

# Linguistic and Conceptual Influences on Adjective Acquisition in 24- and 36-Month-Olds

Toben H. Mintz  
University of Southern California

Two hundred forty English-speaking toddlers (24- and 36-month-olds) heard novel adjectives applied to familiar objects (Experiment 1) and novel objects (Experiment 2). Children were successful in mapping adjectives to target properties only when information provided by the noun, in conjunction with participants' knowledge of the objects, provided coherent category information: when basic-level nouns or superordinate-level nouns were used with familiar objects, when novel basic-level nouns were used with novel objects, and—for 36-month-olds—when the nouns were underspecified with respect to category (*thing* or *one*) but participants could nonetheless infer a category from pragmatic and conceptual knowledge. These results provide evidence concerning how nouns influence adjective learning, and they support the notion that toddlers consider pragmatic factors when learning new words.

This study investigated aspects of word learning surrounding toddlers' interpretation of novel adjectives. In general, when learning a word's meaning by observing its use in context, one of the many problems learners face is determining which of an infinite set of possible meanings is the correct one (see Gleitman, 1990, and Quine, 1960, among others). Fortunately, learners can make use of a number of different biases, cues, and pieces of information that facilitate the selection of the correct interpretation by restricting the hypothesis space of meanings. For example, human learners appear to be biased to interpret novel nouns as referring to whole objects, rather than pieces or parts; but if the learner already has a name for the object, then he or she might posit a part interpretation or an interpretation at a different taxonomic level (Clark, 1997; Markman, 1990). For words of all grammatical categories, being able to observe a word's use over multiple utterances in different situations helps to rule out some interpretations and support others (e.g., Gleitman & Gleitman, 1997; Mintz & Gleitman, 2002; Pinker, 1984). In the case of verbs, possibilities often need to be further limited. In such cases, learners

can rely on structural properties of the sentence to constrain possible meanings, a process called *syntactic bootstrapping* (Gleitman, 1990; Landau & Gleitman, 1985). For example, verbs with sentential complements (e.g., *know* in, "Sally knows *that George is a thief*") are generally mental state verbs: that is, verbs of knowledge or perception. The general idea is that aspects of the linguistic context can help a learner restrict the range of possible meanings of a target word (Fisher, Hall, Rakowitz, & Gleitman, 1994; Gillette, Gleitman, Gleitman, & Lederer, 1999; Gleitman, 1990; Landau & Gleitman, 1985; Naigles, 1990).

In learning the meaning of a novel adjective, children may be able to rely on similar kinds of cues from other elements of the sentence to help restrict the set of possible meanings. When an adjective occurs in a sentence, it generally modifies a noun (e.g., "Look at that *stoof* car!") or is predicated of one (e.g., "That car is *stoof*!"). Hence, an interesting question arises as to whether, in principle, the noun could facilitate the interpretation of a novel adjective by restricting the set of candidate meanings and, furthermore, whether young children are influenced by the noun in interpreting a novel adjective.

---

Toben H. Mintz, Departments of Psychology and Linguistics, and Program in Neuroscience, University of Southern California.

This research was supported in part by Grant HD040368 from the National Institute of Child Health and Human Development, by the Zumberge Faculty Research Innovation Fund at the University of Southern California, and by an equipment grant from the Intel Corporation. Portions of this research were presented at the 2003 biennial meeting of the Society for Research in Child Development in Tampa, FL.

Thanks are due to the parents and children who participated in this research. I would also like to thank Emily Bowen, Nuria Giral, Christy Harding, Lewis Lawyer, and Laura Steenberge for their help in the collection and analysis of the data and Laura Siegel for helpful comments on a draft of this article. Discussions with Amit Almor, Lila Gleitman, Kathy Hirsh-Pasek, Raquel Klibanoff, Maryellen MacDonald, and Sandy Waxman helped shape some of the ideas in this article.

Correspondence concerning this article should be addressed to Toben H. Mintz, Department of Psychology, SGM-501 MC-1061, University of Southern California, Los Angeles, CA 90089-1061. E-mail: tmintz@usc.edu

## Information Carried by the Noun That Is Relevant to Interpreting Adjectives

One situation in which the noun can restrict possible meaning candidates is in the case of *relative* adjectives. Relative adjectives refer to properties that vary along a scale, such as size and weight. Whether or not the property denoted by a relative adjective accurately describes an object depends crucially on how the object is construed, or categorized, by the speaker, because establishing the category construal determines the comparison class against which relative adjectives are evaluated. For example, *big* is interpreted differently when applied to mice than when applied to animals. In contrast, nonrelative adjectives (also called *absolute* adjectives), such as *striped*, are not interpreted differently. To illustrate the distinction, consider the sentence in Example 1a below, in which a novel adjective is used to describe a 6-in.-long mouse. Because the object is categorized as a mouse, *stoof* could mean *big*, because

compared with other mice, a 6-in.-long mouse is big. In contrast, when the very same mouse is described with the sentence in Example 1b, in which the object is construed as an animal, then *stoof* could not mean BIG, because a 6-in. mouse is a relatively small animal.

1a. That's a *stoof* mouse!

1b. That's a *stoof* animal!

As these examples illustrate, knowing how the speaker conceives of an object—the category construal—is often crucial in interpreting the adjective. Because the noun that an adjective modifies indicates the intended construal, the noun could be an important factor in learners' adjective interpretation.

The potential influence of the noun is not limited to relative adjectives. When a prenominal adjective (relative or absolute) modifies a noun, the adjective does not, generally, refer to inherent properties of the category designated by the noun. Thus, on hearing "That's a *drin* zebra!" a learner who knows about zebras will know that *drin* cannot refer to the property STRIPED, because being striped is an inherent property of zebras.<sup>1</sup> On the other hand, the very same object could be described as "a *drin* animal," and in this case *drin* could, indeed, mean STRIPED. The object described by these two sentences is the same physical entity; what differs is how the speaker categorizes it—its construal.<sup>2</sup> In sum, by providing a construal, the noun makes available certain properties, and not others, onto which the novel adjective can be mapped.

### The Noun's Influence on Adjective Learning

Given the informative value of the noun in constraining an adjective's interpretation, an interesting question arises as to whether this information is relevant for child language learners. A recent study with 24- and 36-month-olds by Mintz and Gleitman (2002) provided evidence that children's interpretation of novel adjectives is, in fact, influenced by properties of the noun. Toddlers in their study were shown three different training objects that had each been modified to have the same target property, for example, being covered in felt, drilled with holes, and so forth. The objects were common toys, and each was described using the same novel adjective. The crucial contrast was that for one group of children, the novel adjective modified the basic-level name of each training object, as in "That's a *drin* car! And here's a *drin* ball!" whereas for another group of children, the labeling nouns were *thing* and *one*, as in "That's a *drin* thing! And here's another *drin* one!" The contrast was one of category specificity: Basic-level nouns indicate a specific taxonomic category, whereas *thing* and *one* are nouns that can be used to refer to different categories on different occasions and are hence taxonomically underspecified. After the training objects were described, participants were then shown two additional objects, one that shared the target property with the training objects and one that did not. When asked "Which of these is *drin*?" the 24- and 36-month-olds who had heard the objects described with basic-level nouns reliably chose the test object with the target property, providing evidence that they mapped the adjective to the target property, whereas toddlers who heard the objects described as *thing* or *one* were at chance in their choice of test objects. Mintz and Gleitman reasoned that the taxonomically specific nouns allowed children to identify the

construal of the object, whereas the nouns *thing* and *one*, being taxonomically underspecified, did not. They proposed that identifying the object's construal was a necessary step in determining a novel adjective's meaning and that in providing such a construal, the noun plays an important role in 2- and 3-year-olds' interpretation of adjectives.

Although Mintz and Gleitman (2002) established that the noun can influence toddlers' interpretations of novel adjectives, there remain a number of open questions and unresolved issues concerning this influence, three of which the present research addresses. One issue is whether the taxonomic *level* of the noun is a significant factor in successful adjective mapping. One possibility is that the noun facilitates adjective mapping only when it categorizes objects at the basic level, as did the nouns used by Mintz and Gleitman. Evidence that this might be so comes from a number of studies that have pointed to the facilitatory effect of initially learning adjective-to-property mappings when the mappings are first made within the same basic-level category (Klibanoff & Waxman, 2000; Waxman & Klibanoff, 2000; Waxman & Markow, 1998). On the other hand, if the support from the noun comes from the fact that it provides a construal, or conceptualization, of the labeled object, then *any* noun that does so should facilitate the interpretation of the modifying adjective. Thus, one of the questions addressed in the present study is whether nouns other than basic-level nouns support adjective mapping in toddlers. To answer that question, Experiment 1 included both a condition in which the nouns designated a superordinate category and a condition in which basic-level nouns were used (to replicate the study by Mintz & Gleitman, 2002).

