How Two- and Four-Year-Old Children Interpret Adjectives and Count Nouns

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HALL, D. GEOFFREY; WAXMAN, SANDRA R.; and HURWITZ, WENDY M. *How Two- and Four-Year-Old Children Interpret Adjectives and Count Nouns.* CHILD DEVELOPMENT, 1993, **64**, 1651–1664. We examined the role of object kind familiarity (i.e., knowledge of a count noun for an object) on preschoolers' sensitivity to the relation between a novel word's form class (adjective or count noun) and its reference (to a material kind-property or to an object kind). We used a forced-choice match-to-target task, in which children learned a word for one object (e.g., a metal cup), and then chose between 2 other objects. One was from the same object kind but a different material kind (with different related properties, such as color and texture; e.g., a white plastic cup); the other was from a different object kind but the same material kind (with the same related properties; e.g., a metal spoon). In Experiment 1, children learned either a count noun (e.g., "This is a zav") or an adjective (e.g., "This is a zav one"). Within each form class, we crossed the familiarity of the referent object kind (familiar and unfamiliar) with the age of the children (2- and 4-year-olds). The principal finding was that in interpreting an adjective, 4-year-olds were more likely to choose the object sharing material kind with the target if the target was familiar than if it was unfamiliar. No such familiarity effect was evident among 2-year-olds. In Experiment 2, we employed a more unambiguously adjectival frame (e.g., "This is a very zav-ish one"), and replicated the results of Experiment 1. We interpret the results in terms of 2 proposed word learning biases: one that learners initially expect any word applied to an unfamiliar object to refer to a (basic-level) kind of object, and a second that learners prefer words to contrast in meaning. We consider several interpretations of the observed age difference.

Young children know that a word may belong to any of several different grammatical categories, and that these different grammatical categories are associated with differences in reference. This knowledge is both important and impressive. The knowledge is important because it gives children a tool for limiting hypotheses about word meaning. For example, if children can identify a novel word as a count noun, then they can infer that the word refers to a kind (or a category) of individual (e.g., object). The knowledge is impressive because it is not obvious how children come by it; the grammatical categories are not marked transparently in the input children receive. For example, count nouns do not have a universally constant serial position, stress or pitch level, or identifying affix (Pinker, 1984).

There have been several experimental demonstrations of preschoolers' ability to identify words as coming from different grammatical categories, and to make relevant inferences about meaning. For example, Brown (1957) showed 3- and 4-year-old children a drawing of a pair of hands performing an action upon a substance in a con-

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tainer. If children heard the drawing described with a novel count noun ("a sib"), then they interpreted the word as referring to a kind of object (the container); if children heard a mass noun ("some sib"), then they took the word to refer to a kind of material (the substance); and if they heard a verb ("sibbing"), then they interpreted it as referring to an action (the action performed by the hands). More recently, Katz, Baker, and Macnamara (1974; also Gelman & Taylor, 1984) showed that children as young as 2 years of age expect that a count noun (e.g., "This is a zav") applied to an object will refer to a kind of object, while a proper name (e.g., "This is Zav") will refer to an individual.

Recently scholars have attempted to explain how young children *learn* the distinctions in reference associated with words from different grammatical categories. The acquisition of the category, count noun, may be the result of a relation between (1) children's expectations about the reference of words used under certain conditions and (2) caretakers' tendency to provide count nouns under these same conditions (e.g., Macnamara, 1982; Pinker, 1984). A growing body of evidence suggests that young children expect that a word applied to an unfamiliar object (i.e., an object for which they know no count noun for the kind) in an ostensive definition will refer to a kind of object. More specifically, this expectation appears to be that the word will refer to a particular kind of object, namely, a basic-level kind. Basic-level kinds have members that, among other things, share an intermediate level of shape similarity (for discussion, see Hall & Waxman, 1993). In this paper, our use of the expression "object kind" is always meant to imply "basic-level object kind," unless otherwise noted.

Some of the evidence that children have an object kind expectation in learning words consists of demonstrations that children will extend a count noun (e.g., "This is a dax") applied to an unfamiliar object to another object of the same object kind, rather than to an object of a different object kind sharing some other feature with the target, such as a thematic link, a color, or a texture (e.g., Baldwin, 1989; Landau, Smith, & Jones, 1988; Markman & Hutchinson, 1984; Taylor & Gelman, 1988; Waxman & Kosowski, 1990).

More striking evidence of children's preference to extend a word for an unfamiliar object to other objects of the same object kind consists of findings that children will do this even if the word is not a count noun, and therefore could *not* refer to a kind of object (in the adult language). For example, Soja (1992) and Soja, Carey, and Spelke (1991) have shown that 2-year-olds expect that a word applied to an unfamiliar object will refer to a kind of object, whether its form class implies a count noun interpretation (e.g., "This is a zav"), an unspecified noun interpretation (e.g., "This is my zav"), or a mass noun interpretation (e.g., "This is some zav"). Dickinson (1988) has replicated Soja et al.'s findings with 3-, 4-, and even 5-year-old children. A similar demonstration has been made by Markman and Wachtel (1988), who found that 3-year-old children tended to interpret a novel mass noun (e.g., "This is pewter") applied to an unfamiliar object as referring to a kind of object. Furthermore, Hall (1991) uncovered a similar effect in 2-year-olds' interpretation of a proper name (e.g., "This is Zav") applied to an unfamiliar object.

Fortunately for children, caretakers' strategies for introducing new words under ostension seem to dovetail with children's interpretative preferences. Caretakers strongly prefer to offer count nouns (words that refer to kinds of object), rather than mass nouns or proper names, as ostensive labels for (unfamiliar) objects (see Callanan, 1985; Hall, in press; Ninio, 1980; Shipley, Kuhn, & Madden, 1983). The combination of young children's interpretative preference and caretakers' input suggests how children may discover the grammatical category, count noun. That is, children expect that words applied ostensively to unfamiliar objects will refer to kinds of object, and the words caretakers typically provide ostensively for novel objects are count nouns. Once children know these words' grammatical correlates (e.g., that they may be preceded by the indefinite article), then they may use this knowledge to assist in identifying novel count nouns in the input addressed to them. In this manner, they may come to succeed in drawing the relevant inferences described earlier in Brown (1957).

