Establishing New Subcategories: The Role of Category Labels and Existing Knowledge

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WAXMAN, SANDRA R.; SHIPLEY, ELIZABETH F.; and SHEPPERSON, BARBARA. *Establishing New Subcategories: The Role of Category Labels and Existing Knowledge.* CHILD DEVELOPMENT, 1991, **62**, 127–138. Previous research has revealed that novel nouns highlight category relations at superordinate and basic levels but, paradoxically, make subordinate classification more difficult for preschool children. In Experiment 1, we provide additional evidence that novel nouns put 3-year-old children at a disadvantage in subordinate classification. We suggest that this reflects young children's inclination to label and classify objects at the basic level. In Experiments 2 and 3, we identify 2 circumstances under which 3-year-old children alter their basic level expectation. In Experiment 2, we provide children with specific information to distinguish the relevant subclasses. In Experiment 3, we introduce the novel nouns in conjunction with the familiar basic level labels. Under each of these circumstances, novel nouns do not present an obstacle to subordinate classification. Children's linguistic biases (e.g., the noun-category bias) and their existing knowledge and vocabularies jointly influence early conceptual development.

An impressive amount of empirical support has been summoned in favor of the argument that certain aspects of human psychological development are guided by implicit biases or constraints. But it is equally clear that these biases operate in concert with other important aspects of development, for children's experiences with people, objects, and events are also essential elements in development (Bruner & Haste, 1987; Callanan, 1985; Vygotsky, 1962). To illustrate this, we take one particular bias as a case in point. We examine the ways in which the noun-category bias (Markman & Hutchinson, 1984; Waxman & Gelman, 1986; Waxman & Kosowski, 1990) is influenced by children's existing conceptual and semantic knowledge in the establishment of new subordinate level categories.

Several different research groups have reported that when children are learning the meaning of a novel word, they do not sample randomly among possible meanings, but instead use subtle information conveyed by syntactic form class (e.g., adjectives, nouns, determiners) to help them assign meaning (Brown, 1957; Gelman & Markman, 1985; Gelman & Taylor, 1984; Katz, Baker, & Macnamara, 1974; Waxman, 1990). Nouns, in particular, appear to focus children's attention on taxonomic relations, especially at basic[1] and superordinate levels. As a result, children sort

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[1] We use the expression *basic level* to refer to the level within a taxonomic hierarchy that is most commonly and readily used for identification within a culture (Rosch et al., 1976). We acknowledge that judging which categories are at the basic level may be a function of familiarity and experience. (See Dougherty, 1978, for a discussion of this issue.)

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superordinate categories (e.g., animals, clothing, food) more successfully when they are introduced to novel nouns for these classes than when no novel words are presented (Markman & Hutchinson, 1984; Waxman & Gelman, 1986).

However, this noun-category bias is not a simple one: Nouns do not highlight taxonomic relations in all cases. Waxman (1990) examined the influence of novel nouns on 3-year-old children's taxonomic classification at various hierarchical levels (e.g., subordinate, basic, superordinate). At superordinate levels (animals vs. clothing vs. food), children who heard novel nouns classified more successfully than did their peers who heard no labels. However, at subordinate levels, where children were required to distinguish subclasses of dog and subclasses of grape, this pattern was reversed. For example, in one experiment, children who heard novel labels actually classified *less* well at subordinate levels than did their peers who heard no labels (Waxman, 1990, Experiment 1). Thus, novel nouns put preschoolers at a disadvantage in subordinate level classification.

Why do novel nouns highlight some taxonomic relations and obscure others? In the series of experiments reported here, we address this paradoxical finding. We develop the general hypothesis that children's interpretations of novel words are guided by powerful biases, but that these word-learning biases do not operate in a vacuum. Rather, children's interpretation of novel words will depend crucially on their existing vocabularies as well as their knowledge regarding the items and classes under consideration (Au & Glusman, 1990; Clark, 1987; Hall & Waxman, 1990; Markman & Wachtel, 1988; Taylor & Gelman, 1989).