The second issue concerns toddlers' familiarity with the objects and with the object names. Familiarity with an object, and knowledge of its inherent properties, could make the attributes described by the novel adjective easier to detect (e.g., by ruling out STRIPED as an interpretation of *stoof* in "a *stoof* zebra") or more salient as likely candidates for a novel adjective's meaning. Indeed, Hall, Waxman, and Hurwitz (1993) showed that 4-year-olds were more likely to map adjectives to object properties when the objects were familiar. In order to assess the influence of object knowledge on adjective acquisition, Experiment 2 duplicated the conditions in Experiment 1 but used objects that were unfamiliar entities for 24- and 36-month-olds. Thus, the familiarity contrast across experiments was crossed with the variation in taxonomic levels (basic-level and superordinate) within each experiment. Predictions for each of these conditions are spelled out more fully when the individual experiments are introduced.

The third issue concerns the use of taxonomically underspecified nouns to provide a more detailed understanding of the role of the noun in adjective learning. Recall that Mintz and Gleitman (2002) hypothesized that toddlers failed to map novel adjectives when the described objects were labeled with *one* and *thing* because these taxonomically underspecified nouns failed to provide the necessary information about the intended construal of the object. However, although *thing* and *one* are both taxonomically

<sup>1</sup> There are special situations in which an inherent property might be named with a prenominal adjective. See Prasada (1992) for a summary of this and related issues.

<sup>2</sup> Clark (1997) used the term *perspective* for this idea.

underspecified, they differ in terms of the presuppositions they involve. In particular, the use of *one* implies that the speaker has a specific category in mind (and that the speaker expects it to be salient to the hearer). In contrast, *thing* offers no category information at all except that the referent is a physical entity. For example, an adult hearing “Look at that one” in reference to a car would normally interpret *one* to mean CAR or perhaps, VEHICLE, whereas the interpretation of *thing* in “Look at that thing” would not offer information about the speaker’s construal. Indeed, hearing *thing* in reference to a car might be confusing. This is because *thing* is normally used in a different set of circumstances. It indicates that the speaker does not know the category of the object or that the concept has no name in the language. It can also be used to signal that a construal is unnecessary or to create an ad hoc category. The important point is that *thing* is very different from *one* (and from taxonomically specific nouns) in the information it provides about possible construals. Hence, a learner who has knowledge about the preconditions of the use of *one* could consult his or her conceptual knowledge of an object labeled as *one* and select a specific construal, just as if a more specific label were used. With a specific construal in mind, the learner could then go on to figure out the property that the adjective maps on to. However, *thing* does not afford this possibility. Hence, because *thing* and *one* differ in their implications and presuppositions, using both nouns within a trial (as in Mintz & Gleitman’s study) could be ambiguous and hinder the subsequent interpretation of the adjective. This scenario could account for why toddlers in Mintz and Gleitman’s study failed to make consistent adjective-to-property mappings when *one* and *thing* were used interchangeably and might reconcile their findings with those of other studies that have reported successful adjective mapping when *one* was the modified noun (Hall et al., 1993; Waxman & Klibanoff, 2000). This issue is addressed further in later sections.

In order to determine whether *one* and *thing* have different consequences for adjective mapping, it is necessary to test them independently. To that end, in addition to the experimental conditions discussed earlier, each experiment had a condition in which the noun was always *one* and another condition in which the noun was always *thing*. If the account of the differences between *thing* and *one* in providing a possible construal is correct, then toddlers might successfully map the adjective to the target property when the toys are labeled only with *one*, but they might fail when the noun is *thing*. Moreover, manipulating the familiarity of the objects across Experiments 1 and 2 provides an opportunity to determine whether object knowledge affects how the presence of *one* versus *thing* influences adjective mapping.

To summarize, the overall design of the present study was as follows. To investigate the influence of the taxonomic level of the head noun, Experiment 1 introduced novel adjectives that modified basic-level nouns and superordinate nouns in two separate conditions. To further investigate the influence of underspecified nouns on adjective interpretation, Experiment 1 analyzed the effects of labeling the objects with *one* and with *thing* in two separate conditions. By replicating the design of Experiment 1, but using unfamiliar objects, Experiment 2 provided a means of testing the interaction of the information provided by the four noun types studied in Experiment 1 with toddlers’ conceptual knowledge of the objects. Finally, developmental differences were assessed by

separately testing 24- and 36-month-olds in all conditions of both experiments.

## Experiment 1

Experiment 1 accomplished four main goals in four experimental conditions and one control condition. All conditions were between-subjects conditions. Two conditions assessed adjective mapping when the modified noun was taxonomically specific, and two assessed adjective mapping when the modified noun was taxonomically underspecified. First, the *basic-name* condition was designed to confirm the findings from Mintz and Gleitman’s (2002) study. That study showed that for children as young as 24 months, adjective mapping was facilitated when the described property was observed across multiple objects and when a taxonomically specific noun (in particular, a basic-level term) was the head noun in the description. Second, the *superordinate-name* condition tested whether a superordinate noun would provide facilitation similar to that provided by a basic-level label. A positive result would lend support to the hypothesis that the crucial aspect of the noun is that it designates some category and concept, but not necessarily at the basic level. Third, Experiment 1 tested for effects of the presuppositional differences between the underspecified nouns *thing* and *one*. In the *underspecified-one* condition, the head noun was always *one*, and in the *underspecified-thing* condition, the head noun was *thing*. This design allowed for the assessment of the way in which the differences in the presuppositions that were associated with these terms affected adjective interpretation. Although *one* is a taxonomically underspecified noun, it may encourage toddlers to focus on some specific construal of the object, which would then facilitate the mapping of the novel adjective to the target property. In contrast, *thing* may hinder adjective mapping because, in the context of known objects, toddlers may interpret its use as pragmatically infelicitous and confusing.

In all conditions, children’s success in mapping the novel adjectives was measured by assessing their tendency to select test objects that shared designated properties with training objects. To ensure that such responses were not due to nonlinguistic factors (such as a desire to select visually similar objects), a control condition was used to establish baseline response patterns when no novel adjective was introduced.

Finally, Experiment 1 tested for differences in behavior across the experimental conditions between participants approximately 24 months and 36 months of age.

## Method

### Participants

One hundred twenty children participated in this study. Sixty children were within 3 months of their 2nd birthdays (mean age = 25 months, range = 21.8 to 27 months), and 60 were within 3 months of their 3rd birthdays (mean age = 37 months, range = 34.6 to 39 months). An additional 6 children were tested but excluded from the data analysis because of failure to respond in at least three trials (5) or interference from a parent (1). Participants at each age level were randomly assigned to five independent groups of 12 children each: *basic-name*, *superordinate-name*, *underspecified-one*, *underspecified-thing*, or *control* (all described below).

Participants were tested individually at the University of Southern California Language Development Lab.

### Materials

Each participant received six test trials in which he or she was presented with three training objects that were common toys (e.g., a toy horse, a toy car, or a ball). For a given trial, all three training objects shared one salient property from the following set of six properties: covered in felt, striped yellow, covered in Velcro, wrapped in thin wire, drilled with holes, and covered with blue stars. Participants were also shown two test objects on each trial: a *kind-matched* object and a *property-matched* object. The kind-matched object was the same kind of object as the last of the three training objects presented (e.g., another ball) but differed in its salient property from the training objects. The property-matched object was a common toy that differed in kind from all of the training objects in that trial but that shared the training objects' salient property. Trials were designed so that no test object would appear more than once as the property-matched object throughout the experiment and likewise so that no test object would appear more than once as the kind-matched object. The training and test objects for each trial and the order of presentation within each trial are shown in Table 1.

### Procedure

The entire experiment was described to the children as a kind of show-and-tell game with a puppet named Sam. Participants were told that Sam was going to show the child some of his toys and talk about them. All groups were shown the same sets of modified training and test objects. The primary difference between groups was the linguistic description accompanying the objects. For all groups except the control group, the children were told that Sam sometimes used words from "puppet language" and that the experimenter wanted the child to help figure out what the puppet words meant. The puppet removed each training object from a closed container, one at a time, and described it to the child using a novel, nonsense adjective and a noun. In the basic-name group, the noun was the common basic-level term for the toy object (e.g., *car*, *horsie*, *ball*, *block*, *monkey*). Table 1 lists the objects, using the basic-level labels used in the experiment. The descriptions were of the form "Look! It's a *stoof* car! This car is really *stoof*!" Thus, each object was described with the adjective appearing in prenominal and predicate positions. The novel adjectives were *zav*, *drin*, *rup*, *stoof*, *prall*, and *bisk*. After the three objects were presented in this way, the experimenter placed them together and said, "See, these are all *stoof*!" In the superordinate-name condition, the noun was always the superordinate label *toy*. In the underspecified-one condition, the noun was always *one*, and in the underspecified-thing condition, the noun was *thing*.