If children hold a strong bias to interpret a word applied to an unfamiliar object as referring to a kind of object (i.e., as if it were a count noun), then how do they ever learn that some words may refer to the individual object (i.e., proper names), to its material kind (i.e., mass nouns), to object kinds at different hierarchical levels (i.e., subordinate-

level or superordinate-level, as opposed to basic-level count nouns), or to any of its properties (i.e., adjectives)? A recurrent finding from the experimental literature is that young children appear to be much more likely to interpret a novel word applied to an object as referring to *something other than* a (basic-level) kind of object if the referent object is *familiar* (if children already know a count noun for that kind of object) than if it is *unfamiliar* (if they do not know such a word).

For example, Soja et al. (1991; Soja, 1992) and Dickinson (1988) had difficulty in teaching 2- through 5-year-olds mass nouns for material kinds when the referents were unfamiliar objects. In contrast, Prasada (1993) found that 2½–3½-year-olds will readily interpret a mass noun as referring to an object's material kind when the object is familiar.[1] Moreover, Markman and Wachtel (1988) found that children interpreted a mass noun as referring to a kind of object if the referent object was unfamiliar; however, if the object was familiar, children more readily interpreted the word as referring to material kind. Similarly, Hall (1991) found that children were more likely to interpret a proper name as referring to an individual if the referent object was familiar than if it was unfamiliar. And Taylor and Gelman (1988, 1989) have presented evidence that children are more likely to interpret a count noun as referring to a subordinate-level kind, rather than a basic-level kind, if the referent object is familiar than if it is unfamiliar.

The preceding effects of familiarity upon interpretation may reflect two things. The first is a strong bias to interpret a word applied to a novel solid object as referring to the (basic-level) object kind (see Markman, 1989). The second is a bias to avoid interpreting two words as having the same meaning. Two versions of this second bias have been discussed in the literature: mutual exclusivity and lexical contrast. According to mutual exclusivity, the more stringent version, children should expect that any object will be a member of only one object kind. Although some of the observed familiarity effects are consistent with mutual exclusivity (e.g., Markman & Wachtel [1988]; the findings of Dickinson [1988], Prasada [1993], Soja [1992], Soja et al. [1991]; and Hall [1991]), mutual exclusivity cannot accommodate all the observed familiarity effects (e.g., Taylor & Gelman, 1988, 1989; see also Waxman & Senghas, 1992). The failure of mutual exclusivity to account for all the findings suggests that the bias guiding children's word learning may be less stringent. Children may instead be adhering to a lexical contrast bias (Clark, 1983, 1987). According to lexical contrast, children expect that no two words will have the same meaning, but words may have overlapping reference (see Gathercole, 1987, for critical discussion). Thus, a solid object *may* be construed as a member of more than one object kind.

The effect of familiarity on word interpretation has now been documented for words from several grammatical categories. But there is one category of word for which research has failed to uncover a clear familiarity effect, namely, the adjective. Unlike count nouns, which refer to kinds of individuals (e.g., objects), adjectives refer to properties.[2] The pattern of previous results leads to the prediction that young children should be more likely to interpret a word as referring to a property, rather than to a kind of object, if the referent object is familiar than if it is unfamiliar. Some recent research offers *indirect* support for this prediction.

Consider first a recent paper documenting considerable difficulty in teaching children adjectives for *unfamiliar* objects. Smith, Jones, and Landau (1992) taught one group of 3-year-old children an adjective (e.g., "This is a dax one") and another group a count noun (e.g., "This is a dax") for a target, an unfamiliar geometric object with a salient property (multicolored paint speckles or silver-gold glitter). Children then saw a set of other objects that differed from the target in shape and/or salient property. In their first two experiments, Smith et al.

[1] Prasada also mentioned the familiar count noun in teaching the new mass noun. For example, to teach the mass noun "sponge" for a ball made of sponge, he said, "This ball is made of sponge; this is a sponge ball." This procedural detail, mentioning the familiar count noun (e.g., "ball"), may have contributed to his success in getting such young children to make a material kind interpretation of the mass noun; see Waxman, Shipley, & Shepperson (1991).

[2] Recent analyses reveal principled distinctions between the semantics of adjectives (e.g., "brown") and count nouns (e.g., "dog"). For example, count nouns, but not adjectives, provide principles of identity and individuation; that is, only count nouns pick out individuals with identity (see Gupta, 1980; Macnamara, 1986).

found that children extended a count noun to objects sharing a similar shape, regardless of salient property; moreover, children showed a similar, though weaker, tendency to do the same if they heard an adjective. These results are consistent with the claim that children expect that a word (either a count noun or an adjective) applied to an unfamiliar object will refer to a kind of object, because shape is correlated strongly with object kind, at least for kinds of artifact. In a third experiment, Smith et al. made the salient property extremely salient by presenting the target object in a dark toy "cave," under intense light, so that the surface of the object glowed. In this experiment, children continued to extend the count noun on the basis of shape, but now they extended the adjective on the basis of the salient property. Smith et al. thus *were* able to lead children to interpret an adjective as referring to a salient property of an unfamiliar object, but the context had to be made extremely supportive of such an interpretation before children were willing to make it.

Now consider evidence that children who learn adjectives for *familiar* objects are less likely to show a bias to interpret the words as referring to kinds of object. Waxman and Kosowski (1990) showed that children as young as 2 years of age (2- to 4-year-olds) tended *not* to interpret an adjective as referring to a kind of object when the referent object was familiar. One group of children learned a count noun (e.g., "This is a fopin") and another learned an adjective (e.g., "This is a fopish one") for a drawing of a familiar object (e.g., a cow). All children then had to choose two other objects to which the new word applied. Two of these were from the same superordinate object kind (e.g., a fox, a zebra) and two were related thematically to the target (e.g., milk, a barn). Children who heard a count noun for the familiar object tended to select the objects from the same superordinate object kind; children who learned an adjective did not. Waxman and Kosowski (1990) did not show directly that the young children mapped an adjective onto a property interpretation, but they did show that children clearly avoided an object kind interpretation. Waxman (1990) has made a similar demonstration with 3-year-olds using a different task.