In Experiment 1, we establish more firmly the finding that introducing novel nouns does indeed put preschool children at a disadvantage in subordinate level classification. Next, we suggest that this reflects, at least in part, an inclination on the part of young children to label and classify objects at the basic level (Anglin, 1977; Rosch, Mervis, Gray, Boyes-Braem, & Johnson, 1976). Apparently, this inclination does not serve them well when it comes to establishing subordinate level classes. Yet in the natural course of development, children *do* learn to make subordinate level distinctions and to label them appropriately. Therefore, there must be circumstances under which children will alter their basic level inclination. In Experiments 2 and 3, we identify two such circumstances and demonstrate that under these circumstances, novel nouns do not present an obstacle in subordinate classification.

Experiment 1

The goal of this first experiment was to substantiate the claim that novel nouns put children at a disadvantage in establishing subordinate level classes (Waxman, 1990). To test this claim, we compared preschoolers' subordinate classification with and without novel labels. We employed Waxman's (1990) subordinate level materials (subclasses of dog and subclasses of grape) to provide a point of comparison with previous work in this area. In addition, to extend the foundation upon which this work is grounded, we also introduced a new set of materials (subclasses of fish). A preliminary study, conducted with another group of children, established that 3-year-olds had little knowledge about these subclasses.[2]

Method

Subjects.—Twenty-four children (mean age = 3-7, ranging from 3-1 to 4-0), enrolled in preschool programs serving middle- and upper-middle-class populations in suburban Philadelphia, participated as subjects. Children were randomly assigned to one of two conditions, with approximately equal numbers of boys and girls included in each.

Stimuli.—Three sets of 15 colored photographs were selected from magazines and nature books. Each set consisted of five different photographs of each of three subgroups. The set depicting kinds of dog included five collies, five terriers, and five setters, all of which varied in size, orientation (e.g., profile view, head-on view), and stance (e.g., sitting, standing, running). Subordinate level distinctions among the types of dog were marked by color, texture of fur, and shape of body. The set depicting kinds of fish included five angelfish,

[2] We selected our stimuli based on preliminary work with a different group of 3-year-old children. The experimenter first asked the subjects to label or describe each individual item. Next, the experimenter grouped the items into subordinate level classes and asked the children to label or describe each subclass. The overwhelming majority of children labeled the individual as well as the grouped stimuli at the basic level and offered very few comments regarding the subclasses. We therefore conclude that 3-year-olds' existing knowledge regarding these subclasses was indeed limited.

five salmon, and five trunkfish, all of which varied in size and orientation. Subordinate level distinctions were marked by color, texture, and body shape. In the set depicting kinds of grape (Aurora, Foch, and Thompson), instances varied in size of individual grapes and size of bunch. Subordinate level distinctions were marked by color.

Three target cards, one representative of each subgroup, were selected from each set of 15.

Procedure.—Children were tested individually in a quiet room in their preschools. They were randomly assigned to either the Novel Noun or No Word condition, and were tested on all three sets of stimuli (kinds of dog, fish, and grape). The order of presentation of these sets was counterbalanced. The procedure lasted approximately 15 min.

In the No Word condition, the experimenter first placed the three target cards from a stimulus set in front of the child and said, as she pointed briefly to each target, "These are what we are going to play with. See this, and this, and this." To begin the classification task, she then placed three cardboard boxes before the child and placed a target card in front of each box. She presented the remaining 12 classification cards (four from each subordinate class) one at a time, asking, while holding the card near each target, "Do you think this goes here, here, or here?" The first three cards in each set were each from a different subclass. Thereafter, cards were presented in random order. They were placed face down in the chosen box and no feedback was provided.

The Novel Noun condition was identical to the No Word condition, with one exception: The experimenter offered a novel noun as a label for each target, saying, for example, "These are what we are going to play with; this is an *aka*, this is a *kita*, and this is a *tosa*," as she pointed briefly to each target. She then placed three cardboard boxes before the child, with a target card in front of each box, and proceeded to present the remaining 12 classification cards (four from each subordinate class) one at a time, asking, while holding the card near each target, "Do you think this is an *aka*, a *kita*, or a *tosa*?" The first three cards presented in each set were each from a different subclass. Thereafter, cards were presented in random order and placed face down in the chosen box. No feedback was provided.

Scoring.—Each child earned three scores, one for each stimulus set (kinds of dog, fish, and grape). Scores were determined by counting the number of cards the child placed correctly and could range from 0 (no cards placed correctly) to 12 (all cards placed correctly). Random guessing would yield an average score of 4 for each stimulus set.