Next, the experimenter removed the two test objects from the container and placed them side by side in front of the child and said, "Here are two more things. Which one of these is *stoof*? Which is the *stoof* one?" The left-right order of the test objects (property-matched vs. kind-matched)

was randomized. A response was recorded if the child picked up or pointed to one of the two test objects. If the child chose the object that had the same property as the training objects, a property-matched response was recorded. If the child chose the object that was the same basic-level kind as the last training object, a kind-matched response was recorded. If participants failed to respond, the question was repeated for up to a total of three times. If no response was obtained after the third attempt, a nonresponse was recorded. A "both" response was recorded if the child selected both objects. Each trial involved a different nonsense adjective.

The control condition was designed to provide a baseline response pattern when no adjective was used to describe the objects. In the experimental conditions, children might give property-matched responses simply because they preferred to choose a test object that shared a property with the training objects, without necessarily interpreting the adjective as referring to the shared property. The control condition tested for this possibility by assessing participants' choice patterns when no adjective was used. In this condition, as each object was presented one by one to the child, it was described as something Sam liked: "Look, here's something Sam likes. Sam likes this too. Here's something else that Sam likes." Then, as in the experimental conditions, the three training objects in the trial were placed together and the experimenter said, "See, Sam likes all of these!" Next, the two test objects were presented and the child was asked, "Which of these do you think Sam likes?" Responses were scored in the same way as in the experimental conditions. If property similarity, independent of the linguistic description, was driving children's responses, then they should have given property-matched responses in the control condition. Otherwise, the performance of children in this condition was expected to be at chance.

### Scoring and Analysis

A difference score was computed for each participant that represented the number of property-matched responses minus the number of kind-matched responses. Because there were six trials, the chance difference score is 0. Mean scores significantly above chance would indicate a reliable tendency for participants to select property-matched test objects; mean scores significantly below chance would indicate a tendency to select kind-matched objects. Performance at chance would indicate no consistent difference in response types. In addition to comparisons with chance performance, planned comparisons also evaluated scores in the experimental conditions against scores in the control condition, to ensure that non-chance performance was not due to some nonlinguistic factor. Because the alternative hypothesis in all cases predicts positive difference scores, one-tailed *p* values are reported.

### Results

Mean difference scores (ranging from  $-6$  to  $+6$ ) for all conditions and both age groups are shown in Table 2. A  $2 \times 5$  analysis

Table 1  
*Stimulus Sets in Experiment 1*

Training		Test	
Objects	Property	Property match	Kind match
Elephant, block, ball	FELT	Car-FELT	Ball-VELCRO
Car, cup, pig	STARS	Kangaroo-STARS	Pig-STRIPES
Block, cup, horse	WIRE	Elephant-WIRE	Horse-HOLES
Elephant, car, kangaroo	VELCRO	Pig-VELCRO	Kangaroo-STRIPES
Ball, horse, monkey	HOLES	Block-HOLES	Monkey-WIRE
Block, horse, cup	STRIPES	Monkey-STRIPES	Cup-STARS

Table 2  
Mean Property-Matched Minus Kind-Matched Difference Scores  
for Experiment 1

Condition	24 months	36 months
Control	-0.33	0
Basic-name	1.42*	4.50**
Superordinate	1.70*	3.30**
Underspecified		
One	0.75	3.80**
Thing	0.25	0.58

Note. Scores ranged from -6 to +6.

\*  $p < .05$  (compared with chance and with control condition). \*\*  $p < .01$  (compared with chance and with control condition).

of variance (ANOVA) with age (24 months and 36 months) and condition (control, basic-name, superordinate-name, underspecified-one, and underspecified-thing) as between-subjects variables revealed a main effect of age,  $F(1, 110) = 18.23, p < .01$ , a main effect of condition,  $F(4, 110) = 10.06, p < .01$ , and an Age  $\times$  Condition interaction,  $F(4, 110) = 2.99, p < .05$ . Overall, 36-month-olds gave more property-matched responses than did 24-month-olds, and responses across conditions varied with age. The following sections summarize the results and planned comparisons by age group.

### 24-Month-Olds

*Control condition.* The mean difference score for 24-month-olds was  $-0.33$ , which was not significantly different from chance performance,  $t(11) = -0.48, p = .64$ . Thus, 24-month-olds did not tend to choose property-matched over kind-matched test objects when linguistic cues were not present.

*Basic-name.* The mean difference score for participants in the basic-name condition was  $1.42$  ( $SD = 2.1$ ). This score represented higher than chance performance,  $t(11) = 2.33, p < .05$ , indicating that children in this condition tended to select property-matched test objects. This score was also significantly higher than scores in the control condition,  $t(22) = 1.89, p < .05$ , indicating that participants' property-matched responses were not driven by a nonlinguistic response preference for test objects that matched in property with the training objects. This result replicates the findings in Mintz and Gleitman (2002).

*Superordinate-name.* The mean difference score for participants in the superordinate-name condition was  $1.70$  ( $SD = 2.5$ ). This score represented significantly higher than chance performance,  $t(11) = 2.35, p < .05$ , and was significantly higher than scores for participants in the control condition,  $t(11) = 2.01, p < .05$ . Thus, as in the basic-name condition, when novel adjectives modified the noun *toy*, participants reliably chose property-matched over kind-matched test objects.

*Underspecified-one.* The mean difference score for participants in the underspecified-one condition was  $0.75$  ( $SD = 2.3$ ). This score was not significantly different from chance performance,  $t(11) = 1.15, p = .14$ , and was not significantly different from scores in the control condition,  $t(22) = 1.13, p = .14$ . Thus, when a novel adjective modified the noun *one*, 24-month-olds did

not consistently choose property-matched over kind-matched responses.

*Underspecified-thing.* The mean difference score for participants in the underspecified-thing condition was  $0.25$  ( $SD = 1.9$ ). This score was not significantly different from chance performance,  $t(11) = .45, p = .33$ , and was not significantly different from scores in the control condition,  $t(22) = .65, p = .26$ . Thus, as in the underspecified-one condition, when novel adjectives modified the noun *thing*, participants did not consistently choose property-matched over kind-matched responses.

### 36-Month-Olds

*Control condition.* The mean difference score for 36-month-olds was  $0$  ( $SD = 2.4$ ), which was not significantly different from chance performance,  $t(11) = 0, p = .5$ . Thus, 36-month-olds did not tend to choose property-matched or kind-matched test objects when linguistic cues were not present.

*Basic-name.* The mean difference score for 3-year-olds in the basic-name condition was  $4.5$  ( $SD = 0.9$ ). This score represented higher than chance performance,  $t(11) = 17.23, p < .01$ , indicating that participants in this condition tended to select property-matched test objects. This score was also significantly higher than scores in the control condition,  $t(22) = 6.91, p < .01$ , indicating that participants' property-matched responses were not driven by a nonlinguistic response preference for test objects that matched in property with the training objects. This result replicates the findings of Mintz and Gleitman (2002).

*Superordinate-name.* The mean difference score for participants in the superordinate-name condition was  $3.3$  ( $SD = 2.6$ ). This score was significantly higher than chance performance,  $t(11) = 3.79, p < .01$ , and higher than scores for participants in the control condition,  $t(22) = 2.77, p < .01$ . Thus, as in the basic-name condition, when novel adjectives modified the noun *toy*, 36-month-olds reliably chose property-matched over kind-matched test objects.

*Underspecified-one.* The mean score for participants in the underspecified-one condition was  $3.8$  ( $SD = 1.8$ ). This score was significantly higher than chance performance,  $t(11) = 7.38, p < .01$ , and was also significantly higher than scores in the control condition,  $t(22) = 4.41, p < .01$ . Thus, when a novel adjective modified the noun *one*, 36-month-olds consistently chose property-matched over kind-matched test objects.

*Underspecified-thing.* The average score for participants in the underspecified-thing condition was  $0.58$  ( $SD = 1.9$ ). This score was not significantly higher than chance performance,  $t(11) = 1.05, p = .16$ , and was not significantly different from scores in the control condition,  $t(22) = 0.65, p = .26$ . Thus, when a novel adjective modified the noun *thing*, 36-month-olds were at chance in their choice of test objects.

### Discussion

The results for 24-month-olds are discussed first: Their consistent choice of property-matched over kind-matched responses in the basic-name condition demonstrates that providing a basic-level head noun for each training object facilitated adjective mapping

(replicating Mintz & Gleitman's [2002] findings). Furthermore, when the head noun was a superordinate label, 24-month-old children also learned the adjective-to-property mapping, which indicates that a noun need not designate a basic-level category to support adjective acquisition. Rather, as long as the noun designates a specific category, children consistently map the novel adjective to the target property. These findings lend further support to the hypothesis that a crucial role of the modified noun is to identify the intended category of the object regardless of whether the categorization is at a basic or superordinate level.