The preceding studies offer indirect evidence of a familiarity effect in the interpretation of novel adjectives, but it would be more desirable to compare familiar and unfamiliar objects within a single experiment, keeping all procedural details aside from familiarity constant. Taylor and Gelman (1988, Experiment 1) reported such a comparison. They tested 2-year-olds in a toy selection task. Children in this study saw four toys, members of two object kinds crossed with two kinds of material having distinct properties, such as color and texture (pale green fake fur and yellow and black plaid material). For half the subjects, both kinds of object were unfamiliar (two kinds of stuffed creature); for the other half, the kinds were familiar (stuffed dogs and stuffed birds). Within each group, half the children learned an adjective (e.g., "This is a zav one") for one of the toys; half learned a count noun (e.g., "This is a zav"). After learning the word, children carried out a series of actions in response to requests that included the novel word. Taylor and Gelman (1988) inferred children's interpretations of the novel word from the toys children selected. An object kind interpretation was inferred if children selected toys within the same kind, irrespective of salient property; a property interpretation was inferred if children selected toys that had the same salient property, regardless of object kind.

Taylor and Gelman (1988) found that 2-year-olds made relatively more property interpretations if the word was an adjective and more object kind interpretations if the word was a count noun, averaging over object familiarity. Children thus showed a sensitivity to the distinction in reference between the two types of word. In addition, Taylor and Gelman found a familiarity effect, but only in the interpretation of the count noun. That is, children who learned a count noun were more likely to focus on the named object only, and less likely to select the other member of the same object kind, if the object was familiar than if it was unfamiliar. Subsequent research suggested that this finding likely reflected the fact that children were making a subordinate-kind interpretation of the count noun applied to the familiar object (Taylor & Gelman, 1989). However, Taylor and Gelman (1988) did *not* find a familiarity effect in the interpretation of a novel adjective.

Taylor and Gelman's (1988) findings suggest that 2-year-olds are sensitive to the relation between adjectival form class and reference to a property, because they showed a tendency to make a property interpretation of an adjective irrespective of object familiarity. However, their failure to find a familiarity effect calls out for further

investigation for two reasons. First, other investigations *have* found familiarity effects in the acquisition of words from other grammatical categories (as did Taylor & Gelman, 1988, themselves for count nouns); those results suggest that children should be *more* likely to focus on object kind and *less* likely to attend to a property (or to material kind) if the referent object is unfamiliar than if it is familiar. Second, other research on children's interpretations of adjectives lends indirect support to the hypothesis that adjectives are easier to learn for familiar than unfamiliar objects (e.g., Smith et al., 1992; Waxman & Kosowski, 1990).[3]

In this article, we pursue the study of children's expectations concerning the reference of adjectives. In Experiment 1, we examined the effect of object kind familiarity on children's interpretations of novel adjectives. In order to determine whether any observed familiarity effect was a general effect of acquiring words rather than adjectives in particular, we manipulated the form class of the words taught; half the subjects learned adjectives, and the remainder learned count nouns.

The general design of this experiment is reminiscent of Experiment 1 of Taylor and Gelman (1988), but it differed in two important ways. First, in order to see if Taylor and Gelman's (1988) findings held up with a change in method, we used a forced-choice match-to-target task. Use of this task enabled us to employ several sets of objects, rather than only one set, for each child. Second, and more important, we were curious about any differences in the interpretation of adjectives at different times during the preschool years. Taylor and Gelman (1988) failed to find a familiarity effect with 2-year-olds, and there has been some recent debate about whether the tendency to assume mutual exclusivity (or lexical contrast) is evident in 2-year-olds' word learning. Some evidence suggests that 2-year-olds are less likely to show a familiarity effect than are 4-year-olds (for discussion, see Merriman, 1991, and Woodward & Markman, 1991; see also Merriman & Bowman, 1989; Merriman & Schuster, 1991). To examine the issue of age-related differences in the impact of object kind familiarity on interpretation, we tested equal numbers of 2-year-olds and 4-year-olds on the task.

Experiment 1

Method

Subjects.—Eighty children participated, 40 2-year-olds and 40 4-year-olds. The 2-year-olds ranged in age from 2 years, 2 months to 2 years, 11 months, with a mean age of 2 years, 7 months. The 4-year-olds ranged in age from 4-1 to 4-11, with a mean age of 4-5. Ten children of each age were assigned randomly to each of four conditions, such that all conditions had approximately equal numbers of boys and girls and approximately the same mean age. The four groups were: unfamiliar targets—noun (mean ages 2-6 and 4-5), unfamiliar targets—adjective (mean ages 2-6 and 4-6), familiar targets—noun (mean ages 2-8 and 4-5), familiar targets—adjective (mean ages 2-7 and 4-4). Children were tested in their preschools during normal school hours. They were from primarily white middle- and upper-middle-class backgrounds.

Materials.—Eight triads of objects were used, four involving unfamiliar objects and four involving familiar objects. In each triad there was a target object, for which the children were taught a novel word. In addition, there was an object that matched the target in object kind but differed in material kind (and related properties, such as color and texture). The third object matched the target in material kind (and related properties) but differed in object kind from the target. In the Unfamiliar conditions, the object kinds were all intended to be unfamiliar (i.e., it was intended that children knew no count noun for the basic-level object kind). The object kinds in the Familiar conditions were intended to be familiar. The material kinds (and related properties) used in each triad of Unfamiliar stimuli corresponded to those used in a triad of Familiar stimuli. Table 1 describes all triads.

