. In E. L. Keenan (Ed.), *Formal semantics of natural language* (pp. 3-15). Cambridge: Cambridge University Press.

Lyons, J. (1977). *Semantics, Vol. 1*. New York: Cambridge University Press.

Macario, J. F., Shipley, E. F., & Billman, D. O. (1990). Induction from a single instance: formation of a novel category. *Journal of Experimental Child Psychology*, 50(2):179-199.

Macnamara, J. (1982). *Names for things: A study of human learning*. Cambridge, MA: MIT Press.

MacWhinney, B., & Snow, C. E. (1985). The Child Language Data Exchange System. *Journal of Child Language*, 12, 271-296.

MacWhinney, B., & Snow, C. (1990). The Child Language Data Exchange System: An update. *Journal of Child Language*, 17, 457-472.

Markman, E., & Hutchinson, J. E. (1984). Children's sensitivity to constraints on word meaning: Taxonomic vs. thematic relations. *Cognitive Psychology*, 16, 1–27.

Markman, E. (1989). *Categorization and naming in children: Problems of induction*. Cambridge, MA: MIT Press.

McCarthy, J. (1986). Applications of circumspection to formalizing common-sense knowledge. *Artificial Intelligence*, 28, 89–116.

Medin, D.L. (1989) Concepts and Conceptual Structure. *American Psychologist* 45, 1469-1481.

Medin, D.L., & Rips, L.J. (2005) Concepts and categories: memory, meaning, and metaphysics. In K. J. Holyoak & R. G. Morrison (Eds.), *Cambridge handbook of thinking and reasoning* (pp. 37-72). Cambridge: Cambridge University Press.

Mervis, C. B., & Pani, J. R. (1980). Acquisition of basic object categories. *Cognitive Psychology*, 12, 496–522.

Mervis, C. B., & Rosch, E. (1981). Categorization of natural objects. In M. R. Rosenzweig & L. W. Porter (Eds.), *Annual Review of Psychology*, 32, 89-115

Pappas, A., & Gelman, S. A. (1998). Generic noun phrases in mother-child conversations. *Journal of Child Language*, 25, 19-33.\

Pelletier, F. J. & Asher, N. (1997). Generics and defaults. In van Benthem, J. and ter Meulen, A., (Eds.), *Handbook of Logic and Language*. Elsevier.

Prasada, S. (2000). Acquiring generic knowledge. *Trends in Cognitive Sciences*, 4, 66-72.

Prasada, S. (in press). Conceptual Representation and some forms of genericity. To appear in F.J. Pelletier (Ed.) *Cognitive Issues Involving Generics and Mass Terms*. In *New Directions in Cognitive Science*, v. 12, Oxford Univ. Press, NY.

Prasada, S. & Dillingham E. M. (2006). Principled and statistical connections in common sense conception. *Cognition*, 99, 73-112.

Prasada, S., Salajegheh, A., Bowles, A., Poeppel, D. (in press). Characterizing kinds and instances of kinds: ERP reflections. *Language and Cognitive Processes*.

Quine, W. V. O. (1960). *Word and object: An inquiry into the linguistic mechanisms of objective reference*. New York: Wiley.

Shipley, E. (1993). Categories, hierarchies, and induction. In D. Medin (Ed.), *The Psychology of Learning and Motivation*, vol. 30 (pp. 265-301). New York: Academic Press.

Sloutsky, V.M., Kloos, H., & Fisher, A.V. (2007). When looks are everything: Appearance similarity versus kind information in early induction. *Psychological Science*, 18, 179–185.

Smith, C. L. (1979). Children's understanding of natural language hierarchies. *Journal of Experimental Child Psychology*, 27, 437-458.

Smith, C. L. (1980). Quantifiers and question answering in young children. *Journal of Experimental Child Psychology*, 30, 191-205.

Smith, L. B., & Samuelson, L. (2006). An attentional learning account of the shape bias: Reply to Cimpian and Markman (2005) and Booth, Waxman, and Huang (2005). *Developmental Psychology, 42*, 1339–1343.

Smith, L. B., Jones, S. S., & Landau, B. (1996). Naming in young children: A dumb attentional mechanism? *Cognition, 60*, 143–171.

Smith, L. B., Jones, S. S., Yoshida, H., & Colunga, E. (2003). Whose DAM account? Attentional learning explains Booth and Waxman. *Cognition, 87*, 209–213.

Smith, L. B., & Samuelson, L. (2006). An attentional learning account of the shape bias: Reply to Cimpian and Markman (2005) and Booth, Waxman, and Huang (2005). *Developmental Psychology, 42*, 1339-1343.

Soja, N., Carey, S., & Spelke, E. (1991). Ontological categories guide young children's inductions about word meaning: Object terms and substance terms. *Cognition 38*, 179–211.

Waxman, S. R. (2004). Everything had a name, and each name gave birth to a new thought: Links between early word-learning and conceptual organization. In D. G. Hall & S. R. Waxman (Eds.), *Weaving a lexicon*. Cambridge: MIT Press.

Waxman, S. R., & Booth, A. (2000). Principles that are invoked in the acquisition of words, but not facts. *Cognition, 77*, B33–B43.

Waxman, S. R., & Booth, A. E. (2003). The origins and evolution of links between word learning and conceptual organization: New evidence from 11-month-olds. *Developmental Science, 6*, 130 – 137.

Waxman, S. R., & Booth, A. E. (2001). Seeing pink elephants: Fourteen-month-olds' interpretations of novel nouns and adjectives. *Cognitive Psychology*, 43, 217-242.

Waxman, S. R., & Booth, A.E. (2001). On the insufficiency of evidence for a domain-general account of word learning. *Cognition*, 78, 277-279.

Waxman, S.R., & Lidz, J. (2006). Early word learning. In D. Kuhn & R. Siegler (Eds.), *Handbook of Child Psychology, 6th Edition, Volume 2* (pp. 299-335). Hoboken, NJ: Wiley.

Waxman, S. R., & Markow, D. B. (1995). Words as invitations to form categories: Evidence from 12- to 13-month-old infants. *Cognitive Psychology*, 29, 257-302.

Waxman, S. R., and Markow, D. B. 1998. Object properties and object kind: Twenty-one-month-old infants' extension of novel adjectives. *Child Development*, 69(5), 1313–1329.

Waxman, S. R., & Kosowski, T. (1990). Nouns mark category relations: Toddlers' and preschoolers' word-learning biases. *Child Development*, 61, 1461-1473.

Wellman, H. M., & Gelman, S. A.. (1998). Knowledge acquisition and foundational domains. In D. Kuhn & R. Siegler (Eds.), *Handbook of Child Psychology*,. 523 - 573. New York: Wiley

Zelazo, P. D., & Frye, D. (1998). Cognitive complexity and control: II. The development of executive function in childhood. *Current Directions in Psychological Science*, 7, 121–126.