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Children’s Sensitivity to Constraints on Word Meaning: Taxonomic versus Thematic Relations

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A major problem in language learning is to figure out the meaning of a word given the enormous number of possible meanings for any particular word. This problem is exacerbated for children because they often find thematic relations between objects to be more salient than the objects’ taxonomic category. Yet most single nouns refer to object categories and not to thematic relations. How do children learn words referring to categories when they find thematic relations so salient? We propose that children limit the possible meanings of nouns to refer mainly to categorical relations. This hypothesis was tested in four studies. In each study, preschool children saw a series of target objects (e.g., dog), each followed by a thematic associate (e.g., bone) and a taxonomic associate (e.g., cat). When children were told to choose another object that was similar to the target (“See this? Find another one.”), they as usual often selected the thematic associate. In contrast, when the instructions included an unknown word for the target (“See this fp? Find another fp.”), children now preferred the taxonomic associate. This finding held up for 2- and 3-year-olds at the basic level of categorization, for 4- and 5-year-olds at the superordinate level of categorization, and 4- and 5-year-olds who were taught new taxonomic and new thematic relations for unfamiliar objects. In each case, children constrained the meaning of new nouns to refer mainly to categorical relations. By limiting the hypotheses that children need to consider, this constraint tremendously simplifies the problem of language learning.

One of the major problems confronting someone learning a language is to figure out the meaning of a word given the enormous number of possible meanings for any particular word. Children commonly learn their

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first words (category terms) through ostensive definition: a parent or other teacher points to an object and labels it. Especially in the early phases of language acquisition, when children cannot understand a description of a category, children's learning of new category terms must depend heavily on ostensive definition. Once an adult points to an object and labels it, how does the child settle on an interpretation? At first sight this would seem to be a simple problem, and in fact children make hundreds of such inferences correctly when acquiring new vocabulary. This apparent simplicity, however, belies a complex inferential problem that was formulated by Quine (1960) in his well-known argument about translation. Imagine that someone points to a dog and says "chien," and our job is to figure out what "chien" means. An obvious hypothesis is that it means "dog." But this is not necessary. It could mean "furry object," or "brown object," or "medium-sized object," and so on. To decide if the new term refers to dogs, one might set up test situations by pointing to various objects and asking whether or not "chien" applies. Quine's argument is that no matter how many test situations one constructs, there will always be more than one hypothesis for the meaning of a new term that is consistent with the existing evidence.

Young children beginning to acquire their native language continually face this problem of narrowing down the meaning of a term from an indefinite number of possibilities. Someone points in some direction and then utters a word. On what grounds is the child to conclude that a new unfamiliar word, e.g., "dog," refers to dogs? What is to prevent a child from concluding that "dog" is a proper name for that particular dog? What prevents the child from concluding that "dog" means "four-legged object" or "black object" or any number of other characteristics that dogs share? And finally, what prevents the child from concluding that "dog," in addition to referring to that particular dog, also refers to the bone the dog is chewing on or to the tree the dog is lying under? These last examples of thematic relations pose a particular problem because children are very interested in such relations and may find them more salient than categorical relations. Before continuing to discuss how children narrow down the possible meanings of terms, we briefly review the work on classification showing children's fascination with thematic relations.

One widely used procedure for studying how children form categories of objects is to ask them to sort objects into groups. Typically children are presented with objects from several different categories, for example, vehicles, animals, clothing, and people. They are instructed to put together the objects that are alike or that go together or are given freedom to manipulate and group the objects as they like. Another variant of the sorting procedure is a match to sample task. In this case, children are
shown a target object and two choices, one in the same category as the target and one in a different category. Children must choose which is most like the target. This task in particular is similar to the one that children face in ostensive definition, in that someone points to an object and the child must determine which other objects are like it.

Here is a somewhat oversimplified summary of what is often found in these studies. Children older than about 4 sort objects on the basis of the object's taxonomic category. For example, they place all and only the vehicles together, all and only the clothing together, and so on. They perceive the perceptual or functional properties that the objects share perhaps in a family resemblance structure (Rosch & Mervis, 1975) and to find the common taxonomic category to be a natural way of organizing objects. Younger children sort on some other basis. Sometimes, especially when geometric figures are used, young children create spatial configurations with the objects, arranging them into designs or patterns. When more meaningful objects are used, children represent causal and temporal relations among the objects as well as spatial relations. These thematic relations emphasize events rather than taxonomic similarity. For example, children might sort a man and a car together because the man is driving the car. Or they might place a boy, a coat, and a dog together because the boy will wear his coat when he takes the dog for a walk.