Results and Discussion

Children were interested and attentive throughout the three classification trials.[3] The classification data were submitted to a two-way mixed ANOVA, with condition (No Word vs. Novel Noun) as a between-subjects factor and category (dogs vs. grapes vs. fish) as a within-subjects factor.

As predicted, children in the Novel Noun condition (M = 7.5, SD = 1.6) had considerably more difficulty forming subordinate level classes than did children in the No Word condition (M = 9.8, SD = .8), $F(1,22) = 19.179$, $p < .001$. There was also a main effect for category, $F(2,44) = 5.042$, $p < .01$. Children classified types of grape (M = 9.5, SD = 2.4) more successfully than types of fish (M = 8.1, SD = 1.8) or dog (M = 8.3, SD = 2.2). This may reflect the fact that the grapes could be sorted into systematic subcategories by attending to a single dimension—color—while subtypes of fish and dogs differed along several dimensions, including color, body shape, and texture. There was, however, no interaction between condition and category. Instead, for each category, the same trend was observed: Children in the Novel Noun condition classified less well than their peers in the No Word condition.

An examination of individual scores provides a richer depiction of children's performance. Recall that each classification score could range from 0 to 12, and that if a child had been placing cards randomly, that child would be expected to achieve an average classification score of 4. By the binomial expansion, a classification score of 8 or higher is significantly above this chance level of performance at the $p < .05$ level.

In Table 1, we tabulate the number of classifications (out of a possible three) on which each child achieved a score of 8 or higher. In the No Word condition, 75% of the

[3] On average, the children in this experiment, and in all subsequent experiments, distributed approximately equal numbers of photographs among the three subclasses. Children neither ignored nor favored any particular subclass.

TABLE 1

NUMBER OF CHILDREN IN EACH CONDITION PERFORMING SIGNIFICANTLY ABOVE THE CHANCE LEVEL[a] ON 0, 1, 2, OR 3 SUBORDINATE CLASSIFICATIONS IN EXPERIMENTS 1, 2, AND 3

	NUMBER OF ABOVE CHANCE CLASSIFICATIONS			
	0	1	2	3
Experiment 1, no information:				
No Word (n = 12)	0	0	3	9
Novel Noun (n = 12)	2	4	3	3
Experiment 2, subordinate information:				
No Word (n = 18)	3	2	5	8
Novel Noun (n = 18)	1	4	3	10
Experiment 3, basic label and information:				
No Word (n = 18)	0	3	3	12
Novel Noun (n = 18)	0	1	3	14

[a] $p < .05$, binomial expansion.

children performed reliably better than chance on all three classifications. However, in the Novel Noun condition, only 25% of the children achieved this level of success. This analysis, which is based on individual children's scores, echoes precisely the findings obtained in the ANOVA and fortifies the claim that novel nouns present an obstacle to young children in subordinate level classification.

How can we account for this phenomenon? We suspect that the novel nouns drew the children's attention to category relations at the familiar basic level, thereby interfering with the establishment of new subordinate level distinctions. Recall that our preliminary work established that preschool children are familiar with the basic level classes used in this experiment, but that their knowledge about the subordinate level classes is minimal, at best. Our subjects surely recognized the stimuli as individual members of the basic level classes (as in Fig. 1*b*), but did not organize these individuals categorically into distinct kinds or subclasses (as in Fig. 1*a*).

This pattern appears to be typical of young children, for the acquisition of subordinate level distinctions is dependent upon factors such as familiarity or experience within a given domain (Berlin, 1978; Chi, 1983; Horton, 1982; Mervis, 1987; Mervis & Rosch, 1981). Indeed, this pattern is not uncommon for adults in domains in which they have had little experience. For example, most Western adults readily recognize individual members of the basic level class *cow;* very few (dairy farmers and abattoir employees, among others) organize these individual members into distinct subordinate level kinds.