Considering the superordinate-name condition further, one might remark that the concept TOY is not likely to be terribly helpful in eliminating or making available candidate properties for adjective mapping. The category TOY includes exemplars that are visually and functionally very different from one another. Is the category TOY likely to be helpful in constraining possible adjective meanings, as outlined earlier?

There are two important points to consider with respect to this question. First, as discussed earlier, a construal can rule out certain candidate properties (in the way that ZEBRA rules out STRIPES), and perhaps TOY is very broad in this respect; but just as important, a construal can "rule in" candidates as well: For example, imagine that a car, a motorcycle, and a truck are called, in turn, "a *stoof car*," "a *stoof motorcycle*," and "a *stoof truck*"; the property of having wheels, being inherent in those construals, is unlikely to be the target of *stoof*, and a listener would be biased toward finding some other shared property as the referent of *stoof*. In contrast, if the very same objects were each referred to as "a *stoof toy*," then the property of having wheels would be a possible candidate for all or part of the adjective's meaning. Thus, broad categories such as TOY can play a role in specifying candidates for adjective mapping because they allow interpretations that would be ruled out by alternative category construals.

Second, despite the apparent variability in the defining properties relevant to the entire category of toys, in any particular naming situation, even broad concepts such as TOY can offer restrictions that may be relevant for adjective mapping. Specifically, in Experiment 1, many of the toys were miniature models of real objects (animals such as horses, pigs, elephants, kangaroos, and monkeys, and artifacts such as cars). Being relatively small and being a pretend stand-in for a real entity are properties that are an inherent part of these objects *when they are construed as toys*, and thus these properties are unlikely to be candidates for the meanings of prenominal adjectives when they are labeled as toys. In contrast, being relatively small and being a pretend thing are properties that might be considered when the very same objects are referred to with their basic-level names. In sum, even though superordinate categories may be broad and encompass members whose common, inherent properties are relatively abstract (e.g., TOY, FURNITURE), nevertheless, when applied to an actual object or set of objects, they can serve to highlight some properties and rule out other properties as candidate meanings for a novel adjective, just as more specific, basic-level terms can.

In the two underspecified conditions, the head noun did not directly provide any information as to the intended category of the labeled object. Nonetheless, in the underspecified-one condition, use of *one* implied that the experimenter had in mind a specific object category that the described object was "one of." In princi-

ple, a child who was sensitive to this implication could decide on a specific construal, just as though a specific noun had been used. The underspecified-thing condition does not clearly afford such a possibility, as the use of *thing* essentially is noncommittal as to the category and can even be interpreted as indicating that the construal is not a familiar category. However, for 24-month-olds, neither condition was sufficient to facilitate consistent adjective-to-property mapping, as indicated by the fact that children in both conditions chose property-matched and kind-matched objects at chance levels. In sum, for the younger children in this experiment, having a head noun that named a specific conceptual category was a crucial component for successful adjective-to-property mapping, although the taxonomic level of the category was not a crucial factor.

Thirty-six-month-olds behaved similarly to 24-month-olds in some conditions, and differently in others, giving rise to the Age  $\times$  Condition interaction. Like 24-month-olds, 36-month-olds consistently mapped the novel adjective onto the target property when the modified noun was a basic-level name and also when it was the superordinate noun *toy*. Thus, for children in both age groups, the facilitatory role of a taxonomically specific noun in the modifying adjective's interpretation was not restricted to basic-level nouns. However, unlike 24-month-olds, 36-month-olds showed evidence of adjective-to-property mapping in one of the underspecified conditions as well. In the underspecified-one condition, the 36-month-olds reliably chose property-matched over kind-matched test objects, which indicates that they consistently mapped the novel adjective to the target property. Yet even the older children demonstrated chance performance when the underspecified noun was *thing*. These findings suggest that, unlike 24-month-olds, 36-month-olds recognized that *one* indicates that the speaker has in mind a particular, shared categorization of the described object, and they then settled on a construal (probably basic-level) with which they could then go on to identify the target property as the referent for the novel adjective.

Given 36-month-olds' success in the underspecified-one condition, one might wonder why children would not select the same construal for a given object in the underspecified-thing condition as they putatively did in the underspecified-one condition. The reason, perhaps, is that *thing* is often used to label unfamiliar objects (e.g., "What's that *thing*?"), and a child might hence believe that the speaker was not intending one of the familiar categorizations of the object, and hence might be uncertain as to whether the speaker's construal coincided with one of his or her own. This uncertainty might interfere with the child's selection of a category construal, which would then impede learning the novel adjective. Alternatively, the child might simply be confused or distracted by the fact that the speaker did not use one of the possible familiar labels for the object and that the speaker instead implied that he or she did not know what the object was. The distinction between these explanations is subtle; in the former, the pragmatically marked use of *thing* results in the child failing to decide on a categorization, whereas in the latter it results in overall confusion. Both accounts are consistent with the present data, and in either view, the difference in 36-month-olds' behavior in the two underspecified conditions shows that they do not treat *thing* and *one* equivalently, that they are aware of the words' pragmatic

differences, and that these facts have consequences for word learning.<sup>3</sup>

The findings here are consistent with other research in which *one* was shown to support adjective mapping in 3-year-olds when the objects concerned were familiar (Hall et al., 1993; Waxman & Klibanoff, 2000, Experiment 2). The results also provide an account of why Mintz and Gleitman's (2002) 3-year-olds failed in mapping novel adjectives when objects were labeled by both *one* and *thing* in a given trial: Because the presuppositions regarding category construal for *thing* can be in conflict with those for *one*, labeling an object with both nouns, as Mintz and Gleitman did, creates ambiguity concerning the intended construal of the object, hindering the identification of the target property of the adjective.

In sum, the findings from Experiment 1 support the hypothesis that successful adjective mapping takes place when children can interpret the modified noun in conjunction with the object in the reference field to infer the speaker's construal of the described object. The experiment replicates findings from Mintz and Gleitman (2002) concerning the facilitation in adjective acquisition provided by the head noun when the noun is a basic-level label. Further, the results show that superordinate-level nouns can also play a facilitatory role in adjective interpretation, consistent with the hypothesis that the noun provides a specific categorization of the object that then makes available a restricted set of properties as candidate meanings for the adjective. Experiment 1 shows that the underspecified noun *one* can provide a specific category construal as well. Learners who recognize that the speaker has a specific category in mind when calling an object *one* can use their knowledge of the objects and related concepts to select a specific construal, just as though a taxonomically specific noun had been used.<sup>4</sup> However, this ability appears to develop between the 2nd and 3rd birthdays. One possible cause of the change is that toddlers develop an understanding of the pragmatics involved in the use of *one* (specifically, that it presupposes a shared category) sometime between 24 and 36 months of age. Alternatively, it could be that 24-month-olds have the pragmatic knowledge concerning *one* but have more difficulty in accessing category knowledge when *one* is used in place of a common noun. Mintz and Gleitman (2002) carried out a corpus analysis that showed that 2-year-olds produced phrases of the form [ADJECTIVE one], so they clearly have some knowledge of its appropriate use. Yet, as the results here show, their knowledge is incomplete. Exactly what develops in children's understanding of *one* is a question worth further study. In any case, these findings bear on developing processes and representations relevant to the pronoun *one* as well as on mechanisms of adjective acquisition.

The objects in Experiment 1 were familiar toys, and consequently children had relatively rich conceptual knowledge associated with them. Given the indications from other research (Hall et al., 1993; Taylor & Gelman, 1988) that has reported effects of object familiarity on adjective mapping, the question arises as to what role object familiarity, or object knowledge, played in the successful adjective mapping in Experiment 1. To investigate how object knowledge interacts with the construal information from the noun to influence toddlers' interpretation of adjectives, in Experiment 2 I duplicated the test conditions of Experiment 1 but used objects that were selected to be unfamiliar to 2- and 3-year-olds. This manipulation made it possible to analyze the role of children's conceptual knowledge of objects in how they interpret adjectives.

## Experiment 2

The account just given for 36-month-olds' success in adjective mapping in the underspecified-one condition of Experiment 1 was that the noun *one* activated a category that the exemplar object was "one of." That is, *one* selected one of a set of familiar concepts that the child had associated with the objects. This account raises the possibility that a crucial part of children's ability to interpret the novel adjective in the basic-name and superordinate-name conditions in Experiment 1 was also due to their familiarity with the objects and perhaps with the object names (Hall et al., 1993). Children's familiarity with the objects and related concepts includes information about typical properties and other conceptual information that could help narrow down the target property. In that case, the successes in Experiment 1 might have come not only from identifying a unique category but also from identifying a familiar and richly represented one.