This attention to thematic relations between objects rather than to how objects are alike is a common finding replicated in many studies. In addition to sorting experiments, this thematic bias shows up in studies of memory clustering and word association (Inhelder & Piaget, 1964; Denney, 1974; Denney & Ziolowski, 1972; Nelson, 1977). These findings indicate that children are more interested in the thematic relations among objects or that thematic relations are simpler or more readily constructed than categorical relations.

It is not surprising that children notice these thematic relations. They are obviously very important for making sense of the world for adults and children alike. As we move about in our daily life, we observe people interacting or using tools or other artifacts to accomplish goals. We view natural occurrences such as storms, and we admire scenery. Much of our perception is interpretive, trying to figure out what is happening and how. Even infants tend to place causal interpretations on events they perceive (cf. Gibson & Spelke, 1983). Thus, these event-like structures are a fundamentally important and natural way of organizing information. Moreover, there seem to be fewer developmental and cross-cultural differences in understanding this type of organization (Mandler, Scribner, Cole, & DeForest, 1980). This is in marked contrast to the cross-cultural and developmental differences found in studies of taxonomic classification. In sum, interest in thematic relations is not limited to young children.
Nor should attention to thematic relations be viewed as a useless or nonproductive bias. Noticing causal, spatial, and temporal relations between objects is essential for understanding the world. It is children's attention to categorical relations and not their attention to thematic relations that changes most with development.

When the procedures used in sorting tasks specifically guide children's attention toward categories and away from thematic relations, children do show some understanding of categorical organization (see Carey, in press; Gelman & Baillargeon, 1983; Markman & Callanan, 1983; Horton, Note 1, for reviews). To take one example, Smiley and Brown (1979) tested whether 5- and 6-year-old children could understand taxonomic relations even though they prefer thematic ones. They presented children with a target picture and two choice pictures. One of the choices was thematically related to the target, and one of the choices was taxonomically related to the target. For example, children were shown a spider (target), a spider web (thematic choice), and a grasshopper (taxonomic choice). The experimenter pointed to the spider and asked for "the one that goes best with this one." As usual, these young children tended to pick the spider web, rather than the grasshopper, thereby indicating a thematic relation. Nevertheless, when they were asked about the grasshopper, all of the children could explain the taxonomic relation. Thus, children have a rudimentary ability to organize objects taxonomically, but it is often obscured by their attention to thematic relations.

Although children are biased toward organizing objects thematically, single words, in particular count nouns, do not often encode thematic relations. English does not have a single noun for thematically related objects such as a boy and his bike, a spider and its web, or a baby and its bottle. Thus to return to Quine's problem of induction, we are faced with a kind of paradox. Children seem to readily learn concrete nouns like "ball" or "dog" that refer to object categories. Yet they tend to notice and remember thematic relations between objects more readily than categorical relations. How is it that children readily learn labels for categories of objects if they are attending to these thematic relations between objects instead? To take a concrete example, imagine a mother pointing to a baby and saying "baby." Based on the sorting studies, we should assume that the child will be attending to the baby shaking a rattle or to the baby being diapered. Why, then, doesn't the child infer that "baby" also refers to the rattle or to the diaper, in addition to the particular baby?

1 There are a few exceptions, however. Relational information is contained in the meaning of kinship terms such as "brother" or "cousin." The term "friends" also refers to people who have a particular kind of thematic relationship with each other.
As a possible solution to this problem, we propose that children have implicit hypotheses about the possible meaning of words that help them acquire words for categories. Children may well prefer to construe the environment in a way that conflicts with the way that language is organized. But even very young children may be aware of the constraint on word meaning so that when they believe that they are learning a new word, they shift their attention from thematic to categorical organization.

This proposal has a strong and a weak form. The strong form is that sensitivity to the constraint on word meaning can help children discover and learn new categories. That is, on hearing an unfamiliar word, children will search for categorical relations. If no familiar, previously unlabeled category is available, children will analyze the environment to form a new categorical relation to label. In this way, the constraint on possible word meanings could help children acquire new categories. The weak form of the proposal is that children use the constraint to help them link a new word to a concept they already know. If a familiar categorical relation is not available, however, children will not attempt to search for a new one.

