Nouns Mark Category Relations: Toddlers' and Preschoolers' Word-Learning Biases

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WAXMAN, SANDRA R., and KOSOWSKI, TOBY D. *Nouns Mark Category Relations: Toddlers' and Preschoolers' Word-Learning Biases.* CHILD DEVELOPMENT, 1990, 61, 1461–1473. Recent research suggests that preschool children approach the task of word learning equipped with implicit biases that lead them to prefer some possible meanings over others. The noun-category bias proposes that children favor category relations when interpreting the meaning of novel nouns. In the series of experiments reported here, we develop a stringent test of the noun-category bias and reveal that it is present in children as young as 2 years of age. In each experiment, children participated in a 5-item match-to-sample task. Children were presented with a target item (e.g., a cow) and 4 choices, 2 of which belonged to the same superordinate category as the target (e.g., a fox and a zebra) and 2 of which were thematically related to the target (e.g., milk and a barn). In Experiment 1 we demonstrate that novel nouns prompt preschool children to attend to superordinate-level category relations, even in the presence of multiple thematic alternatives. In Experiment 2, we ascertain that the bias is specific to nouns; novel adjectives do not highlight superordinate category relations. In Experiment 3, we demonstrate the noun-category bias in 2-year-olds. The nature and utility of the noun-category bias are discussed.

Developmental research over the last decade has documented remarkable cognitive abilities in very young children and has sparked a renewed interest in revealing the origins of their early capacities. We now know that very young children, and perhaps infants, appreciate a rich variety of conceptual relations, including taxonomic, thematic, and associative relations (Cohen & Younger, 1983; Mandler, Fivush, & Reznick, 1987; Smiley & Brown, 1979; Sugarman, 1982). We also appreciate the facility with which they master the complex task of language acquisition. Between the ages of 2 and 6, children learn an average of six words per day (Templin, 1957). In addition to these semantic advances, children make rapid progress in their appreciation of syntactic principles. By at least 2½ years of age, they obey the structural regularities that distinguish formal syntactic categories like nouns and adjectives (Gordon, 1987; Valian, 1986).

This extraordinarily dynamic early period of conceptual and linguistic development has been a puzzle to developmental psychologists. For, in principle, children's flexible appreciation of different conceptual relations could complicate the task of word learning. Consider, for example, the acquisition of a simple term like *dog*. Children must learn that the word may refer to a specific object (e.g., Fido) and may be extended to other category members (e.g., other dogs) but not to thematic relations (e.g., a dog and its bone), isolated aspects of the object (e.g., its tail), or to an action in which it is engaged (e.g., running, barking). If children weighed these and countless other possible meanings before arriving at the correct mapping, word learning would be a painstaking process indeed (Quine, 1960).

However, the developmental data suggest that children do not traverse this laborious route (Carey, 1978). Instead, they seem to approach the task of word learning equipped with implicit biases that lead them to prefer some possible meanings over others. Preschool children exploit abstract information conveyed by *syntactic* categories (e.g., noun, adjective) to help them determine the *seman-*

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tic content of novel words (Brown, 1957; Hall & Waxman, 1990; Katz, Baker, & MacNamara, 1974; Landau & Gleitman, 1985; Naigles, Gleitman, & Gleitman, in press; Waxman, 1990). That is, children interpret novel words differently, depending on the syntactic environment in which they occur. Findings like these have contributed to the view that there may be tacit links between linguistic and conceptual development.

In this article, we focus on the development of one such link: the noun-category bias. This bias has been proposed on the basis of evidence indicating that preschool children are especially prone to interpret words from one particular linguistic form class—nouns—as referring to one particular type of conceptual relation—category relations (Markman & Hutchinson, 1984; Waxman & Gelman, 1986).[1] This bias appears to guide the word-learning process by placing limits on the number of possible meanings children will entertain for a new noun. We amplify the evidence for the noun-category bias and reveal that it is evident in children as young as 2 years of age. Evidence for the noun-category bias has come from two different experimental paradigms. Waxman and Gelman (1986) used a classification task to examine the role of novel labels in superordinate-level classification (e.g., animals vs. clothing vs. food). It is well known that under most circumstances, preschool children have difficulty sorting objects into taxonomic categories at this abstract level (Gelman & Baillargeon, 1983; Rosch, Mervis, Gray, Boyes-Braem, & Johnson, 1976). However, when children are introduced to novel words for these categories, their classification improves substantially.