In order to test this possibility, the design of Experiment 1 was duplicated in Experiment 2, except that novel, unfamiliar objects were used instead of familiar toys. This manipulation changed children's conceptual knowledge of the objects and afforded an investigation of the interplay of the information provided by the different types of nouns, across experimental conditions, and the richness of children's conceptual information. In the basic-name condition, each kind of novel object was assigned a novel name, to parallel the basic-name condition in Experiment 1. Here, however, the object and noun (as well as the adjective) were unfamiliar to the participants. Considerable research in noun learning suggests that toddlers will interpret the novel noun to name a basic-level, shape-based categorization of the novel object (e.g., Golinkoff, Shuffbailey, Olguin, & Ruan, 1995; Hall & Waxman, 1993; Landau, Smith, & Jones, 1988, 1992, 1998; Markman & Hutchinson, 1984). Thus, this condition provided a strong test of the hypothesis that the supporting role of the noun in adjective acquisition is that it specifies a category construal, whether or not that category is one the learner is familiar with. If familiarity was not a crucial factor in Experiment 1, then novel nouns should also support adjective mapping by providing a specific category label for the object.<sup>5</sup>

In the superordinate-name condition, the familiar noun *toy* was used, as in Experiment 1. It would have been possible to use a

<sup>3</sup> Of course, it is also true that *thing* can be used to indicate that a more specific categorization is unnecessary or irrelevant, and this usage should not interfere with adjective interpretation; perhaps this is not the most readily accessible meaning for young children, if it is part of their knowledge of *thing* at all.

<sup>4</sup> It is not hypothesized here *how* children make this choice or what specific construal they settle on. Nor is it claimed that the children each settle on the same construal. These details are interesting and important for an ultimate understanding of the processes at play here. What is important for these experiments, however, is simply that children have some basis for selecting a category construal.

<sup>5</sup> Although the literature suggests that toddlers will converge on a shape-based concept for the novel noun that is roughly equivalent to a basic-level category, it is not crucial for the purposes of this study that toddlers converge on this precise interpretation. Rather, the proposal is that as long as a toddler makes some specific conjecture about the concept designated by the novel noun, adjective acquisition should be able to proceed.

novel superordinate term in this condition, just as novel basic-level terms were used in the basic-name condition. However, the toddler's task of figuring out the reference category of the novel noun would arguably be much greater for a novel superordinate term than for novel basic-level terms, as there is no obvious supercategory that covers all the objects, whereas shape and appearance are reasonable criteria for defining characteristics of the concepts associated with the novel basic-level terms. Thus, the purpose behind using a known superordinate label was to increase the likelihood that toddlers would, indeed, consider a superordinate category construal of the object.

Because the superordinate noun designates a specific category, one might predict adjective mapping would be successful, as it was in the analogous condition in Experiment 1. However, it might be that the compatibility between the noun and the labeled object is an important factor in how well a noun designates a conceptual category. Specifically, if the labeled objects do not fit into children's concepts of TOY, then the label might not provide a coherent construal of the object and might lead to a failure to successfully interpret the adjective.

Finally, as in Experiment 1, in the underspecified conditions in Experiment 2, the modified noun was *one* in the underspecified-one condition and *thing* in the underspecified-thing condition. Recall that in Experiment 1, the account of the 36-month-olds' success in adjective mapping was that they understood that when speakers use the pronoun *one*, they have a specific category in mind, and that toddlers used their knowledge of the objects and related concepts to select a specific category, as though a more specific label had been used. In situations in which the learners' knowledge of the objects is impoverished, there are no familiar concepts available for them to select as the referent of *one*, and this violates the presuppositions inherent in *one* (that there is a specific, known concept in question). The violation might then hinder successful adjective mapping in at least two ways: (a) because a construal cannot easily be computed—there is no *known* concept for *one* to activate or (b) because the violation itself is a source of confusion that draws attention from the word-learning task. In contrast, a lack of conceptual information about an object might lead to more consistent adjective-to-property mapping when the head noun is the underspecified label *thing*. This is because *thing* is an appropriate noun to use when the name of the object is unknown or when conceptual knowledge of the object is impoverished, both of which would be true in the case of unfamiliar objects. In these situations, *thing* can be interpreted as specifying the default, basic-level construal of the object, which, in the absence of functional information, can be assumed to be a shape-based construal (Diesendruck & Bloom, 2003; Landau et al., 1988, 1992, 1998). If a learner interprets *thing* in this way—which was the account put forth in Experiment 1 for the reason why 36-month-olds failed the adjective mapping task when the noun was *thing*—then he or she would select a basic-level/shape-based categorization of the object, which would then permit mapping of the adjective to the target property. Thus, in the older age group, one might expect a pattern of responding in the underspecified conditions in Experiment 2 that was the reverse of that found in Experiment 1. Whereas children could interpret *one* in conjunction with their knowledge of the objects to arrive at a construal in Experiment 1, object knowledge would be impoverished in Experiment 2, thus preventing a construal and subsequent adjective

mapping. On the other hand, whereas *thing* was infelicitously applied to objects in Experiment 1, because they were familiar, it was used appropriately given the unfamiliar objects in Experiment 2 and could provide a construal.

## Method

### Participants

One hundred twenty children participated in this study. Sixty children were within 2 months of their 2nd birthdays (mean age = 25 months, range = 22 to 27 months), and 60 were within 2 months of their 3rd birthdays (mean age = 37 months, range = 34 to 39 months). Two additional participants were tested but excluded from the data analysis because of failure to respond in at least three of the trials. Participants at each age level were randomly assigned to five independent groups of 12 children each: basic-name, superordinate-name, underspecified-one, underspecified-thing, or control (all described below). Participants were tested individually at the University of Southern California Language Development Lab.

### Materials

The materials were 30 small objects that young children were not likely to have names for or to have much experience with. The objects comprised nine different types: small paint roller (3), small plastic tube (4), small plastic elbow (3), electric socket adapter (3), small plastic spacer (4), small plastic dome (3), light switchplate (3), metal bracket (3), and suction cup (4). Each of the nine object types was associated with a nonce name: *noof*, *nex*, *zim*, *sook*, *poztaro*, *wug*, *jivik*, *fimp*, and *chunalop*, respectively. As in Experiment 1, the objects were grouped to form six trial sets, each consisting of three training objects and two test objects. The training objects were modified such that for a given trial set, they shared one salient property. The six properties were identical to those used in Experiment 1. Training objects were ordered in each trial set to be presented one by one to participants.

For each trial set, the kind-matched item matched the final training object in kind but differed in its salient property from the three training objects. The property-matched test item differed in kind from the three training objects but shared their salient property. Trial sets were designed such that no test object appeared more than once as the property-matched object in the experiment and, likewise, such that no test object appeared more than once as the kind-matched object. The training and test objects for each trial and the order of presentation within each trial are shown in Table 3.

### Procedure

The procedure was nearly identical to that of Experiment 1. One difference was that in the basic-name condition, each object kind was given a nonce name, as described in the previous section; thus, when these objects were described in the basic-name condition, participants heard both a novel adjective and a novel noun. Another difference was that, in addition to informing participants that Sam used "puppet-language," the experimenter told participants that Sam was going to show them lots of "funny monster toys" that they (experimenter and participant) could learn about together.

## Results

Mean difference scores for all conditions and both age groups are shown in Table 4. Recall that difference scores ranged from  $-6$  to  $+6$ . An omnibus  $2 \times 2 \times 5$  ANOVA combining results from Experiments 1 and 2 with object type (familiar [Experiment 1] and unfamiliar [Experiment 2]), age (24 months and 36 months), and

Table 3  
Stimulus Sets in Experiment 2

Training		Test	
Objects	Property	Property match	Kind match
Adapter plug, plastic cylinder, switchplate	FELT	Suction cup – FELT	Switchplate – VELCRO
Suction cup, rectangular plastic spacer, metal bracket	STARS	Plastic dome – STARS	Metal bracket – STRIPES
Plastic cylinder, rectangular plastic spacer, elbow pipe	WIRE	Adapter plug – WIRE	Elbow pipe – HOLES
Adapter plug, suction cup, plastic dome	VELCRO	Metal bracket – VELCRO	Plastic dome – STRIPES
Switchplate, elbow pipe, mini paint roller	HOLES	Plastic cylinder – HOLES	Mini paint roller – WIRE
Plastic cylinder, elbow pipe, rectangular plastic spacer	STRIPES	Mini paint roller – STRIPES	Rectangular plastic spacer – STARS

condition (control, basic-name, superordinate-name, underspecified-one, and underspecified-thing) as between-subjects variables revealed the following main effects and interactions: There was a main effect of familiarity,  $F(1, 220) = 11.608, p < .01$ , with more property-matched responses, overall, to familiar objects than to novel objects. There was also a main effect of age,  $F(1, 220) = 9.385, p < .01$ , with 36-month-olds contributing more property-matched responses than 24-month-olds, and there was a main effect of condition,  $F(4, 220) = 8.934, p < .01$ , the details of which are discussed below. In addition, there were three significant interactions: a Familiarity  $\times$  Age interaction,  $F(1, 220) = 6.205, p < .05$ , with the difference between ages being greater with familiar than with unfamiliar objects; a Familiarity  $\times$  Condition interaction,  $F(4, 220) = 3.421, p < .01$ ; and a three-way Familiarity  $\times$  Age  $\times$  Condition interaction,  $F(4, 220) = 2.70, p < .05$ . These interactions are discussed in detail below. The interaction between age and condition was not significant,  $F(4, 220) = 1.40, p = .24$ . The following sections summarize the results and planned comparisons by age group.