The four studies that follow test mainly the weak form of the hypothesis. Experiment 1 focuses on 2- and 3-year-old children's knowledge of the constraint on word meaning for basic level categorization. Experiments 2 and 3 focus on 4- and 5-year-olds' sensitivity to the constraint for superordinate level categories. And Experiment 4 tests the hypothesis for 4- and 5-year-olds who were taught new taxonomic and new thematic relations for unfamiliar objects.

All of the experiments use a match to sample procedure with a target picture, taxonomic choice, and thematic choice. In the No Word condition, children are shown the target and asked to simply "find another one." In the Novel Word condition, children hear a new label for the target (e.g., "biv") and are asked to "find another biv." The Novel Word task is quite like ostensive definition: someone points to an object and labels it, and the child must figure out what else the label refers to. We predicted that the majority of choices in the Novel Word condition would be taxonomic. The No Word task also has much in common with ostensive definition, except that no label is given. We expected children in this condition to give many more thematic responses than children in the Novel Word condition.

EXPERIMENT 1

This first study investigates whether hearing a novel word will cause 3-year-old children to shift their attention from thematic to categorical relations. Basic level categories (such as "dog" or "chair") were used with these young children rather than general superordinate level
categories (such as "animal" or "furniture"). The basic level, according to Rosch and her colleagues, is the level of categorization at which category members have the most features in common without being confused with members of contrasting categories (Rosch, 1978; Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976; Mervis & Rosch, 1981).

**Methods**

**Subjects**

Forty-one children from nursery schools in Palo Alto, California, participated in the study. They ranged in age from 2 years 3 months to 3 years 11 months, with a mean age of 3 years 4 months. An additional two children failed to pass a pretest described below and were not included in the study. Children were randomly assigned to one of two conditions with the constraint that the conditions be roughly equated for age and sex.

**Procedure**

**Pretest.** A simple pretest was given to ensure that the children understood instructions to find an object that is the same as another. A target picture was propped up against a frame and the child's attention was drawn to the picture. Then another identical picture and a distractor were placed on the table in front of the child, and the child was asked to "find one that is the same as this one" (the target picture). Three sets of pictures were used: two identical circles with a squiggle as the distractor, two rectangles with a z as the distractor, and two arrows with a U-shaped figure as the distractor. Children were scored as passing the pretest only if they answered all three items correctly.

**No Word condition.** The procedure used in this condition was very similar to the pretest procedure. Children were first introduced to a hand puppet and were told to put the picture they chose in the puppet's mouth. On each trial, the experimenter propped the target picture against the frame and told the child, "Look carefully now. See this?" as she pointed to the picture. Then the experimenter placed the two choice pictures on the table and told the child to "find another one that is the same as this," as she continued to point to the target picture. The instructions were designed to make it as clear as possible to these young children that we were looking for a taxonomic match.

One of the choice pictures was a member of the same basic level category as the target for example, the target might be a poodle and the choice a German shepherd (both dogs).

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2 Rosch, Mervis, Gray, Johnson, and Boyes-Braem (1976) showed that 3-year-old children are capable of using category membership to sort objects at the basic level of categorization, even though they fail to sort objects taxonomically at the superordinate level. In the Rosch et al. (1976) study, children were presented with two objects related at the basic level, along with an unrelated distractor, and were asked to find the two that are alike. Three-year-olds almost always selected the two category members over the unrelated distractor. Because this study failed to include any competing thematic relations, however, it did not establish the relative salience of thematic and categorical relations. In a preliminary study, we demonstrated that when a competing thematic relation is present (e.g., a baby and a bottle), 3- and 3-year-olds often select it over the basic level category (e.g., two babies). When an unrelated distractor was used, children selected the categorical associate 94% of the time, as in the Rosch et al. (1976) study. When a thematically related distractor was used, however, children selected the categorical associate only 56% of the time. This finding allows us to address the main question about the role of a word in inducing categorical organization.
attempted to make the two category exemplars fairly dissimilar yet still readily identifiable to these young children. The other choice picture was a strong thematic associate to the target—in this case, dog food. There were 10 such triads in all. They are listed in Table 1. The left–right placement of the thematic and category choices was randomly determined for each subject with the constraint that half of the thematic choices be on the left and half on the right. The presentation order of the 10 items was also randomly determined for each subject.