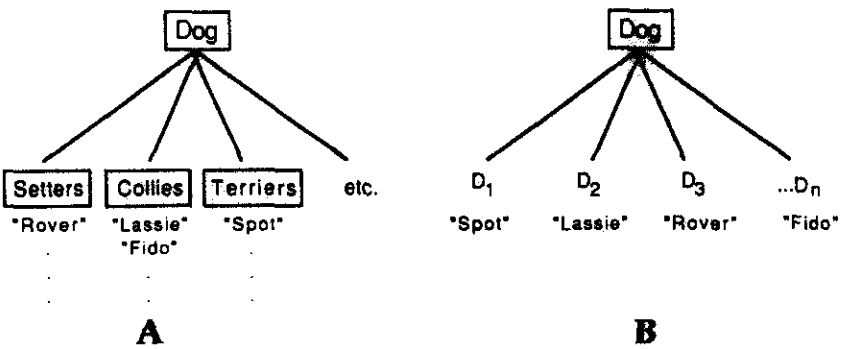

FIG. 1.—Two possible representations of the category *dog.* (Reprinted with the permission of Ablex Publishing Corp., Norwood, NJ.)

There is an important difference between recognizing individual members of a particular class and organizing these members into distinct subclasses. Consider, for example, the consequence of introducing novel labels in each case. If children appreciate subordinate distinctions (Fig. 1*a*), we would expect them to have no difficulty applying novel nouns to the subclasses. However, if children have not yet established categorical distinctions at subordinate levels (Fig. 1*b*), novel nouns may have a very different effect: They may highlight taxonomic relations at the basic level, and consequently interfere with the creation of new subclasses (e.g., collie, terrier) when an already familiar overarching taxonomic class (e.g., dog) is available. This might be especially difficult if children were attempting to translate each of the three novel words (e.g., *aka, kita, tosa*) as basic level terms (e.g., dog). We note here that children's spontaneous comments during the classification task were consistent with this possibility. Many children, even those in the Novel Noun condition, persisted in labeling the subclasses at the basic level.

To pursue this spontaneous behavior in a more systematic fashion, we interviewed another group of five 3-year-old children, none of whom had participated in Experiment 1. We showed these children the three targets from each stimulus set and said, for example, "This is what we are going to play with. This is an *aka*, this is a *kita*, and this is a *tosa*." We then asked the children what they thought the novel words meant. All children "translated" the novel nouns into familiar basic level terms. In fact, with only one exception, children provided identical labels for each of the three novel nouns. For example, children reported that *aka, kita,* and *tosa* translated as "dog," "dog," and "dog." The one exception was a boy, aged 3-8, who labeled all subsets of dog as "dogs," all subsets of grape as "grapes," but offered a different term for the trunkfish ("lobster") than for the salmon and angelfish ("fish," and "fish"). (See Waxman, 1990, for further evidence to this effect.) These results are consistent with the view that children hearing novel nouns in Experiment 1 were inclined to interpret them at the basic level.

There are two routes by which this basic level inclination could have influenced children's performance in the Novel Noun condition. First, children in the Novel Noun condition may have tried to impose a basic (rather than subordinate) level classification on the materials. In contrast, children hearing no novel nouns would be unobstructed in their efforts to arrive at a classification based on the observable subordinate level distinctions (e.g., subordinate distinctions marked by color, form, or texture).

Second, it is possible that children in the Novel Noun condition were also influenced by the principle of mutual exclusivity (Markman & Wachtel, 1988; Merriman & Bowman, 1989). According to this principle, children will resist taking a novel word as having the same reference as a known (here, basic level) term. The "translation" data described above reveal that children did not hold tenaciously to the mutual exclusivity assumption. Nonetheless, it is still possible that children in the Novel Noun condition were faced with a direct conflict between their inclination to interpret novel nouns at the basic level and their adherence to the principle of mutual exclusivity. Performance in the Novel Noun condition may have reflected children's uncertainty concerning the resolution of this conflict.[4]

Both of these interpretations are consistent with the results obtained in Experiment 1, where children hearing novel nouns classified less well than did their age-mates in a No Word condition. Both are consistent with the view that children's relative difficulty in the Novel Noun condition was related to their inclination to interpret the novel nouns at the basic level. This view leads to a clear prediction. If we could move children away from making basic level interpretations, then we should eliminate the difficulty children encounter when they are introduced to novel nouns in subordinate level classification tasks.

In the next two experiments, we test this prediction in two different, but complementary, ways. In Experiment 2, we provide children with specific information to highlight categorical distinctions at the subordinate, rather than basic, level. In Experiment 3, we introduce the novel nouns in conjunction with the basic level labels. This "anchoring" strategy, which is often adopted by parents by young children, seems to guide children away

[4] This series of experiments was not designed as an explicit test of the influence of the principle of mutual exclusivity. Consequently, we do not examine that principle directly. However, we note here that our efforts to guide children away from making basic level interpretations of the novel nouns (in Experiments 2 and 3) also have the coincidental effect of circumventing any conflict concerning the application of the principle of mutual exclusivity.

from making a basic level interpretation and to foster the formation of subordinate categories (Callanan, 1989b).