[3] There is another study that has examined preschoolers' understanding of adjectives. Gelman and Markman (1985) report two experiments on children's understanding of adjectives and count nouns. However, they did not teach children a word for an object in order to examine to which other objects children would extend it. Instead children in these experiments saw arrays of four drawings. The authors' interest lay in seeing whether children expected an adjective (e.g., "Find the zav one") to pick out a drawing that depicted an object that contrasted on a dimension within an object kind, and whether they expected a count noun (e.g., "Find the zav") to pick out a drawing that depicted an object that contrasted with other objects in object kind. They found some evidence that (especially older) preschoolers had this expectation.

TABLE 1

DESCRIPTION OF STIMULUS TRIADS

Target	Same Object Kind	Same Material Kind
Unfamiliar sets:		
glass tongs	red plastic tongs	glass napkin ring
metal garlic press	white plastic garlic press	metal apple corer
straw cornucopia	denim cornucopia	straw basket handle
black leather warmer	blue wool warmer	black leather pack
Familiar sets:		
glass plate	red plastic plate	glass cup
metal cup	white plastic cup	metal spoon
straw hat	denim hat	straw basket
black leather glove	blue wool glove	black leather belt

Familiarity of the object kinds.—We conducted a separate pretest with a different group of children to verify that the intended unfamiliar objects were unfamiliar (i.e., that children likely knew no count noun for the object kinds) and that the familiar objects were familiar. We based this pretest on the one employed by Markman and Wachtel (1988, Experiment 2). Seven 2-year-olds (mean age 2-9; ranging from 2-5 to 2-11) and seven 4-year-olds (mean age 4-5; ranging from 4-1 to 4-8) were tested individually. None participated in either of the experiments.

The experimenter first provided a practice trial. She showed children a pencil (a familiar object not included as a target or test item), and asked them if they knew a name for the kind of thing. All children answered "a pencil." The experimenter then said "yes," and told them that it was good to say the names for kinds of things that they knew. She next showed children a plastic object (an unfamiliar object not included as a target item) and asked if they knew a name for it. No child provided a label. The experimenter admitted that she also knew no name for the kind of thing (a true statement), and that it was good not to say a name for kinds of things that one did not know.

Children then saw each of the 24 objects described in Table 1, one at a time. For each object, the experimenter asked the children if they knew what it was. If children produced an appropriate count noun, or if they indicated that they did not know a name, the experimenter moved to the next item. If children attempted some description of the object, then they were given a forced-choice comprehension task. In this task, children saw the object along with two other unfamiliar distractors. The distractors were selected from among the following: a white plastic pasta measurer, a pasta measurer made of wooden dowels, a clear plastic architect's curve, a piece of a purple plastic clip, a black metal three-hole punch, a white plastic pot scraper with a thumb hole, and a plastic accordion telescope. Children were asked to point to the X, where X was the (basic-level) count noun for the object. Thus, an object was judged familiar if children generated an appropriate count noun for it, of if they pointed to it in the comprehension task. An object was judged unfamiliar if children said "I don't know" or shrugged, or if they failed to point to it in the comprehension task.

We assigned each object a familiarity score; this score ranged from 0% (never judged familiar) to 100% (always judged familiar). The mean familiarity scores for the *familiar targets* (glass plate, metal cup, straw hat, black leather glove) were 100% for the 2-year-olds and 96% for 4-year-olds. The mean familiarity scores for the *unfamiliar targets* (glass tongs, metal garlic press, straw cornucopia, black leather warmer) were 7% for the 2-year-olds and 14% for the 4-year-olds. Mean familiarity scores also were computed for the *familiar test objects;* this score was 91% for both the 2-year-olds and the 4-year-olds. Mean familiarity scores for the *unfamiliar test objects* then were computed; they were 5% for the 2-year-olds and 2% for the 4-year-olds.[4]

[4] For familiar target items, the 2-year-olds and 4-year-olds received the comprehension test on average on 11% and 7% of trials, respectively. For unfamiliar target items, 2-year-olds received the comprehension test on 21% of the trials, on average; 4-year-olds did so on 29% of the trials, on average. For familiar test items, the comprehension test was administered on 9% of trials for

TABLE 2

MEAN NUMBER OF MATERIAL KIND SELECTIONS OUT OF FOUR

	Unfamiliar	Familiar
Experiment 1:		
Count noun:		
2-year-olds	1.2 (.63)*	.7 (.48)*
4-year-olds	.4 (.70)*	1.0 (1.63)
Adjective:		
2-year-olds	1.6 (.97)	1.1 (.57)*
4-year-olds	.8 (1.03)*	3.0 (1.16)**
Experiment 2:		
Adjective:		
2-year-olds	1.3 (1.06)	1.2 (1.03)*
4-year-olds	1.4 (1.58)	3.3 (.68)**

NOTE.—N = 10 per condition. Standard deviations are in parentheses.

* Mean is significantly less than chance, $p < .05$.

** Mean is significantly greater than chance, $p < .05$.

In summary, the pretest results reveal clear differences in object kind familiarity between the unfamiliar and familiar stimuli. Whereas the familiarity scores for the familiar objects were above 90% on average, the familiarity scores for the unfamiliar objects were on average below 15%.

Procedure.—In the experiment proper, children took part in four trials. Children saw either four unfamiliar triads or four familiar triads. There were two conditions.

In the Count Noun conditions, the experimenter began each trial by presenting the target object from the triad, pointing to it, and labeling it with a count noun. She said, for example, "See this? This is a zav." The experimenter then asked the child to repeat the count noun. She then repeated the count noun up to three times herself. The target was kept in view as the child saw the two choices, one that matched the target in object kind but differed in material kind, one that matched in material kind but mismatched in object kind. Children were asked, "Can you find another zav?"

Children in the Adjective conditions received the same treatment, except that they heard the novel word introduced as an adjective. The experimenter labeled the object by saying "See this? This is a zav one." Children were asked, "Can you find another one that is zav?"