To demonstrate this, Waxman and Gelman introduced 3- and 4-year-old children to three puppets, explained that the puppets were "very picky," and asked the children to help the puppets "find the things they would like." In their Instance condition, to get the children started, the experimenter displayed photographs of three typical instances (e.g., a dog, a horse, and a cat) for each superordinate category (e.g., animal). Children then sorted the remaining items (various members of the categories animals, clothing, and food) with no further instructions. In their Novel Label condition, children saw the same three instances but were also introduced to a novel label for each superordinate class (e.g., "These are *dobutsus,* these are *gohans,* and these are *kimonos*"). As one would expect on the basis of the existing classification literature, 3-year-old children in the Instance condition had difficulty forming the superordinate classes. In sharp contrast, those in the Novel Label condition formed the superordinate classes readily. The introduction of a novel noun label effectively alerted children to the taxonomic relations among the objects and licensed the induction of superordinate-level categories. Waxman (1990) has since extended the classification paradigm to demonstrate that at the superordinate level, the category bias may be reserved for nouns. Novel adjectives do not highlight superordinate-level taxonomic relations.

Markman and Hutchinson (1984) provided independent support for the noun-category bias at the superordinate level with 4- and 5-year-old children. They designed a triad task involving a target stimulus (e.g., a dog) and two response stimuli, one bearing a taxonomic relation to the target (e.g., a cat) and the other bearing a thematic relation to the target (e.g., a dog bone). In a neutral No Word condition, when the experimenter pointed to the target and asked children to "find another one," they either chose at chance or preferred the thematically related item. In contrast, when the experimenter introduced the target with a novel noun and asked children to "find another *dax*," children tended to choose taxonomically. In addition, children in the neutral No Word condition tended to justify their choices by appealing to thematic relations, while those in the Novel Noun condition referred to taxonomic relations among the objects.

Taken together, these data support the claim that children do not sample randomly among possible hypotheses when determining the mean of novel nouns; instead, they favor categorical relations. This claim is a strong one. It forges a precise link between children's linguistic and conceptual systems and bears on issues regarding the connection between language and thought. To better understand this intriguing phenomenon, it is

[1] In this article, we use the terms *category* and *taxonomy* interchangeably. Within cultural anthropology, the term *taxonomy* is typically reserved for hierarchical classification systems within the plant and animal kingdoms. Within the psychological literature, *taxonomy* carries a slightly different meaning. Taxonomic relations are contrasted with other types of conceptual organization (e.g., thematic).

vital that we discern its developmental status. We therefore decided to examine the noun-category bias in 2-year-olds. Children at this age are at an important developmental crossroad: Following their remarkable vocabulary "explosion," 2-year-old children typically enter a phase of rapid syntactic and semantic development. This dynamic period of language acquisition is likely to coincide with very active periods in conceptual organization.

Unfortunately, the classification and triad tasks described earlier do not lend themselves directly to testing children of this age. Structured classification tasks often fail to capture and sustain the attention of children younger than 3 years of age (Sugarman, 1982; Waxman, 1987). And although triad tasks are simple enough to be easily administered to very young children, they present interpretative problems with children 3 years of age and younger. This is because inferring the basis upon which a child makes a given selection depends, in large part, on their justifications or on other supplemental data. Because Markman and Hutchinson's youngest subjects in their superordinate-level task were 4- and 5-year-olds, these experimenters were able to supplement data from their triad task with children's justifications. However, we were concerned about 2- and 3-year-olds' ability to justify their selections. And without justifications or other supplemental data, the bases upon which children make their selections in triad tasks remain obscure.

In order to develop a rigorous test of the noun-category bias for 2-year-olds, we devised a five-item match-to-sample task. Children were presented with a target (e.g., a cow) and four possible choices, two of which belong to the same superordinate category as the target (e.g., a fox and a zebra) and two of which are thematically related to the target (e.g., milk and a barn). In lieu of justifications, we asked children to select two items, rather than one, for each target. The particular benefit of this design is straightforward: For children too young to provide coherent justifications, the second-choice data permit us to make inferences regarding the reasons underlying their choices. We submit that children who select both of the superordinate category members and none of the thematic alternatives are likely to have established taxonomic criteria and applied them consistently. If novel nouns specifically highlight category relations, we would expect children in a novel noun condition to select the members of the same superordinate category.

We begin this series of experiments with a preliminary study in which we administer the match-to-sample task to 3- and 4-year-olds, a population whose sensitivity to the noun-category bias has been established clearly (Markman & Hutchinson, 1984; Waxman & Gelman, 1986). Once we ascertain that the new paradigm yields results comparable to those from the triad and classification tasks, we go on in Experiment 2 to ascertain whether the bias is evident for nouns, but not adjectives. In Experiment 3 we focus on the relation between linguistic form class and conceptual organization in 2-year-old children.