Although Experiments 2 and 3 will differ with respect to the types of information we provide, they follow the same experimental logic. Within each experiment, we hold constant the amount and type of information provided to the children. We then examine the effect of introducing novel nouns by comparing performance of children in a No Word condition with children in a Novel Noun condition. We expect that in each of these two experiments, our manipulations will shift the children's focus away from a basic level interpretation of the novel nouns. Consequently, we predict that children in a Novel Noun condition will suffer no disadvantage relative to those in the No Word condition in subordinate classification.

Experiment 2

In this experiment, we focus on the status of children's subordinate level knowledge. To support the emergence of distinct subordinate classes and to strengthen their conceptual coherence, we provided all children in this experiment with specific information to highlight categorical distinctions among the subclasses. (For more detailed arguments on category coherence, see Carey, 1985; Murphy & Medin, 1985; Shipley, 1989.) We then compared performance in a Novel Noun and No Word condition. We expected that when they were offered specific information to distinguish the relevant subclasses, children would focus on subordinate level distinctions. We therefore predicted that children in this experiment would evidence no detriment in subordinate classification when they were introduced to novel nouns.

Method

Subjects.—Thirty-six children (mean age = 3-5, ranging from 3-0 to 3-11) enrolled in preschool programs serving middle- and upper-middle-class populations in Cambridge, Mass., participated as subjects. Children were randomly assigned to one of two experimental conditions, with approximately equal numbers of boys and girls included in each condition.

Stimuli.—Stimuli were identical to those described in Experiment 1.

Procedure.—Children were tested individually in a quiet room in their preschools. They were randomly assigned to either the Novel Noun or No Word condition, and were tested on all three sets of stimuli (kind of dog, fish, and grape). The order in which these sets were presented was counterbalanced. The procedure lasted approximately 15 min.

The procedure entailed two phases: provision of subordinate level information by the experimenter and classification of the photographs by the child. The procedure began with the experimenter placing the three target cards from a stimulus set in front of the child, in random order. She then offered specific subordinate level information about each subgroup as she pointed briefly to the appropriate target card. Based on evidence that the term "kind" promotes subcategorization (Markman, Horton, & McLanahan, 1980), we adopted this terminology in both conditions to insure that the information was attributed to the subclasses. The subclasses of dog were distinguished by information concerning their typical function for man, means of transporting objects, and temperament. The subclasses of fish were distinguished by facts concerning means of locomotion, means of protection, and type of teeth. The subclasses of grape were distinguished by facts concerning geographical region, type of seeds, and taste. None of this information could be detected perceptually from examining the stimuli themselves. The complete information is given in Table 2.

In the No Word condition, the experimenter briefly pointed to the appropriate target and said, for example, "Here's what we are going to play with. Let me tell you about this kind. This kind helps take care of sheep, and they push things around with their bodies, and they are very gentle and stay very close to their owners." Pointing briefly to the next target, she said, "This kind goes underground to catch rats, and they carry things around by holding them with their sharp teeth, and they are very noisy and playful." Comparable information was then offered regarding the third target. The classification task was identical to that used in the No Word condition in Experiment 1.

In the Novel Noun condition, the experimenter recounted the same information, but in addition labeled each target with a novel noun. For example, the experimenter said, "Here's what we are going to play with. Do you know what they call this kind? They are *tosas*. *Tosas* help take care of sheep, and they push things around with their bodies, and they are very gentle and stay very close to their owners." She proceeded in a similar fashion to provide labels and information for the remaining two subclasses. The classi-