24-Month-Olds

*Control condition.* The mean score for 24-month-olds was 0.25 ( $SD = 1.4$ ), which was not significantly different from chance performance,  $t(11) = 0.61, p = .28$ . Thus, 24-month-olds did not tend to choose property-matched over kind-matched test objects when linguistic cues were not present.

*Basic-name.* The mean score for participants in the basic-name condition was 1.9 ( $SD = 2.2$ ). This score represented higher than chance performance,  $t(11) = 3.03, p < .01$ , indicating that participants in this condition tended to select property-matched test

objects. This score was also significantly higher than scores in the control condition,  $t(22) = 2.21, p < .05$ , indicating that participants' property-matched responses were not driven by a nonlinguistic response preference for test objects that matched in property with the training objects.

*Superordinate-name.* The mean score for participants in the superordinate-name condition was 0.42 ( $SD = 2.5$ ), which was not different from chance performance,  $t(11) = 0.59, p = .29$ , and did not differ from scores in the control condition,  $t(22) = 0.20, p = .42$ . Thus, unlike with familiar objects, with novel objects, 24-month-olds were at chance in their response to the novel adjective when it modified the superordinate noun *toy*.

*Underspecified-one.* The mean score for participants in the underspecified-one condition was 0.17 ( $SD = 2.5$ ), which did not differ from chance performance,  $t(11) = 0.23, p = .41$ , or from scores in the control condition,  $t(22) = -0.10, p = .54$ . Thus, as in Experiment 1, 24-month-olds were at chance in their response to the novel adjective when it modified the underspecified noun *one*.

*Underspecified-thing.* The mean score for participants in the underspecified-thing condition was 0.0 ( $SD = 2.8$ ), which was equivalent to chance performance,  $t(11) = 0, p = .5$ , and did not differ from scores in the control condition,  $t(22) = -0.28, p = .60$ . Thus, as in Experiment 1, 24-month-olds were at chance in their response to the novel adjective when it modified the underspecified noun *thing*.

36-Month-Olds

*Control condition.* The mean score for 36-month-olds was  $-0.75$  ( $SD = 2.1$ ), which did not differ from chance performance,  $t(11) = -1.27, p = .88$ . Thus, 36-month-olds did not tend to choose property-matched over kind-matched test objects when linguistic cues were not present.

*Basic-name.* The mean score for participants in the basic-name condition was 2.1 ( $SD = 1.8$ ). This score was higher than chance performance,  $t(11) = 4.05, p < .01$ , indicating that participants in this condition tended to select property-matched test objects. This score was also significantly higher than scores in the control condition,  $t(22) = 3.61, p < .01$ , indicating that participants' property-matched responses were not driven by a nonlinguistic response preference for test objects that matched in property with the training objects.

*Superordinate-name.* The mean score for participants in the superordinate-name condition was 0.25 ( $SD = 3.1$ ), which was not different from chance performance,  $t(11) = 0.28, p = .40$ , and did not differ from scores in the control condition,  $t(22) = 0.92, p =$

Table 4  
Mean Difference Scores for Experiment 2: Property-Matched Minus Kind-Matched Responses

Condition	24 months	36 months
Control	0.25	-0.75
Basic-name	1.90**†	2.10**††
Superordinate	0.42	0.25
Underspecified		
<i>One</i>	0.17	-0.08
<i>Thing</i>	0.00	2.10**††

*Note.* Scores ranged from  $-6$  to  $+6$ .  
†  $p < .05$  (compared with control condition). ††  $p < .01$  (compared with control condition). \*\*  $p < .01$  (compared with chance).

.18. Thus, as with the 24-month-olds in this experiment, but unlike in Experiment 1, with novel objects, 36-month-olds were at chance in their response to the novel adjective when it modified the superordinate noun *toy*.

*Underspecified-one.* The mean score for participants in the underspecified-one condition was  $-0.08$  ( $SD = 3.0$ ), which did not differ from chance performance,  $t(11) = -.10$ ,  $p = .54$ , or from participants' mean response in the control condition,  $t(22) = 0.63$ ,  $p = .27$ . Thus, when objects were unfamiliar and labeled with the underspecified noun *one*, 36-month-olds were at chance in their choice of test object, whereas in Experiment 1, where the objects were familiar, they reliably chose property-matched over kind-matched test objects.

*Underspecified-thing.* The mean difference score for participants in the underspecified-thing condition was  $2.1$  ( $SD = 2.3$ ), which represented significantly greater than chance performance,  $t(11) = 3.30$ ,  $p < .01$ , and was significantly greater than scores in the control condition,  $t(22) = 2.3$ ,  $p < .01$ . Thus, when objects were unfamiliar and labeled with the underspecified noun *thing*, 36-month-olds reliably picked property-matched over kind-matched test objects. This contrasts with the results of Experiment 1, where, with familiar objects, 36-month-olds were at chance in their object choice.

### Discussion

The results from Experiment 2 provide further evidence concerning the interplay between linguistic and conceptual information in children's adjective mapping. First, when the novel adjectives modified basic-level names that were also novel and described unfamiliar objects, children's responses indicated that they mapped the adjective to the target property shared by the training objects. Unlike in the analogous condition in Experiment 1, each trial here included novel nouns as well as a novel adjective, thus making for a more challenging learning situation. Nevertheless, even the youngest participants were successful in the adjective learning task. Thus, whatever role the modified noun plays in the mechanisms of adjective acquisition, it is not essential that it, nor the object it labels, be familiar to the learner. Learners presumably assign a shape-based category interpretation to the novel noun, which is similar to a basic-level construal (Diesendruck & Bloom, 2003; Landau et al., 1988, 1992, 1998). Thus, even though learners' knowledge of these objects was sparse, the noun could provide a construal of the object so that they could then determine the relevant property to associate with the adjective.

Results from the superordinate-name condition provide an interesting contrast. In this condition, the noun, *toy*, was familiar, yet children in both age groups failed to show consistent mapping of the adjective to the target property. These results contrast with those for the basic-name condition just discussed and with the results for the analogous superordinate condition in Experiment 1: With familiar objects, both 2- and 3-year-olds mapped the novel adjective to the target property when the object label was *toy*. Clearly, then, the presence of a category-specific noun is not sufficient to support successful adjective mapping.<sup>6</sup> The interpretation of participants' behavior in the superordinate condition becomes clearer once one considers the results in the other conditions collectively and compares them with the results in the analogous conditions in Experiment 1. Hence, the results from the

superordinate condition are reconsidered following a discussion of the results of the remaining conditions in Experiment 2.

For the older children, the underspecified conditions in this experiment yielded results the reverse of those in Experiment 1: Here, 36-month-olds in the underspecified-one condition did not consistently map the novel adjective to the target property, whereas in the underspecified-thing condition, they did. In Experiment 1, *thing* was argued to be an infelicitous noun because learners were not guided to select a category and perhaps were confused by the pragmatic oddness of using *thing* to label familiar objects. But in Experiment 2, the use of *thing* made sense, as participants had no names for the objects and no specialized conceptual knowledge about them. Recall, in addition, that the experimenter solicited participants' help in learning about the "monster toys" at the beginning of the experiment, so participants also had reason to believe that the experimenter was unfamiliar with the objects. In contrast, whereas *one* was felicitous for 36-month-olds in Experiment 1, presumably because it presupposed a specific category, in Experiment 2 there were no known categories for *one* to select, and thus a crucial step on the way to adjective mapping could not be taken. Of course, in principle, 36-month-olds could have interpreted *one* in the same way that they did *thing* or the novel basic-name terms; their inability to reliably map the novel adjective's meaning suggests, however, that *one* was interpreted differently than the other terms and that this difference somehow hindered subsequent adjective acquisition. The account proposed here is that toddlers were hindered by the use of the pronoun *one* because they were unable to figure out what kind of category the speaker had in mind—the speaker's construal of the object—since the objects were unfamiliar. Apparently, children did not revert to a shape-based interpretation—as they putatively did when novel names or *thing* was used—because they understood that *one* presupposes shared knowledge on the part of speaker and hearer, and this presupposition was violated. This account is consistent with other research demonstrating that children consider pragmatic information in word learning (Akhtar, Carpenter, & Tomasello, 1996; Diesendruck & Markson, 2001; Diesendruck, Markson, Akhtar, & Reudor, 2004; Tomasello & Akhtar, 1995).