Experiment 1

Experiment 1 was designed with a dual purpose: First, to determine whether the five-item match-to-sample paradigm yielded results comparable to those from the triad and classification tasks, and second, to evaluate our concern that children younger than 3 years of age would have difficulty providing justifications for their item selections.

We began with the assumption that by 2 years of age, children appreciate both categorical and thematic relations among objects (Bauer & Mandler, 1989; Fenson, Cameron, & Kennedy, 1988; Smiley & Brown, 1979; Scott, Serchuk, & Mundy, 1982), and that their preference for one over the other type of relation depends largely on the items themselves and the task instructions. To reflect this assumption, we selected stimuli and instructions to insure that children in a neutral context would demonstrate neither a taxonomic nor thematic preference.[2] We predicted that only children who were introduced to novel nouns would prefer the taxonomic choices.

[2] We conducted a pilot study to determine how best to achieve this end. We compared 22 3- and 4-year olds' performance under two types of instructions (also see Markman & Hutchinson, 1984). Children who were asked to "Find another one" chose taxonomically on 49% of their (first) trials. Children who were asked to "Find another one that is the same kind of thing" selected taxonomically on only 30% of their (first) trials. Because the first set of instructions is more neutral for our stimuli and procedure (i.e., children were at chance in selecting items), it provides a stronger, more conservative test of the noun-category bias.

TABLE 1

STIMULI USED IN ALL EXPERIMENTS

Target	Taxonomic Responses		Thematic Responses	
squirrel ...	cat	mouse	acorn*	tree
fish	bird	frog	fishtank*	fishing rod*
bread	corn	ice cream	knife	toaster
banana ...	grapes	apple	boy	monkey
horse	giraffe	elephant	saddle	jockey*
rabbit	skunk	pig	carrot	easter egg*
bird	butterfly	mouse	tree	nest*
dog	deer	bear	bone	dog house*
flower	tree	houseplant*	vase	bee
mouse	raccoon	fish	cheese	mousetrap
bee	owl	butterfly	beehive*	flower
cow	zebra	fox	milk	barn

* These items were produced in this laboratory. All others were selected from Snodgrass and Vanderwart (1980).

METHOD

Subjects

Sixteen 3-year-old (mean age, 3-5, ranging from 3-1 to 4-0) and 15 4-year-old (mean age, 4-7, ranging from 4-2 to 5-0) children participated in the study. All were enrolled in preschool programs serving racially mixed, middle-class populations in the greater Boston area. Approximately equal numbers of boys and girls were assigned to each condition.

Stimuli

Stimuli were black-and-white line drawings; each was approximately 4 cm high. See Table 1 for a complete list of stimuli and their sources. These were arranged in a book, with five pictures on each page. The center picture on each page served as the "target"; the four surrounding pictures were "response" stimuli. Two of these response stimuli belonged to the same superordinate category as the target and two were thematically related to the target. There were 12 such pages; each page comprised a trial. The position of taxonomically related and thematically related items on each page was counterbalanced over trials.

Procedure

Children were tested individually, in quiet testing rooms on their preschool premises. They were randomly assigned to either the No Word or the Novel Noun condition (described below). All children went through the picture book twice, first to select items and second to justify their selections. The procedure lasted about 15 min.

In both experimental conditions, the experimenter introduced the child to a hand puppet. She explained that the puppet wanted to show the child some pictures, but that he could not speak English and had his "own special names for things."

No Word condition.—For each trial, the experimenter pointed to the target item (e.g., a dog) and said, "See this one? Can you find another one?" Children were instructed to indicate their choices by pointing.

After completing 12 trials, the experimenter went through the book a second time, this time reminding children of their choices and asking them to justify those choices. For each trial, she said, "Remember when I showed you this one [indicating the target], and you told me that this [indicating the child's selection] is another one? Can you tell me why?"

Novel Noun condition.—This condition was identical to the No Word condition, with one exception: For each trial, as the experimenter pointed to the target item, she labeled it with a nonsense word, using a different word for each trial. For example, she said, "See this? This is a *cham.* Can you find another *cham*?" Children were instructed to indicate their choices by pointing.

After all 12 trials had been presented, children were asked to justify their responses. The experimenter said, for example, "Remember when I showed you this *cham* [pointing to the target], and you told me that this [pointing to the child's selection] is a *cham* too? Can you tell me why?"

Scoring

Each child received two scores: one for item selections and the other for justifications.

Item selections.—The proportion of taxonomic selections made by each child was calculated. A score of .50 represents chance performance.

Justifications.—Justifications were coded as taxonomic, thematic, or other/irrelevant. Cases in which a child mentioned a category name or common attribute (e.g., "They are both animals," or "They both have tails") were coded as taxonomic; cases in which a child referred to an interaction among objects (e.g., "The bunny eats the carrot") were coded as thematic; justifications that did not fit these criteria (e.g., "I don't know," or "Because that's a bunny and that is a carrot") were coded as irrelevant.