TABLE 2

CATEGORIES AND SUBORDINATE LEVEL INFORMATION USED IN EXPERIMENT 2

Basic Level and Subordinate Level	Information
Dogs:	
Collie	Help take care of sheep
	Push things around with their bodies
	Are very gentle, stay close to owners
Setter	Find birds for hunters
	Hold things gently with their lips
	Are very energetic and run around alot
Terrier	Go underground to catch rats
	Carry things around by holding them with their sharp teeth
	Are very noisy and playful
Fish:	
Salmon	Use their whole body to swim
	Swim fast to get away from enemies
	Have teeth on their tongues
Angelfish	Use their fins to swim
	Change color to hide from enemies
	Have fused teeth (which means their teeth are all stuck together)
Trunkfish	Use their tails to swim
	Have hard shells so their enemies can't hurt them
	Have very sharp teeth
Grapes:	
Aurora (red grapes)	Grown in the woods in Pennsylvania
	Have many little seeds
	Taste sour
Foch (blue)	Grown on farms in the south
	Have only one big seed
	Don't have any taste at all
Thompson (green)	Grown in the vineyards in California
	Have no seeds
	Taste very sweet

fication task was identical to that used in the Novel Noun condition in Experiment 1.

Scoring.—As in Experiment 1, each child earned three scores, one for each stimulus set (dogs, fish, and grapes).

Results and Discussion

The data were submitted to a two-way mixed ANOVA, with condition (No Word vs. Novel Noun) as a between-subjects factor and category (dogs vs. grapes vs. fish) as a within-subjects factor. In this experiment, the difference between performance in the No Word (M = 8.1, SD = 2.2) and Novel Noun (M = 9.0, SD = 2.0) conditions was eliminated, $F(1,34) = 1.56$, $p > .05$. As predicted, these 3-year-olds, who had been provided with information about subordinate level distinctions, encountered no difficulty in subordinate classification when they were introduced to novel nouns. As in Experiment 1, there was a main effect for category, $F(2,68) = 13.796$, $p < .001$, with children classifying types of grape (M = 9.9, SD = 2.8) more successfully than types of fish (M = 7.8, SD = 2.3) or dog (M = 7.9, SD = 2.7). Again, there was no interaction between condition and category.

As in Experiment 1, we tabulated the number of subordinate classifications (out of three) on which each child in each condition performed above the chance level (Table 1). An examination of Table 1 provides converging evidence for the view that when children have been provided with specific subordinate level information, those hearing novel nouns to describe the subclasses perform similarly to those hearing no novel words at all.

Thus, unlike children in Experiment 1, children in this experiment were offered specific information regarding categorical subordinate level distinctions. And unlike children in Experiment 1, these children encountered no obstacle with the introduction of the novel nouns. This result supports the assumption that by providing information about distinct kinds, we can focus children's attention on subordinate level distinctions

within a known basic level class (as in Fig. 1*b*). The specific information appears to have helped children to work out how the subordinate level classes contrast with one another and, perhaps more important, to see how the subordinate classes contrast with the category picked out by the familiar basic level term (e.g., dog).

This experiment provides empirical support for the view that children's biases in word learning and their existing knowledge jointly influence conceptual development. However, this finding also presents us with a challenge: Throughout the course of development, children learn to make subordinate level distinctions and to label them appropriately, yet parents and teachers do not typically accompany novel subordinate level terms with such substantial distinguishing information. How, then, do children come to make subordinate level distinctions under such conditions? To address this question, we turned our attention to another source of category development—parental labeling strategies.

Adults employ a characteristic strategy when introducing children to subordinate level labels (Callanan, 1989a, 1989b; Mervis, 1987; Shipley, Kuhn, & Madden, 1983). They tend to "anchor" a new subordinate level term (e.g., *terrier*) with the familiar basic level term (e.g., "This is a dog. It's a *terrier*"). This strategy serves an important function: When adults use a novel noun in conjunction with the familiar basic level word, children seem to expect that there will be a hierarchical relation between the two terms (Callanan, 1989a, 1989b). Furthermore, when it is clear to children that two words are hierarchically related, they relax the principle of mutual exclusivity (Au & Glusman, 1990; Markman & Wachtel, 1988). Thus, explicit mention of basic level terms appears to reduce the likelihood that children will mistakenly interpret the novel noun at the preferred, basic level.

Experiment 3

In this experiment, we explicitly mentioned the familiar basic level terms to all children as we introduced the materials. To further highlight the basic level classes, we also provided children with new information concerning general properties of the *basic* level classes. We then compared performance in a Novel Noun and No Word condition. We expected that when we anchored the novel nouns at the basic level, children would be less inclined to interpret them as referring to the basic level. Consequently, we predicted that in this experiment, children in a Novel Noun condition would evidence no detriment in subordinate classification.