After making these selections, children were asked for explanations. For example, pointing to the chosen object, the experimenter asked, "Why is this a zav?" or "Why is this a zav one?"

To counterbalance, we used a Greco-Latin square design. Subjects within each condition saw the object triads in a varying order and heard the nonsense words in a separately varying order. The left-right position of the two choice objects was determined randomly. The same Greco-Latin square and the same left-right positions were used in all conditions. The novel words used were "blick," "fep," "wug," and "zav."

Results and Discussion

Children received a score from 0 to 4 to reflect the number of trials on which they made a material kind selection. We conducted a three-way ANOVA using this dependent measure, with age (2-year-olds, 4-year-olds), familiarity (Unfamiliar, Familiar), and form class (Count Noun, Adjective) as between-subjects factors. The means from each condition appear in Table 2.

There was a significant effect of familiarity, $F(1, 72) = 4.35$, $p < .05$. As predicted, there were more material kind selections if the target was familiar than if it was unfamiliar. Form class also was a significant factor, $F(1, 72) = 13.76$, $p < .0005$, with children

the 2-year-olds and 4% for the 4-year-olds, on average. For unfamiliar test items, the comprehension test was administered on average on 23% of trials for 2-year-olds and 13% of trials for 4-year-olds.

TABLE 3

NUMBER OF CHILDREN MAKING THREE OR FOUR MATERIAL KIND SELECTIONS OUT OF FOUR

	Unfamiliar	Familiar
Experiment 1:		
Count noun:		
2-year-olds	1	0*
4-year-olds	0*	2
Adjective:		
2-year-olds	1	0*
4-year-olds	1	6**
Experiment 2:		
Adjective:		
2-year-olds	2	1
4-year-olds	2	9**

NOTE.—N = 10 per condition.
* Significantly below chance, $p < .05$.
** Significantly above chance, $p < .05$.

making more material kind selections if they learned an adjective than if they learned a count noun. Finally, the age × familiarity interaction was significant, $F(1, 72) = 19.40$, $p < .0001$. Follow-up tests of simple effects revealed a significant familiarity effect among the 4-year-olds ($p < .001$), but not among the 2-year-olds ($p > .10$).

Three effects approached significance ($p = .07$). The first two were the age × form class and the familiarity × form class interactions. Because we had a theoretical interest in these interactions, we computed simple effects tests. These tests revealed that the effect of form class was significant among 4-year-olds ($p < .001$) but not among 2-year-olds ($p > .15$), and that the effect of familiarity was significant in the Adjective conditions ($p < .01$), but not the Count Noun conditions ($p > .85$). The third near-significant effect was the three-way interaction, which can be interpreted as showing that the age × familiarity interaction (i.e., the tendency for 4-year-olds but not 2-year-olds to show a familiarity effect) was larger for the Adjective than for the Count Noun conditions.

We next considered children's performance with respect to chance. If children had selected items at random on the four trials, then they should have made two material kind selections out of the four forced choices (i.e., they should have made a material kind selection on 50% of the trials). The results showed that 4-year-olds in the Familiar Adjective condition were the only group who made significantly more material kind selections than would have been expected by chance: $t(9) = 2.79$, $p < .05$; 4-year-olds in the Unfamiliar Adjective condition were significantly below chance, $t(9) = 3.67$, $p < .01$. Among 2-year-olds in the Adjective conditions, those in the Unfamiliar condition selected at chance levels, while those in the Familiar condition were significantly below chance, $t(9) = 5.10$, $p < .001$. In all Count Noun conditions but the 4-year-old Familiar condition (performance not significantly different from chance expectancy), children selected the material kind match significantly less often than chance. Table 2 shows how performance in each condition compared to chance.

To analyze further the age differences in the familiarity effect, we classified children based on the pattern of their performance over all four trials. We classified those who selected a material kind match on three or four trials out of four as having made a material kind (or related property) interpretation. The resulting numbers appear in Table 3. For both 2- and 4-year-olds, we used Fisher's exact tests to examine the relation between making or not making a material kind interpretation and being in an Unfamiliar or a Familiar condition. In the Count Noun conditions, the relation was not significant for either 2-year-olds or 4-year-olds. In the Adjective conditions, the relation was significant for the 4-year-olds ($p < .05$), but not the 2-year-olds.

We then used the binomial theorem to determine whether the number of children in any condition showing a material kind (or

related property) interpretation exceeded chance expectancy. Any child should have made three or four material kind selections with a probability of .3125. In a group of 10 children, if six children or more made three or four material kind selections, then performance exceeded chance, $p < .05$; if no child in a group made three or four material kind selections, then performance was below chance, $p < .05$. Thus, the only condition in which the number exceeded chance was the 4-year-old Familiar Adjective condition. The number was below chance in three other conditions. The conditions are indicated in Table 3.

Finally, we carried out analyses that treated items, rather than subjects, as a random effect. We examined differences among conditions in terms of the numbers (out of 10 children) of material kind selections made on each item. Again, within the Adjective conditions, we found a familiarity effect in the 4-year-old conditions, paired $t(3) = 3.31$, $p = .05$; significantly more 4-year-olds selected a same material kind match if the objects were familiar ($M = 7.50/10$) than if they were unfamiliar ($M = 2.00/10$). This effect was not significant for the 2-year-olds. Within the Count Noun conditions, there was no familiarity effect for the 4-year-olds, but there was a reversed familiarity effect for the 2-year-olds. In other words, significantly more 2-year-olds selected an object matching in material kind if the targets were unfamiliar ($M = 3.00/10$) than if they were familiar ($M = 1.75/10$), paired $t(3) = 5.00$, $p < .05$. However, notice that in neither case was the mean number of children selecting a material kind match greater than 3 out of 10.