Results and Discussion

The results of this preliminary study are noteworthy on two counts. First, they strengthen earlier findings regarding a privileged relation between nouns and categorical relations. Children as young as 3 years of age interpret novel nouns taxonomically, even in the presence of multiple thematic alternatives. In addition, these results underscore the importance of interpreting children's justifications with caution.

Item selection.—A two-way analysis of variance with age and condition as between-subjects factors revealed a main effect for condition, with children in the Novel Noun condition selecting category members significantly more often (M = .69, SD = .17) than those in the No Word condition (M = .51, SD = .22), $F(1,30) = 6.40$, $p < .02$. Children in the Novel Noun condition exhibited a clear preference for taxonomic choices, selecting them more often than would be expected by chance, $t(14) = 4.43$, $p < .001$. Children in the No Word condition performed at chance. Thus, our efforts to select stimuli for which children in a neutral context would show neither a taxonomic nor thematic preference were successful.

With items treated as a random factor, the same effect was observed. When items were labeled with a novel noun, they evoked more taxonomic responses (M = .68) than when those items received no label (M = .51), paired $t(11) = 3.478$, $p < .005$. This suggests that the effects observed here should generalize to other stimuli (Clark, 1973).

Justifications.—As we had suspected, our subjects often had difficulty justifying their choices. Fifty-one percent and 27% of the 3- and 4-year-olds, respectively, were unable to articulate the reasons underlying their choices (see Markman & Wachtel, 1988, for a similar finding). Clearly, justification data are likely to be of little value in our efforts to examine word learning biases in children younger than 3 and 4 years of age.

Nonetheless, if we consider only those justifications that were relevant, we find converging evidence for the hypothesis that novel words highlight category membership. Children in the Novel Noun condition were twice as likely to offer taxonomic justifications (.73) as were children in the No Word condition (.36).

In order to make the task more suitable for research with very young subjects, in the next experiment we supplement children's first choices with second choices, rather than with justifications. Further, in Experiment 2 we examine the specificity of the proposed bias by asking whether children interpret novel nouns, but not novel adjectives, as clues to superordinate category relations.

Experiment 2

In this experiment, we compare the performance of children who hear targets labeled with novel nouns and children who hear novel adjectives. Previous research has demonstrated that 2- and 3-year-old children are sensitive to the syntactic cues that distinguish adjectives (e.g., "This is a *fopish* one") from nouns (e.g., "This is a *fopin*") (Waxman, 1990). Therefore, we expect that children in this experiment will treat the novel nouns and novel adjectives differently. If the noun-category bias is specific to nouns, then children hearing nouns will opt for category members, but those hearing adjectives will demonstrate no such preference.

Method

Subjects

Thirty preschoolers (mean age, 3-9; ranging from 3-1 to 5-0) participated in the study. All were enrolled in preschool programs serving middle-class populations in the greater Boston area and in West Palm Beach, Florida. Approximately equal numbers of boys and girls participated in each condition. Nine subjects were replaced (four in the Novel Noun condition, five in the Novel Adjective condition) because they failed to make a complete set of second choices.

Stimuli

The stimuli were identical to those in Experiment 1.

Procedure

Children were tested individually in quiet rooms on their preschool premises. They were randomly assigned to either the Novel Noun or the Novel Adjective condition (described below). The procedure lasted about 15 min.

In both conditions, the experimenter introduced the child to a hand puppet. She explained that the puppet wanted to show the child some pictures but could not speak English and had his "own special words for things." The novel words were introduced as part of the puppet's "special" language. For each trial, as the experimenter pointed to the target item, she labeled it with a nonsense word, using a different word for each trial. The experimenter asked children to repeat each novel word. Only the linguistic form of the novel words differed in the two conditions.

Novel Noun condition.—Instructions in this condition were similar to those in the Novel Noun condition in Experiment 1. For each trial, the experimenter pointed to the target and labeled it twice with a novel noun. For example, she would say, "See this? This is a *fopin.* Can you say that? Can you find another *fopin*?" Children were instructed to indicate their choices by pointing. After completing all 12 trials, the experimenter went through the book a second time to elicit second choices. For example, she would say, "Remember when I showed you this *fopin* [indicating target], and you told me that this [indicating child's response] is another *fopin*? Are there any more?"

Novel Adjective condition.—In this condition, the novel labels were presented in an adjectival context. As in the Novel Noun condition, each adjective was mentioned twice per trial. For example, the experimenter would say, "See this? This is a *fopish* thing. Can you say that? Can you find another one that is *fopish*?" After all 12 trials, the experimenter went through the book a second time to elicit second choices. For example, she would say, "Remember when I showed you this *fopish* one [indicating target], and you told me that this one [indicating child's response] was *fopish* too? Are there any more?"