Method

Subjects.—Thirty-six children (mean age = 3-8, ranging from 3-4 to 3-11), enrolled in preschool programs serving middle- and upper-middle-class populations in suburban Philadelphia, participated as subjects. Children were randomly assigned to one of two experimental conditions, with approximately equal numbers of boys and girls in each.

Stimuli.—Stimuli were identical to those described in Experiment 1.

Procedure.—Children were tested individually in a quiet room in their preschools. They were randomly assigned to either the Novel Noun or No Word condition, and were tested on all three sets of stimuli (kinds of dog, fish, and grape). The order of presentation of these sets was counterbalanced. The procedure lasted approximately 15 min.

The procedure entailed two phases: provision of the basic level label and information by the experimenter and classification of the photographs by the child. The procedure began with the experimenter placing the three target cards from a stimulus set in front of the child. She then offered the basic level label and information as she pointed briefly to each target card. The information provided about each basic level class is given in Table 3.

For children in the No Word condition, the experimenter began by saying, for example, "We've got three dogs here, this one, this one, and this one [pointing to each target card]. Dogs can't hear anything until they are 10 days old. And all dogs' tails curve up. And a dog's temperature is higher than a person's temperature." The classification task was identical to that used in the No Word condition in the preceding experiments.

In the Novel Noun condition, the experimenter introduced the same basic level labels and information, but in addition labeled each target with a novel noun. For example, she said, "We've got three dogs here. This is a *tosa*, this is an *aka*, and this is an *akita* [pointing to each target card]. Dogs can't hear anything until they are 10 days old. And all dogs' tails curve up. And a dog's temperature is higher than a person's temperature." The classification task was identical to that used in the Novel Noun condition in the preceding experiments.

TABLE 3

CATEGORIES AND BASIC LEVEL INFORMATION PROVIDED IN EXPERIMENT 3

Basic Level	Information
Dogs	Dogs can't hear anything until they are 10 days old
	A dog's temperature is always higher than a person's temperature
	All dogs can make their tails curve up
Fish	Fish breathe by taking water into their mouths
	A fish can't hear other fish, but it can feel their movements in the water
	All fish have backbones; they were the first animals with backbones on earth
Grapes	Grapes grow on vines that can be more than 50 years old
	Grapes grow from tiny flowers that have a sweet smell
	Grapevines have long roots, longer than from here to there (12–20 feet)

Scoring.—As in Experiments 1 and 2, each child earned three scores, one for each stimulus set (dogs, fish, and grapes).

Results and Discussion

The data were submitted to a two-way mixed ANOVA, with condition (No Word vs. Novel Noun) as a between-subjects factor and category (dogs vs. grapes vs. fish) as a within-subjects factor. Children in the Novel Noun condition (M = 10.2, SD = 1.2) classified significantly more successfully than did their peers in the No Word condition (M = 9.4, SD = 1.0), $F(1,34) = 4.62$, $p < .05$. As was the case in both Experiments 1 and 2, there was a main effect for category, $F(2,68) = 20.668$, $p < .001$, with children classifying types of grape (M = 10.8, SD = 1.5) more successfully than types of fish (M = 8.8, SD = 1.6) or dog (M = 9.8, SD = 1.8). Although the magnitude of this effect is not large, its direction is consistent across three subordinate level classifications. For each classification, children in the Novel Noun condition sorted more items correctly than did their peers in the No Word condition. Again, there was no interaction between condition and category.

As in Experiments 1 and 2, we tabulated the number of subordinate classifications (out of three) on which each child in each condition performed above the chance level (Table 1). An examination of Table 1 provides converging evidence for the view that when children have been provided with the basic label and basic information, those hearing novel nouns to describe the subclasses perform similarly to those hearing no novel words at all.

General Discussion

In this series of experiments, we have focused on the noun-category bias to illustrate the point that implicit word-learning biases operate in concert with other important aspects of development. Although nouns highlight basic and superordinate level relations, they put children at a disadvantage at the subordinate level (Waxman, 1990). We have suggested that the difficulty engendered by novel nouns at the subordinate level derives, at least in part, from children's inclination to label and classify at the basic level. We have identified two different circumstances which weaken that inclination.