Across experiments, the pattern of results in the underspecified conditions suggests that children evaluate the information provided by the noun against their conceptual knowledge of the objects at hand. When this evaluation yields a compatible construal, then adjective mapping can proceed. According to this view, 24-month-olds' failure in all underspecified conditions might be due to their incomplete knowledge of the presuppositions involved in *one* and *thing*, or it might be due to their inability to integrate and evaluate this information with the objects in the reference field and with their conceptual knowledge of the objects. This account of the steps leading to successful adjective mapping also provides an account of the results for the superordinate condition in Experiment 2. Specifically, the superordinate noun *toy* is a familiar word and designates a familiar concept to participants.

<sup>6</sup> Three-year-olds in a study by Klibanoff and Waxman (2000) also failed to map a novel adjective, even when it modified a familiar noun, when they were shown only one instance of an object with the designated property (see also Mintz & Gleitman, 2002, for discussion).

However, the objects that were labeled as toys were unfamiliar and did not resemble familiar toys. Nor was there any functional demonstration of these objects playing a toylike role (Diesendruck, Markson, & Bloom, 2003). Thus, toddlers were unsure how to reconcile their conceptual knowledge of toys with the objects being labeled as toys. According to this account, the failure to integrate category information from the noun with conceptual information about the objects hindered subsequent adjective mapping. Hence, linguistically providing a taxonomic construal is not sufficient to support adjective acquisition if the conceptual information associated with the label cannot be integrated with the labeled object.

Preliminary evidence in support of this account comes from a pilot study that resembled the superordinate-name condition in Experiment 2 but in which the experimenter and several puppets played with the novel “toys” for a brief period of time, for each trial, before the test questions for the trial were administered. In this way, the status of the novel objects as toys was emphasized and demonstrated functionally. Thirty-six-month-olds then successfully mapped the novel adjective to the shared property, as evidenced by their significant tendency to select property-matched over kind-matched test objects. An additional control condition confirmed that it was not merely the increased interaction and play with the objects that resulted in this new behavior. These preliminary findings provide evidence in support of the proposal that 36-month-olds’ failure to map the novel adjectives in the superordinate-name condition in the present experiment resulted from their difficulty in integrating the novel objects into their concept of toys.

The failure in mapping in the superordinate condition is especially striking given 36-month-olds’ successful adjective mapping in the underspecified-thing condition, because superficially these conditions were quite similar in that one label was used for each training object, *toy* in the superordinate condition and *thing* in the underspecified-thing condition. This contrast is one example of the overall pattern of the differences in children’s behavior between conditions and between the two experiments, underscoring the influence of the modified noun in children’s interpretation of adjectives and offering some clues as to how children integrate the linguistic information from the noun with the referential context.

As in Experiment 1, in Experiment 2 there was a developmental change in children’s behavior in the underspecified conditions. Twenty-four-month-olds did not learn the adjective mappings when the objects were labeled as *things*, whereas 36-month-olds did. Twenty-four-month-olds were clearly able to conceive of the objects in such a way as to be able to learn labels for their attributes, as evidenced by their success in learning the adjectives in the basic-name condition; hence, their failure in the underspecified-thing condition must have been partially linguistic. Their mastery of *thing* and its conditions and implications of use was apparently less developed than that of 36-month-olds, so for them it did not bias a specific (shape-based) category construal of the objects. This account is similar to that given for the contrast between 24- and 36-month-olds’ performance in the underspecified-one condition in Experiment 1: Children’s understanding of the pragmatic and discourse consequences of *thing* and *one* develops in the 2nd year. Although this account makes sense logically and is consistent with the pattern of findings here, ideally one would like independent confirmation of the developing knowl-

edge of these words. In any case, something clearly must develop to account for the specialized efficacy of *one* and *thing* to support adjective mapping in different situations among 36-month-olds, and that something is not simply a general ability to learn adjectives, because the support of the individual underspecified nouns is conditioned by the familiarity of the objects (and, presumably, by related conceptual knowledge of them). Studies are currently under way that explicitly test how *one* and *thing* are interpreted by toddlers given novel and familiar objects.

## General Discussion

When a child hears a novel adjective used to describe an object, he or she is faced with the task of determining to which property the adjective refers. For a given object, the particular way in which it is construed when it is described (e.g., as a toy, a zebra, or an animal) makes available certain properties, but not others, as plausible targets for a novel adjective; some properties that are possible interpretations under one construal are not possible under another. Therefore, knowing the construal allows a learner to constrain the possible interpretations and rule out the unlikely or impossible ones.

One reliable source of information about the intended category of an object is provided by the noun that labels it: In general, a noun, such as *car*, or *toy*, activates a specific category or concept that indicates how the speaker construes the object in a labeling event. There are exceptions, however: Nouns such as *one* and *thing* are underspecified with respect to category, and on different occasions they can be used to specify different taxonomies and different levels within a taxonomy. For example, referring to a toy zebra as “this thing” or “this one” gives no indication as to whether it is construed as a zebra, an animal, or a toy. Alone, those nouns do not indicate a specific category, but each of these terms carries specific implications about the speaker’s construal of the objects. In particular, in the case of *one*, there is an implication that the speaker has a particular category in mind, that the speaker thinks the hearer knows the category, and that the object is an exemplar of that category. In contrast, *thing* implies that the particular category is unknown or unavailable to the speaker, or is perhaps unimportant in the discourse, and further implies that any known category concept associated with the object was not explicitly intended by the speaker.

The results presented here both add to the evidence that toddlers rely, in part, on the noun that the adjective modifies to compute an interpretation (Mintz & Gleitman, 2002) and help to elucidate some of the specific ways that information from nouns can be used. The results also suggest that between 24 and 36 months of age, toddlers develop an understanding of the pragmatic conditions governing the use of *one* and *thing*. Finally, the results provide evidence that children’s conceptual knowledge of the labeled objects is evaluated against the information provided by the noun: Whether the objects are novel or familiar modulates the effect of the noun on the ability of children to map a novel adjective to the target property. Given adjectives’ critical dependence on category construal for interpretation, the hypothesis put forward here is that toddlers integrate the category information supplied by the noun with their knowledge of the labeled object to arrive at a specific taxonomic construal of the object; when this integration process

does not result in a coherent categorization of the object, adjective mapping is hindered.

However, there is another interpretation of these findings that is consistent with the notion that children evaluate the noun with respect to their conceptual knowledge but that attributes failure in adjective mapping to the child's perception of a violation of discourse pragmatics and ensuing confusion, rather than to the child's failure to identify a category construal of the object. The logic of that account is that if an utterance is pragmatically anomalous (e.g., as is claimed to happen when *one* and *toy* refer to novel objects, or when *thing* refers to a familiar object), then children are reluctant to confer meaning to unknown words in light of this confusing anomaly. In this view, taxonomic identity per se is not what is crucially lacking when adjective mapping fails; rather, what is lacking is pragmatic coherence. This interpretation has the flavor of other recent theories that propose that some constraints involved in word learning are most accurately described as constraints governed by general pragmatic considerations as opposed to being specific to word learning (e.g., Diesendruck & Markson, 2001). Thus, perhaps there is not a special condition in the mechanisms of adjective acquisition that requires a construal; rather, perhaps it is the case that when a construal is not provided, toddlers are confused about the speaker's intent and hesitant to make further inferences about the utterances, including inferences about the meaning of a novel adjective.

It would be interesting to carry out follow-up studies to test whether the crucial role of the construal is to provide a means of restricting candidate adjective meanings or whether, more generally, it is to provide an indication of pragmatic coherence that only indirectly affects adjective learning. At present, the former interpretation provides the most parsimonious account of the data from a range of studies in adjective acquisition and of the logical necessities of adjective interpretation. However, the data presented here are consistent with both interpretations.

Even if the first account turns out to be correct, an open question is whether the failures in adjective mapping in these studies were a result of a special adjective-learning constraint that halts attempts to map the word to a property when a category construal is not successfully computed or whether the absence of a construal simply makes the mapping task more difficult and less consistent (for the logical considerations outlined earlier). The kind of evidence that would address this question would come from studies in which possible meanings are restricted to various degrees without providing specific category information. A word-learning constraint account would predict that adjective mapping should be successful only when category information is available, whereas a difficulty account would predict that successful mapping should be more likely as the degree of restriction is increased. Although not designed for this purpose, some prior studies provide such experimental scenarios. In a study by Akhtar (2002) with 2- and 3-year-olds, the learning situation provided strong directive cues to the target property by first specifying the attribute dimension using known adjectives. When children heard three novel objects described sequentially as "a round one," "a square one," and "a *dacky* one," they associated *dacky* with the shape of the third object. In contrast, when the first two objects were described as "a fuzzy one" and "a smooth one," then toddlers associated *dacky* with the third object's texture. In another study with 3- and 4-year-olds (Waxman & Klibanoff, 2000, Experiment 1), the target property

was cued by explicitly contrasting two exemplars, one that had the property and one that did not.