Note that although the novel nouns appeared in the same syntactic context on both occasions (e.g., a *fopin;* another *fopin*), the novel adjectives appeared in two different syntactic contexts (e.g., *fopish* thing; another one that is *fopish*). Further, the adjectives carried a characteristic adjectival suffix (*-ish*). Because preschool children demonstrate productive use of these syntactic frames (Valian, 1986) and of the adjectival suffix, this treatment provides unambiguous information to the children concerning the syntactic status of the novel nouns and adjectives. (See Waxman, 1990, for further evidence that preschool children clearly distinguish novel nouns from novel adjectives on the basis of precisely this information.)

Scoring

Children's first and second choices were recorded. For a first choice, the probability of choosing taxonomically (or thematically) is .50. For a second choice, where children are essentially "sampling without replacement," we must take into account the conditional probability of choosing in a particular way on a second trial, given the choices that remain after the first selection: The probability of choosing taxonomically (or thematically) on both first and second choices is .17 (.50 for the first choice × .33 for the second choice yields .17); the probability of making one taxonomic and one thematic choice is .33 (.50 for the first choice × .67 for the second yields .33).

Results and Discussion

The results of this experiment provide solid support for the hypothesis that nouns, but not adjectives, highlight category relations at the superordinate level. They also reveal that children can and will supplement their first choices with second choices. The overall response patterns obtained in the Novel Noun and Novel Adjective conditions are depicted in contingency tables in Figure 1.

We were primarily interested in comparing the proportion of trials in which children selected taxonomically related items for both their first and second choices. In the Novel Noun condition, this consistently taxonomic pattern of response accounted for .41 of all trials (SD = .28); in the Novel Adjective condition, children made consistently taxonomic responses on only .23 of their trials (SD = .25). Children in the Novel Noun condition chose both category members more often than would have been expected by chance, $t(14) = 3.41$, $p < .002$, one-tailed, and more often than did children in the Novel Adjective condition, $t(29) = 1.87$, $p < .04$, one-tailed. As expected, children in the Novel Adjective condition performed at chance.

Thus, the effects engendered by nouns appear to be specific to that particular syntactic class and are not a consequence of word

Expected

Second Choice \ First Choice	tax	them
tax	.17	.33
them	.33	.17

Expt. 2 **Noun**

Second Choice \ First Choice	tax	them
tax	.41** (.28)	.20** (.12)
them	.22** (.14)	.17 (.25)

Adjective

Second Choice \ First Choice	tax	them
tax	.23 (.25)	.29 (.22)
them	.30 (.26)	.18 (.18)

Expt. 3 **Noun**

Second Choice \ First Choice	tax	them
tax	.40** (.19)	.19** (.09)
them	.32 (.17)	.09* (.13)

Adjective

Second Choice \ First Choice	tax	them
tax	.26* (.16)	.29 (.11)
them	.30 (.14)	.14 (.13)

No Word

Second Choice \ First Choice	tax	them
tax	.22 (.16)	.32 (.16)
them	.29 (.18)	.16 (.12)

FIG. 1.—Contingency tables for mean proportions (and standard deviations) of taxonomic (tax) and thematic (them) choices in Experiments 2 and 3. Experiment 2 includes 30 3–4-year-old subjects. Experiment 3 includes 45 2-year-old subjects. Asterisks mark those cells that differ reliably from the proportion expected by chance (*$p < .05$; **$p < .01$).

learning in general. Novel nouns, but not novel adjectives, served to focus children's attention on superordinate-level category relations. Several researchers have argued that novel adjectives exert a very different influence: Although nouns highlight higher-order category relations, adjectives highlight specific properties (e.g., size, color, shape) of objects (Heibeck & Markman, 1987; Taylor & Gelman, 1988) and promote the establishment of lower-order distinctions (e.g., types of grapes, breeds of dogs) (Waxman, 1990; Waxman & Shipley, 1987).

There are two possible explanations for the high proportion of consistently taxonomic responses in the Novel Noun condition. We have argued that this finding reflects the fact that novel nouns highlight taxonomic relations. An alternative hypothesis is that nouns merely prompt children to choose consistently across both trials. If this were the case, children in the Novel Noun condition would exhibit a similarly high proportion of consistently thematic responses as well. To test this hypothesis, we conducted a separate analysis, using children's consistently thematic responses (thematic-thematic) as a dependent measure. We found no difference between the proportions of consistently thematic responses in the Novel Noun and the Novel Adjective conditions. Furthermore, performance in neither experimental condition differed from chance. This supports our claim that nouns, but not adjectives, focus attention specifically on superordinate category relations.