The analyses of Experiment 1 thus revealed clear differences between 2- and 4-year-olds in the tendency to distinguish the reference of an adjective taught for a familiar and an unfamiliar object. Four-year-olds, but not 2-year-olds, were more likely to select another object matching in material kind (not in object kind) than one matching in object kind (not in material kind) when the object was familiar than when it was unfamiliar. In this regard, 2-year-olds' performance on this task recalls the findings of Taylor and Gelman (1988), who also failed to uncover a familiarity effect in the interpretation of novel adjectives.

What might account for 2-year-olds' failure to demonstrate a familiarity effect in the interpretation of a novel adjective? One possibility is that the syntactic frame in which the adjective was introduced was not clear enough for 2-year-olds. Given recent suggestions that 2-year-olds *do* show some sensitivity to the distinction in reference between adjectives and count nouns, we decided in Experiment 2 to use a sentence frame that marked the novel word more clearly as an adjective. If the age difference we obtained in Experiment 1 is attributable to 2-year-olds' failure to notice that particular adjectival frame (and not an overall insensitivity to the reference of adjectives), then this manipulation should lead 2-year-olds to make more material kind selections when they hear an adjective applied to a familiar object.

Experiment 2

Method

Subjects.—Forty children, 20 2-year-olds and 20 4-year-olds took part, drawn from the same area preschools as in Experiment 1. None had taken part in Experiment 1. The 2-year-olds ranged in age from 2-0 to 2-9, with a mean age of 2-4. The ages of the 4-year-olds ranged from 4-2 to 4-11, with a mean age of 4-7. Ten children within each age group were assigned randomly to a familiar condition (mean ages 2-4 and 4-8); the remaining children were assigned to an unfamiliar condition (mean ages 2-4 and 4-6). The numbers of boys and girls were approximately the same in all conditions. They were from primarily white middle- and upper-middle-class backgrounds.

Materials.—These were the same as in Experiment 1.

Procedure.—This was identical to the Adjective conditions in Experiment 1, with one change. Recall that in Experiment 1, the syntactic frame had been "See this? This is a zav one." In order to suggest more strongly an adjective interpretation, the experimenter now introduced the word in the following way: "See this? This is a very zav-ish one." She asked the child to repeat the new word, and then asked the child, "Can you find another one that is very zav-ish?" The addition of the adverbial modifier "very" along with the adjectival suffix "-ish" (see Waxman & Kosowski, 1990) gave the children two additional clues that the word was intended to be interpreted as an adjective.

Results and Discussion

Children received a score from 0 to 4 to reflect the number of material kind selections they had made. The means from each condition, along with their standard deviations, appear in Table 2. An ANOVA with age (2-year-olds, 4-year-olds) and familiarity

(Unfamiliar, Familiar) as between-subjects factors was conducted. There was a significant effect of familiarity, $F(1, 36) = 6.31$, $p < .05$, revealing as predicted that there were more material kind selections if the object was familiar than if it was unfamiliar. There also was an effect of age, $F(1, 36) = 9.43$, $p < .005$, showing that there were more material kind selections made by 4-year-olds than by 2-year-olds. Finally, there was a significant familiarity × age interaction, $F(1, 36) = 7.79$, $p < .01$. Tests of simple effects revealed that the effect of familiarity was significant for the 4-year-olds ($p < .005$) but not the 2-year-olds ($p > .75$).

Children's performance next was compared to chance. If children had selected items at random on the four trials, then they should have made two material kind selections. The results showed that only 4-year-olds in the Familiar condition made significantly more material kind selections than would have been expected by chance: $t(9) = 6.02$, $p < .0005$; 4-year-olds in the Unfamiliar condition selected at chance levels. Neither group of 2-year-olds exceeded chance significantly, and 2-year-olds in the Familiar condition actually were below chance, $t(9) = 2.45$, $p < .05$. Table 2 reveals children's performance with respect to chance in each condition.

We then classified children according to the overall pattern of their selections. Those who made three or four material kind selections out of four trials were coded as having made a material kind (or a related property) interpretation. The numbers from each condition appear in Table 3. Fisher's exact tests revealed that for the 2-year-olds, there was no significant relation between making or not making a material kind interpretation and being in a familiar or an unfamiliar condition; for the 4-year-olds, however, the relation was significant, $p < .005$.

Recall our use of the binomial theorem in Experiment 1. Any condition in which six or more children out of 10 made a material kind (or related property) interpretation exceeded chance, $p < .05$; any condition in which no child made such an interpretation was below chance, $p < .05$. In this experiment, again, the only condition in which performance differed from chance was the 4-year-old Familiar condition, as indicated in Table 3, where performance exceeded chance.

Again, we carried out analyses that treated items as a random effect. We studied differences among the conditions in terms of the numbers (out of 10 children) who made material kind selections for each item. For the 4-year-olds, we again uncovered a significant difference between the Unfamiliar ($M = 3.50/10$) and Familiar conditions ($M = 8.25/10$), paired $t(3) = 7.55$, $p < .01$. This familiarity effect was not significant for the 2-year-olds.

Finally, we conducted an ANOVA to compare the results of Experiment 2 with those from the Adjective conditions of Experiment 1. This was a three-way ANOVA, with age (2-year-olds, 4-year-olds), familiarity (Unfamiliar, Familiar), and experiment (1, 2) as between-subjects factors. There were significant effects of age, $F(1, 72) = 12.39$, $p < .001$, familiarity, $F(1, 72) = 13.94$, $p < .0005$, and age × familiarity, $F(1, 72) = 25.13$, $p < .0005$. However, there was no significant main effect of experiment, and no significant interaction involving experiment, revealing that the interpretation of the novel adjective in Experiments 1 and 2 was essentially similar.

In summary, the age difference observed in Experiment 1 persisted in Experiment 2. Use of a more unambiguously adjectival sentence frame in Experiment 2 did not appear to have had an effect on 2-year-olds' tendency to show a familiarity effect in the interpretation of a novel adjective. In both studies, 2-year-olds showed no familiarity effect; 4-year-olds in both studies were significantly more likely to make a material kind selection if the object was familiar than if it was unfamiliar.