Both of those studies provided directive cues that severely restricted the possible meanings to a very narrow range, and adjective mapping was successful. Further research is necessary to determine whether less extreme cues could also guide a learner to the target property in the absence of a category construal, but it appears that when strong cues to the relevant property dimension are available, the noun need not provide category information for effective adjective learning to occur (see also Smith, Jones, & Landau, 1992). Nevertheless, when strong cues are not available, information provided by the noun plays an important role in restricting the myriad of meanings available to the learner, and toddlers appear to pay attention to the noun in determining an adjective's meaning, from as early as 24 months.

The present results pertain to issues in adjective acquisition, but they also provide interesting data relevant to understanding the development of children's knowledge of the terms *thing* and *one*. For 36-month-olds, but not 24-month-olds, *one* and *thing* gave rise to complementary patterns of adjective mapping that depended on the familiarity of the labeled objects. This result suggests that the older children were aware of the pragmatic implications of these terms, whereas the younger children were not, or at least they were not able to put this knowledge to use in interpreting novel adjectives. Precisely what knowledge or capacities develop is an open question, but these data suggest that something important develops with respect to knowledge of these words between the 2nd and 3rd birthdays. The data also have implications for designing experiments to study language development: *One* and *thing* are not merely neutral substitutes for specific object labels. In using these terms in experiments, one has to consider how children will evaluate them against their knowledge of the entities to which the terms refer.

In this context it is interesting to reconsider the previously cited familiarity effect for 4-year-olds reported by Hall et al. (1993). Recall that Hall et al. found successful adjective mapping in 4-year-olds for familiar objects, but not for unfamiliar objects, when the modified noun was *one*. They concluded that adjective mapping was facilitated when the described objects were familiar. The results from the present studies suggest that the familiarity effect reported by Hall et al. was due in part to the use of the noun *one* to label the objects. The present studies show that for 36-month-olds, the familiarity effect is reversed when the noun is switched from *one* to *thing*, and further that unfamiliar objects do not hinder adjective mapping as long as coherent category labels are used. Nevertheless, the omnibus ANOVA did reveal that familiar objects elicited relatively more property-matched responses, overall, than did novel objects, suggesting that adjective learning might be globally easier when familiar objects are involved, as might any kind of word learning.

## Conclusion

When toddlers assign a meaning to a novel adjective, they attend to the noun that is used to label the object as part of the process of determining the adjective's meaning. Nouns that designate a category facilitate adjective mapping, whether they designate basic-level or superordinate concepts, presumably because they restrict the set of possible meanings the learner considers, much like

syntactic information restricts learners' hypotheses of verb meanings (Gleitman, 1990; Landau & Gleitman, 1985). However, the noun need not designate a category in and of itself. Taxonomically underspecified nouns such as *thing* and *one* can facilitate adjective mapping when the referential scene combines with the underspecified noun to give rise to a category interpretation. Thus, 36-month-olds interpret *one* with respect to familiar objects to settle on a known category, and children of the same age interpret *thing* with respect to novel objects to designate a shape-based categorization of the objects. Under these conditions, taxonomically underspecified nouns facilitate adjective mapping, as do nouns that designate specific category concepts. However, 24-month-olds do not succeed when *thing* or *one* is used. Thus, in addition to demonstrating the importance of nouns in toddlers' interpretation of adjectives, these findings suggest that toddlers' knowledge of the nouns *one* and *thing* and their conditions of use develops between the 2nd and 3rd years of life. Finally, these findings suggest that the best interpretation of the familiarity effects on adjective mapping reported in prior research (Hall et al., 1993; Taylor & Gelman, 1988) is not that novel adjectives are learnable only when applied to familiar objects, but that the noun used in those studies was *one*, which reliably provides a construal only with familiar objects. Thus, the studies reported here synthesize several areas of prior research in adjective acquisition and provide further evidence of the importance toddlers place on nouns in interpreting novel adjectives.

### References

- Akhtar, N. (2002). Relevance and early word learning. *Journal of Child Language, 29*, 677–686.
- Akhtar, N., Carpenter, M., & Tomasello, M. (1996). The role of discourse novelty in early word learning. *Child Development, 67*, 635–645.
- Clark, E. V. (1997). Conceptual perspective and lexical choice in acquisition. *Cognition, 64*, 1–37.
- Diesendruck, G., & Bloom, P. (2003). How specific is the shape bias? *Child Development, 74*, 168–178.
- Diesendruck, G., & Markson, L. (2001). Children's avoidance of lexical overlap: A pragmatic account. *Developmental Psychology, 37*, 630–641.
- Diesendruck, G., Markson, L., Akhtar, N., & Reudor, A. (2004). Two-year-olds' sensitivity to speakers' intent: An alternative account of Samuelson and Smith. *Developmental Science, 7*, 33–41.
- Diesendruck, G., Markson, L., & Bloom, P. (2003). Children's reliance on creator's intent in extending names for artifacts. *Psychological Science, 14*, 164–168.
- Fisher, C., Hall, D. G., Rakowitz, S., & Gleitman, L. R. (1994). When it is better to receive than to give: Syntactic and conceptual constraints on vocabulary growth. *Lingua, 92*, 333–375.
- Gillette, J., Gleitman, H., Gleitman, L. R., & Lederer, A. (1999). Human simulations of vocabulary learning. *Cognition, 73*, 135–176.
- Gleitman, L. R. (1990). The structural sources of verb meanings. *Language Acquisition: A Journal of Developmental Linguistics, 1*, 3–55.
- Gleitman, L. R., & Gleitman, H. (1997). What is a language made out of? *Lingua, 100*, 29–55.
- Golinkoff, R. M., Shuffbailey, M., Olguin, R., & Ruan, W. J. (1995). Young children extend novel words at the basic level: Evidence for the principle of categorical scope. *Developmental Psychology, 31*, 494–507.
- Hall, D. G., & Waxman, S. R. (1993). Assumptions about word meaning: Individuation and basic-level kinds. *Child Development, 64*, 1550–1570.
- Hall, D. G., Waxman, S. R., & Hurwitz, W. M. (1993). How 2-year-old and 4-year-old children interpret adjectives and count nouns. *Child Development, 64*, 1651–1664.
- Klibanoff, R. S., & Waxman, S. R. (2000). Basic level object categories support the acquisition of novel adjectives: Evidence from preschool-aged children. *Child Development, 71*, 649–659.
- Landau, B., & Gleitman, L. R. (1985). *Language and experience: Evidence from the blind child*. Cambridge, MA: Harvard University Press.
- Landau, B., Smith, L. B., & Jones, S. S. (1988). The importance of shape in early lexical learning. *Cognitive Development, 3*, 299–321.
- Landau, B., Smith, L. B., & Jones, S. S. (1992). Syntactic context and the shape bias in children's and adults' lexical learning. *Journal of Memory and Language, 31*, 807–825.
- Landau, B., Smith, L. B., & Jones, S. S. (1998). Object shape, object function, and object name. *Journal of Memory and Language, 38*, 1–27.
- Markman, E. M. (1990). Constraints children place on word meanings. *Cognitive Science, 14*, 57–77.
- Markman, E. M., & Hutchinson, J. E. (1984). Children's sensitivity to constraints on word meaning: Taxonomic versus thematic relations. *Cognitive Psychology, 16*, 1–27.
- Mintz, T. H., & Gleitman, L. R. (2002). Adjectives really do modify nouns: The incremental and restricted nature of early adjective acquisition. *Cognition, 84*, 267–293.
- Naigles, L. (1990). Children use syntax to learn verb meanings. *Journal of Child Language, 17*, 357–374.
- Pinker, S. (1984). *Language learnability and language development*. Cambridge, MA: Harvard University Press.
- Prasada, S. (1992). Acquisition of adjective meanings: A lexical semantic approach (Doctoral dissertation, Massachusetts Institute of Technology, 1992). *Dissertation Abstracts International, 54*, 1124.
- Quine, W. V. (1960). *Word and object*. Cambridge, MA: MIT Press.
- Smith, L. B., Jones, S. S., & Landau, B. (1992). Count nouns, adjectives, and perceptual properties in children's novel word interpretations. *Developmental Psychology, 28*, 273–286.
- Taylor, M., & Gelman, S. A. (1988). Adjectives and nouns: Children's strategies for learning new words. *Child Development, 59*, 411–419.
- Tomasello, M., & Akhtar, N. (1995). Two-year-olds use pragmatic cues to differentiate reference to objects and actions. *Cognitive Development, 10*, 201–224.
- Waxman, S. R., & Klibanoff, R. S. (2000). The role of comparison in the extension of novel adjectives. *Developmental Psychology, 36*, 571–581.
- Waxman, S. R., & Markow, D. B. (1998). Object properties and object kind: Twenty-one-month-old infants' extension of novel adjectives. *Child Development, 69*, 1313–1329.

Received August 26, 2003

Revision received June 28, 2004

Accepted August 9, 2004 ■