As can be seen in Figure 1, children in the Novel Noun condition made significantly fewer thematic-taxonomic and taxonomic-thematic selections than would have been ex-

pected by chance (both p's $< .001$). This is a consequence of the high rate of consistently taxonomic (taxonomic-taxonomic) responding in the Novel Noun condition. In contrast, children in the Novel Adjective condition performed at chance in all cells.

To provide a point of comparison with Experiment 1, we also conducted an analysis based on children's first choices. Children in the Novel Noun condition chose category members on .65 of their first trials (SD = .31). This is significantly more often than would be expected by chance, $t(14) = 1.83$, $p < .04$, one-tailed, and comparable to the result obtained in the Novel Noun condition in Experiment 1 (.69). Children in the Novel Adjective condition chose category members on .56 of their first trials (SD = .35), a rate that differs neither from chance nor from performance in the No Word condition in Experiment 1 (.51).

Finally, a third analysis, taking items as a random factor, offers converging evidence for the hypothesis that this bias may be specific to nouns. As in Experiment 1, when target items were labeled with novel nouns, they elicited significantly more consistently taxonomic responses ($M = .42$, SD = .17) than when those items were labeled with novel adjectives ($M = .24$, SD = .14), paired $t(11) = 2.94$, $p < .004$, one-tailed.

The results of Experiment 2 extend previous research (Markman & Hutchinson, 1984; Waxman, 1990) by demonstrating that novel nouns, but not adjectives, highlight superordinate relations even in the presence of clear thematic alternatives. Children are indeed sensitive to the syntactic environment in which novel words are introduced. Moreover, the effect of introducing a novel noun is forceful enough to guide both a first and second choice. On the basis of these results, we proceeded to examine the influence of linguistic form class on conceptual organization in 2-year-olds.

Experiment 3

METHOD

Subjects

Forty-five 2-year-olds (mean age 2-7 ranging from 2-1 to 3-0) were drawn from preschool programs serving middle-class populations in the greater Boston area. Five subjects were replaced (two in the Novel Noun condition, three in the Novel Adjective condition) because they did not select a complete set of second choices.

Stimuli

The stimuli were identical to those used in Experiments 1 and 2.

Procedure

Children were tested individually in quiet areas on their preschools' premises; sessions lasted approximately 15 min. Children were randomly assigned to one of three experimental conditions. As in Experiment 2, children in all conditions were introduced to a puppet who did not know how to speak English but who had his own "special words for things." Approximately equal numbers of boys and girls were included in each condition.

No Word condition.—Instructions in this condition were identical to those used in the No Word condition in Experiment 1. For each trial, the experimenter pointed to the target item and said, "See this one? Can you find another one?" After completing all 12 trials, the experimenter went through the book a second time to elicit second choices. Pointing to the target picture once again she would say, "Remember when I showed you this [the target] and you told me that this [indicating the child's first choice] was another one? Can you show me another one?"

Novel Noun condition.—As in Experiments 1 and 2, on each trial the experimenter pointed to the target and labeled it with a novel noun. For example, she would say, "See this? This is a *fopin*. Can you say that? Can you find another *fopin*?" Children were instructed to indicate their choices by pointing. After completing all 12 trials, the experimenter went through the book a second time, asking children to make a second choice. For example, she would say, "Remember when I showed you this *fopin* [indicating target], and you told me that this one [indicating child's response] is a *fopin* too? Can you show me another *fopin*?"

Novel Adjective condition.—In this condition, the novel labels were presented in an adjectival context. For example, the experimenter would say, "See this? This is a *fopish* one. Can you say that? Can you find another one that is *fopish*?" After all 12 trials, children were asked to make a second selection of each trial.

Scoring

As in Experiment 2, children's first and second choices were recorded.

RESULTS AND DISCUSSION

Children as young as 2 years of age interpreted the novel nouns as referring specifically to category relations. The overall response patterns for the Novel Noun, Novel Adjective, and No Word conditions are shown in Figure 1. This overall pattern may be examined in more detail by comparing the proportion of trials for which children in each experimental condition consistently selected taxonomically related items on both their first and second trials. An ANOVA based on this cell of the contingency tables revealed a significant effect for condition, $F(2,42) = 4.72$, $p < .01$. Children in the Novel Noun condition were more likely to select both category members ($M = .40$, SD = .19) than were their age-mates in either the Novel Adjective ($M = .26$, SD = .16) or the No Word ($M = .22$, SD = .16) conditions, Fisher PLSD, $p < .05$.