Explanations

Recall that we asked children to explain each of their four selections. We report these explanations to shed further light on questions concerning (1) children's knowledge of relevant words (count nouns, mass nouns, and related adjectives) for both familiar and unfamiliar objects, and (2) the consistency of children's explanations for their selections.

We pooled the justifications from Experiments 1 and 2. The maximum number of explanations was 40 within a condition (four trials per subject; 10 subjects per condition) and 240 over the six conditions (four conditions in Experiment 1; two in Experiment 2) within each age group. On 87% of their trials, 2-year-olds failed to respond to all (see also Merriman & Bowman, 1989, and Waxman & Kosowski, 1990, for similar difficulties in eliciting explanations from very

young children.) Four-year-olds responded at a higher rate; they failed to produce explanations on only 18% of their trials. Within the pool of explanations, we also found some that were ambiguous, that is, consistent with either an object kind or a material kind selection (i.e., those that mentioned the nonsense word, and those that said "because it's the same" or "because it looks like it" or some variant of this). For the 2- and 4-year-olds, respectively, 4% and 31% of the total number of trials fell into this category.

This left us with useful explanations from 9% and 52% of the trials for 2- and 4-year-olds, respectively. The vast majority of these explanations fell into seven categories: color, function, material kind, object kind, parts, shape, texture (or other material kind–related property). A small percentage of 4-year-olds' explanations (about 1%) did not fit any of these categories.

First, we considered the relation between object kind familiarity and children's tendency to mention object kind or material kind (or related properties) in their explanations. Judging from the pretest results, we expected that children would tend to mention a specific object kind only for familiar objects, because they would not know the object kind word for the unfamiliar objects. We also expected that children's willingness to mention a specific material kind or related property (such as a color or a texture) would *not* be linked to object familiarity, because material kind and related properties were matched between unfamiliar and familiar objects.

The explanations supported these predictions. First, object kinds were mentioned almost exclusively for familiar objects. Among 2-year-olds, there were 11 mentions of an object kind; 10 of these were for familiar objects. Among 4-year-olds, there were 14 mentions of an object kind; *all* were for familiar objects. In contrast, mention of material kind or a related property (e.g., color, texture) was not restricted to familiar objects. Two-year-olds never mentioned material kind or any other related property except color, which they mentioned five times. Three of these mentions were for unfamiliar objects; two were for familiar objects. Four-year-olds were more likely than 2-year-olds to mention material kind or a related property; they did so a total of 67 times. Thirty-eight of these were mentions of color; 23 were allusions to material kind; six were references to other material kind-related properties (e.g., texture). Fifty-five of the 67 explanations mentioned a specific kind or property (the remainder simply mentioned, e.g., "same kind of material" or "same color"). Twenty-two of these were for unfamiliar objects; 33 were for familiar objects. The specific words children mentioned appear in the Appendix.

Second, we examined the extent to which children's explanations were consistent with their selections. We reasoned as follows. If children selected the object kind match, then an explanation alluding to a function, an object kind, a part, or a shape was consistent, because it reflected some commonality shared by the target and the selection. If children selected the material kind match, then an explanation that alluded to a color, a material kind, or a texture (or another related property) was consistent, for the same reason. Among 2-year-olds, 13 of the 18 object kind selections had consistent explanations, but none of the four material kind selections did. Thus, 59% of 2-year-olds' selections were consistent. Among 4-year-olds, 46 out of 63 object kind selections received consistent explanations, as did 51 out of 61 material kind selections. Thus, 78% of 4-year-olds' selections were consistent.

In sum, the explanation data revealed that among both 2- and 4-year-olds, references to object kind were essentially restricted to the familiar objects, consonant with the pretest findings. However, children alluded to material kind or a related property to explain their choice of either a familiar or an unfamiliar object. Moreover, 4-year-olds offered a greater number of relevant material kind (or related property) words than did 2-year-olds. Finally, 4-year-olds were more likely than 2-year-olds to offer explanations that were consistent with their selections.

General Discussion

These experiments provide new evidence about preschoolers' understanding of the reference of adjectives and count nouns. The central finding was that 4-year-olds, but not 2-year-olds, showed a familiarity effect in the interpretation of a novel adjective (modeled in the syntactic frame "This is an X one" or "This is a very X-ish one"). In other words, 4-year-olds were more likely to select an object matching a target in material kind (and less likely to select one matching in object kind) if the target was familiar (i.e., children likely knew a count noun for the basic-level kind) than if it was unfamiliar

(i.e., children likely did not). No familiarity effect was evident in 2-year-olds' interpretation of an adjective; their tendency to select an object matching the target in material kind did not differ significantly according to the familiarity of the referent object. Furthermore, none of the 2-year-old groups showed a significant tendency to select the material kind matches; only the 4-year-old groups that learned adjectives for *familiar* objects did so. Moreover, neither 2- nor 4-year-olds showed a familiarity effect in the interpretation of a count noun; this finding is consistent with the possibility that they tended to make a basic-level interpretation if the target was unfamiliar and a subordinate-level interpretation if the target was familiar (see Taylor & Gelman, 1988, 1989).

Our finding of a familiarity effect in the interpretation of an adjective among 4-year-olds recalls related findings with other categories of word (e.g., Hall, 1991, for proper names; Markman & Wachtel, 1988, for mass nouns; Taylor & Gelman, 1988, for count nouns). Our failure to uncover such an effect among 2-year-olds, consistent with findings by Taylor and Gelman (1988), raises the question of why 2- and 4-year-olds performed so differently on our task.

We first rule out three possible answers. First, the observed age difference cannot be attributed to a general predisposition among 4-year-olds to make a material kind selection in response to *any* word applied to a familiar object, because 4-year-olds avoided making material kind selections regardless of object familiarity if they heard a count noun; note that some previous studies (e.g., Markman & Wachtel, 1988) have not been able to rule out this interpretation because they did not manipulate form class, in addition to familiarity, within a single study. Second, it is unlikely that the lack of material kind selections among 2-year-olds reflects the fact that the adjectival form class cues were ambiguous, and that 2-year-olds *could* identify adjectives but mistakenly interpreted these words as coming from some other category (e.g., count noun). The syntactic frame in Experiment 2 quite strongly called for an adjectival interpretation (see also Waxman & Kosowski, 1990).