Our first hypothesis concerned the status of children's existing subordinate level knowledge. In Experiment 2, we found that providing children with specific subordinate level information supported the establishment of subordinate level distinctions. When we provided children with information to distinguish the relevant subclasses, novel nouns did not exert a deleterious effect. Our next hypothesis concerned the conditions under which novel terms are typically introduced. In Experiment 3, when we mentioned the familiar basic level terms and provided basic level information, children in the Novel Noun condition completed the subordinate level classification tasks more successfully than did their peers in the No Word condition.

Experiments like these may contribute to a reconciliation of the controversy surrounding the argument for constraints or biases in development (Carey, 1982; Hall & Waxman, 1990; Markman, 1989; Nelson, 1988). We have taken the position that biases guide the young child's development and make possible the rapid acquisition of complex systems of knowledge. But we have emphasized that these biases will exert their influence within the context of the child's existing social, cultural, and physical milieu. Therefore, identifying such biases does not, in any sense, preclude examining other important sources of

development. For biases also leave open ample opportunity for variation and elaboration, depending upon the child's experience.

This point is crucial, particularly when one considers the remarkable flexibility which is characteristic of human conceptual organization. We classify items in various ways in response to our various goals. Hierarchical systems, composed of nested taxonomic classes at multiple levels of abstraction (e.g., Doberman pinscher, dog, mammal, animal), have been singled out for their exceptional power and utility. Within such hierarchical systems, classifications capture deep commonalities among objects, support logical reasoning, and allow us to extend our knowledge in important ways.

Yet hierarchical systems are not carved in stone. On the contrary, throughout the course of development, we refine and revise our existing categories to incorporate new information, new items, and new labels (Markman, 1989; Taylor & Gelman, 1989; Waxman, 1990). Therefore, although there are almost certainly implicit biases that guide us in the establishment of hierarchical systems, the precise categories that we compose will also be dependent upon our experience. (See Dougherty, 1978, for an interesting discussion of this point from an anthropological perspective.)

These experiments also bear on more general questions regarding the relation between language and thought. We find that semantic and conceptual development are linked in important ways, but our results are certainly not consistent with linguistic determinism in its strong form (Whorf, 1956). Labels alone are not sufficient to motivate the establishment of a new category. In fact, the results of Experiment 1 illustrate that there are circumstances under which hearing a new label actually interferes with the emergence of a new conceptual distinction.

If novel nouns highlight existing taxonomic relations and interfere with the establishment of new conceptual distinctions, then must we conclude that language plays a conservative role, tagging along behind conceptual development? We would argue against this broad interpretation. Semantic and conceptual development appear to be mutually intertwined, each influencing the other in very specific ways. Children are very sensitive to syntactic form class (e.g., noun, adjective) as well as their existing conceptual knowledge when interpreting a novel word's meaning. Nouns highlight basic and superordinate level relations among objects (Markman & Hutchinson, 1984; Waxman, 1990; Waxman & Kosowski, 1990). Modifier-noun constructions, including novel adjective-noun phrases (e.g., *ak*-ish ones) and novel noun compounds (e.g., *pumpkin-house*), highlight specific properties of objects (e.g., shape, size, color, position) and foster the establishment of new subordinate level distinctions (Au & Markman, 1987; Clark, Gelman, & Lane, 1985; Waxman, 1990).

The results of the current series of experiments reveal that at 3 years of age, conceptual development is a joint function of children's word learning biases and their existing knowledge. We have shown that either (*a*) providing children with specific subordinate level information or (*b*) anchoring novel subordinate level terms at the basic level will support the acquisition of new subordinate level classes. In the normal course of events, children may well benefit from both of these sources.

One limitation in this series of experiments bears mention. By virtue of the particular nature of our experimental design, it was not possible to make direct, statistical comparisons across the three experiments. This is because the experiments were conducted by different experimenters, in different preschools, in different cities. We therefore have limited ourselves to comparing performance in the Novel Noun and No Word conditions within each experiment. As a consequence, it is not possible in this series to evaluate the contribution of the various types of information per se. In future work, it will be important to design experiments that permit direct comparisons among the various types of information and that allow us to examine the consequence of introducing novel labels under the various types of information.

In closing, we underscore the importance of extending this general line of inquiry beyond the noun-category bias to ascertain how other proposed biases (e.g., Markman's [1989] principle of mutual exclusivity, Clark's [1987] principle of contrast) influence one another and interact with other aspects of human development. Coordinated investigations of children's implicit biases and their existing knowledge are essential if we are to formulate a thorough account of conceptual development.

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