Children in the Novel Noun condition also selected both category members significantly more often than would be expected by chance (recall that chance is .17), $t(14) = 4.67$, $p < .0001$; those in the No Word condition were at chance. Interestingly, performance in the Novel Adjective condition was intermediate. As predicted, 2-year-olds in this condition selected both category members less often than did children in the Novel Noun condition; however, their performance in this cell was higher than would be expected by chance, $t(14) = 2.22$, $p < .04$.

This finding may provide an important clue regarding the developmental status of word-learning biases. Our analyses reveal that by 2 years of age, children interpret novel nouns as referring specifically to category relations. However, at this early stage, they may tend to interpret novel adjectives in a similar fashion (See Markman & Hutchinson, 1984, for the argument that children may initially overextend the noun-category bias to new words from other linguistic form classes). A thorough examination of this possibility awaits additional data from children younger than 2 years of age.

We also point out that in the remaining three cells (thematic-taxonomic and taxonomic-thematic, thematic-thematic), children in the Novel Noun condition performed at or below the level expected by chance. As was the case in Experiment 2, this pattern is a consequence of the children's high rate of consistently taxonomic (taxonomic-taxonomic) responding in the Novel Noun condition.

As in Experiment 2, an analysis based on children's first responses alone revealed the main effect for condition as well, $F(2,42) = 5.99$, $p < .005$. Children in the Novel Noun condition selected more category members ($M = .72$, SD = .13) than did their age-mates in either the Novel Adjective ($M = .56$, SD = .19) or the No Word ($M = .51$, SD = .19) conditions, Fisher PLSD, $p < .05$. Performance in these latter two conditions did not differ significantly. Children in the Novel Noun condition selected category members more often than would be expected by chance, $t(14) = 6.38$, $p < .0001$; those in the No Word and the Novel Adjective condition did not.

Once again, when items were taken as a random factor, we found a main effect for condition, $F(2,35) = 5.33$, $p < .01$. When target items were labeled with novel nouns, they elicited significantly more consistently taxonomic responses on both trials ($M = .40$, SD = .18) than when they were labeled with novel adjectives ($M = .26$, SD = .26), or when they received no novel label ($M = .22$, SD = .11), Fisher PLSD, $p < .05$.

General Discussion

Summary of Results

The results of these three experiments fortify the argument for a privileged connection linking nouns and superordinate-level category relations. When interpreting the meaning of novel nouns, children do not sample randomly from the range of possible meanings, but instead focus predominantly on category relations. In the experiments reported here, only children in the Novel Noun condition consistently restricted their selections to other superordinate level category members. This category bias appears to be specific to nouns, for children hearing novel adjectives (like children hearing no novel words) demonstrated no consistent preference for either taxonomic or thematic relations.

In addition to providing early evidence of children's systematic predispositions in word learning, these results challenge the long-held notion that preschool children's categories are "concrete" and perception-bound (e.g., Fenson et al., 1988; Inhelder & Piaget, 1964). We have shown that 2-year-old children readily recognize the categorical relations linking perceptually disparate members (e.g., a bird and a mouse) of superordinate-level classes (e.g., animal), and that this ab-

stract conceptual ability becomes especially apparent within the context of learning a novel noun.

This conclusion advances the claims of several earlier reports regarding the influence of nouns on categorization, but is at odds with one recent finding. Bauer and Mandler (1989) found no difference between children's tendency to offer taxonomic responses in their Novel Noun and No Word conditions. There is, however, one crucial difference between their procedure and the one we employed. Bauer and Mandler introduced an initial training period during which they rewarded their 1–2-year-old subjects for categorical selections and corrected all thematic selections. Not surprisingly, children who were so rewarded chose predominantly taxonomic alternatives in the experiment proper, whether or not they were introduced to novel nouns. This result provides testimony to the power of reinforcement and reveals that novel nouns are not the sole vehicle through which taxonomic relations may be made salient. We take no exception to this conclusion.

However, in the normal course of events, children do not have the benefit of such reinforcement trials during word learning. Instead, they find themselves confronted with novel words, objects, and an infinite array of possible mappings that could, in principle, link the two. Our data indicate that in such situations, nouns (and not adjectives) highlight category relations. Indeed, we suspect that under more naturalistic learning conditions, the noun-category bias may exert even more influence than we were able to observe in our forced-choice task. Of course, the noun-category bias does not immediately reveal to the child the correct meaning for a particular novel noun. Rather, it guides the child to focus primarily on category relations. We expect that this bias affords the young child a substantial advantage in both word learning and category development.