Finally, although 4-year-olds likely know a greater number of relevant mass nouns and related adjectives than 2-year-olds, this cannot *in itself* explain the observed results. The reason stems from the fact that there are many possible mass nouns or related adjectives that could have applied to any of our objects. For example, the word applied to the metal cup could have been "metal," "steel," "stainless steel," "silver," "shiny," "hard," or "heavy," among other possibilities.[5] Unless 4-year-olds knew *all* the relevant possibilities, then they should *not* have been blocked (by lexical contrast or mutual exclusivity) from making a material kind (or related property) interpretation of the novel word. In other words, knowledge of any single relevant mass noun or related adjective should not have affected either 4- or 2-year-olds' tendency to make a material kind selection. (This assumes that both age groups have a lexical contrast or mutual exclusivity bias.)

However, even if some 4-year-olds did know *all* relevant material kind (and related property) words for an object, then adherence to lexical contrast (or mutual exclusivity) should have made them *less* likely than 2-year-olds to map the novel words onto a material kind or a related property. In contrast, what we found was that 4-year-olds were, overall, *more* likely than 2-year-olds to make a material kind selection in these studies.

Another reason that 4-year-olds' knowledge of relevant mass nouns or related adjectives for the objects cannot explain our findings is the following: This knowledge should have affected their interpretations of words applied to familiar and unfamiliar objects *to the same extent,* because the unfamiliar and familiar objects were matched for material kind (and related properties). However, recall our finding that 4-year-olds were *less* likely to make a material kind selection if the object was unfamiliar than if it was familiar.

We now offer three interpretations of the observed age difference in the familiarity effect. The first, and perhaps most plausible, is that both 2- and 4-year-olds have a (basic-level) object-kind bias and a lexical contrast (or mutual exclusivity) bias. That is, both age groups expect that a word applied to an unfamiliar object refers to a (basic-level) kind of object (see Hall & Waxman, 1993; Markman, 1989; Soja et al., 1991), and both groups expect that different words

[5] This comment also applies to some previous studies that have pitted object kind against material kind (and related properties) (e.g., Taylor & Gelman, 1988, and Experiments 4 to 6 of Markman & Wachtel, 1988). At issue is the difficult question of specifying what is the *salient* material kind (or related property).

will mean different things (see Markman & Wachtel, 1988). Moreover, both groups know that adjectives, and not count nouns, refer to properties (see Taylor & Gelman, 1988; see also Smith et al., 1992; Waxman & Kosowski, 1990). However, 2-year-olds are simply *less* willing (or able) than 4-year-olds to map an adjective applied to an object onto material kind or related properties (e.g., color). Consistent with this possibility are findings that children below 3½ years of age produce and comprehend very few words for material kinds (e.g., Dickinson, 1986; Soja, 1987, 1992). Moreover, our explanation data suggested that at least some of the 4-year-olds knew words that refer to material kinds (or to related properties); no 2-year-olds produced words for material kinds, and only a few provided color adjectives. It would be interesting to examine children's performance on a variant of this task in which material kind was not relevant or in which different, perhaps more distinctive, materials were employed in each triad (see Prasada, 1993).

A second possibility is that the locus of the age difference lies in 2-year-olds' being *more* willing (or able) than 4-year-olds to map an adjective onto certain object kind–related properties such as shape. It is difficult to know for certain whether an object kind selection reflected an object kind interpretation or a shape (property) interpretation, because (basic-level) object kind and shape tend to be highly correlated (for discussion, see Landau et al., 1988, 1992; Soja, Carey, & Spelke, 1991, 1992). It is possible, however, that selections of the object kind matches in these studies reflected a shape interpretation of the adjectives. If this is the appropriate interpretation of the age difference, then it raises the question of why 2- and 4-year-olds differ in their willingness to construe an adjective as referring to shape.

Finally, 2-year-olds, but not 4-year-olds, simply may require explicit mention of the familiar basic-level count noun in order to be willing to assume lexical contrast, and thus to move beyond interpreting a novel word as referring to a (basic-level) object kind. If this is the basis of 2-year-olds' failure to show a familiarity effect, then 2-year-olds may benefit from hearing a familiar count noun in being led to interpret a novel adjective as referring to something other than a (basic-level) object kind (see Waxman et al., 1991).

The striking age difference observed in these experiments suggests an important change in young children's interpretations of adjectives over the course of the preschool years. Discovering the precise nature of this change is a task that calls out for further attention.

Appendix

Object Kinds and Material Kinds (and Related Properties, Such as Color and Texture) Mentioned in Children's Explanations (Frequency in Parentheses)

1. Object kind. (*a*) 2-year-olds: "hat" (4), "plate" (4), "glove" (1), "belt" (1), "fork" for the tongs (1); (*b*) 4-year-olds: "hat" (3), "plate" (3), "cup" (2), "glove" (2), "spoon" (2), "belt" (1), "mitten" (1).

2. Material kind. (*a*) 2-year-olds: NONE; (*b*) 4-year-olds: "glass" (9), "metal" (3), "same kind of material" (3), "straw" (3), "wood" (2), "twigs" (1), "plastic" (1), "rubber" (1).

3. Color. (*a*) 2-year-olds: "red" (4), "purple" (1); (*b*) 4-year-olds: "(same) color" (9), "black" (8), "blue" (7), "white" (5), "red" (3), "silver" (also a material kind) (2), "gray" (2), "dark" (1), "yellow" (1).

4. Texture (and other material kind-related properties). (*a*) 2-year-olds: NONE; (*b*) 4-year-olds: "soft" (3), "clear" (1), "hard" (1), "squishy" (1).

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