Although some researchers have referred to this phenomenon as the taxonomic assumption (Markman, 1987), we prefer to describe it as the noun-category bias. We do this to underscore the fact that children do not, as a rule, prefer taxonomic relations among objects. They focus predominantly on *category* relations in the context of learning *nouns.*

Evidence against the "Translation Hypothesis"

We have interpreted the consistent difference between performance in the Novel Noun condition and the other conditions as evidence that children focus on category relations when interpreting the meaning of a novel noun. However, an alternative interpretation also warrants consideration. Perhaps children "translate" novel nouns into known category terms (e.g., *dog*), and novel adjectives into known attributes or descriptive phrases (e.g., *furry thing* or *greenish one*) and then use their translations to guide their item selections. In other words, is it possible that performance differences in the preceding experiments reflect children's translations to particular known words rather than an abstract bias in word learning?

Our strong impressions from these experiments led us to doubt this interpretation. First, although we did not specifically ask our subjects what they thought the novel words meant, we did interview a small number of particularly enthusiastic subjects *after* they had completed the experiment proper. These children carefully studied the pictures before offering a translation, suggesting that they had not previously translated the terms. Second, we noticed that children in both the Novel Noun and Novel Adjective conditions tended to "translate" the novel terms into basic level terms.

Because post hoc impressions cannot take the place of experimental evidence, we chose to conduct a small control study to ascertain whether this tendency to translate both novel adjectives and novel nouns to basic level nouns was a general one. Twelve children (mean age 3-4 years; ranging from 2-5 to 4-3), none of whom had participated in any of the preceding experiments, served as subjects. In the Novel Noun condition, the experimenter pointed to a target item and asked, for example, "See this? The puppet says this is a *fopin.* What do you think *fopin* means?" In the Novel Adjective condition, she said, for example, "The puppet says this is a *fopish one.* What do you think *fopish* means?" As a control, we asked another group of children to label the target items, but did not provide them with novel words. In the No Word condition, the experimenter pointed to each target picture and simply asked, "What do we call this?"

The results of this control study were consistent with our initial impressions. Children in all conditions translated the novel terms (be they novel adjectives or novel nouns) into familiar basic level nouns. This finding counters the translation hypothesis in two crucial ways. First, if children had relied on direct translations in the preceding experi-

ments, performance in all three conditions would have been indistinguishable. Yet this was clearly not the case. In the forced-choice procedure, children in the Novel Noun condition performed very differently than did children in the other experimental conditions. Second, Markman and Hutchinson (1984) have demonstrated that basic level translations, though typical of children at these ages, fail to highlight superordinate-level categories. Thus, it is unlikely that children's performance in the preceding experiments could have been mediated by direct translation of novel words into known English words. Additional research, focused specifically on the question of translation, is likely to add depth and dimension to these preliminary data.

Discerning the Origin of the Noun-Category Bias

We have solid evidence that by 2 years of age, children have systematic predispositions in interpreting novel nouns, but we can only speculate as to how such linkages between linguistic and conceptual organization are acquired (see Markman [1989], Nelson [1988], and Waxman [1990] for fuller discussions of this point). The data available to date do not yet reveal the original of the noun-category bias. One possibility is that the noun-category bias is induced on the basis of experience with language. If this is the case, then children make this powerful induction before the age of 2, for performance across our 2-, 3-, and 4-year-old subjects is striking for its similarity (see Fig. 1). It is also possible that the noun-category bias is part of the child's natural endowment and is available from the very earliest stages of conceptual and language development.

We do not commit ourselves on this issue because we believe that such a commitment must rest on a firm empirical foundation. Instead, we outline the type of evidence that will bring us closer to ascertaining the origin of the noun-category bias. In brief, if the noun-category bias is innate, then it should be evident very early and across all human languages. Therefore, we must continue to develop procedures that lend themselves to testing very young children prior to the onset of nominal insight and the attendant "vocabulary explosion." (see, e.g., Baldwin & Markman, 1989; Golinkoff, Hirsh-Pasek, Cauley, & Gordon, 1987; Naigles et al., in press; Spelke, 1982). Second, we must extend this research program to include children learning languages other than English (see Waxman & Benveniste, 1989, and Waxman & Ross, 1989, for empirical evidence pertaining to Spanish- and French-speaking children).

Finally, in addition to identifying children's implicit biases in word learning (Au, in press; Clark, 1983; Markman, 1987), we must examine how these biases interact with other important influences, including input from teachers and parents (Callanan, 1985) and the child's existing conceptual and linguistic knowledge (Gelman, 1988; Mervis, 1987; Waxman & Shipley, 1987).

Conclusion

A sensitivity to relations linking the linguistic and conceptual systems is well developed as early as 2 years of age. Children expect novel nouns to refer to categories of objects and expect words from other syntactic form classes to have different referring functions. These expectations guide children in their rapid acquisition of conceptual and linguistic knowledge.

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