**Novel Word condition.** The materials and procedure for this condition were identical to those of the No Word condition, with one change. Children in this condition were told that the puppet could talk in puppet talk. They were instructed to listen carefully to the right picture. The puppet gave the target picture an unfamiliar name and used the same name in the instructions for picking a choice picture. For example, the puppet might say, “See this? It is a suz. Find another suz that is the same as this suz.” Ten meaningless one-syllable words were used and a different random assignment of words to pictures was made for each child.

**Results**

When children in the No Word condition had to select between another category member and a thematically related object, they chose the thematic relation almost half of the time. They selected other category members a mean of 5.95 times out of 10 (59%), $SD = 2.28$. This was not significantly different from chance. When the target picture was labeled with an unfamiliar word children were much more likely to select categorically. They now chose the other category member a mean of 8.29 times out of 10 (83%), $SD = 1.82$. This was significantly different from chance, $t(20) = 8.08$, $p < .01$, and was significantly different from the No Word condition, $t(39) = 3.63$, $p < .001$. The effect held up over every item and was significant when items rather than subjects were treated as random factor, paired $t(9) = 8.40$, $p < .001$. As predicted, when children think they are learning a new word they look for categorical relationships between objects and pay less attention to thematic relations. These re-

<table>
<thead>
<tr>
<th>Standard object</th>
<th>Taxonomic choice</th>
<th>Thematic choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Police car</td>
<td>Car</td>
<td>Policeman</td>
</tr>
<tr>
<td>Tennis shoe</td>
<td>High-heeled shoe</td>
<td>Foot</td>
</tr>
<tr>
<td>Dog</td>
<td>Dog</td>
<td>Dog food</td>
</tr>
<tr>
<td>Straight backed chair</td>
<td>Easy chair</td>
<td>Man in sitting position</td>
</tr>
<tr>
<td>Crib</td>
<td>Crib</td>
<td>Baby</td>
</tr>
<tr>
<td>Birthday cake</td>
<td>Chocolate cake</td>
<td>Birthday present</td>
</tr>
<tr>
<td>Blue jay</td>
<td>Duck</td>
<td>Nest</td>
</tr>
<tr>
<td>Outside door</td>
<td>Swinging door</td>
<td>Key</td>
</tr>
<tr>
<td>Male football player</td>
<td>Man</td>
<td>Football</td>
</tr>
<tr>
<td>Male child in swimsuit</td>
<td>Female child in overalls</td>
<td>Swimming pool</td>
</tr>
</tbody>
</table>

**TABLE 1**

Stimulus Materials for Experiment 1
Results support the hypothesis at least for very young children and basic level categories. The next three studies examine whether the effect holds up for familiar superordinate level categories and for newly learned object categories.

EXPERIMENT 2

This study tests the hypothesis that hearing a new word will induce older preschoolers to look for superordinate level taxonomic relations rather than thematic relations. The superordinate level of categorization, according to Rosch and her colleagues, is more abstract than the basic level. Members of superordinate level categories share fewer attributes, especially perceptual attributes, than members of basic level categories (Rosch, 1978; Rosch et al., 1976; Mervis & Rosch, 1981).

Methods

Subjects

Sixty children attending nursery schools in Palo Alto, California, and surrounding towns participated in the study. They ranged in age from 4 years 4 months to 5 years 3 months, with a mean age of 4 years 10 months. An additional two children were dropped from the study, one who did not cooperate with the experimenter and one who did not understand the task. The children were randomly assigned to four conditions, 15 per condition, with the constraint that the conditions be roughly equated for age and sex.

Procedure

No Word condition. The procedure used in this condition was very similar to that used in the No Word condition of Experiment 1, except that superordinate level categories were used instead of basic level categories. The experimenter saw each child individually for one 15- to 20-min session. Subjects were shown 30 colorful pictures of common objects. Ten of the pictures served as targets. Associated with each of the target pictures were two choice pictures. One of the choice pictures was related in a thematic way to the target (e.g., milk/cow). The other choice picture was a member of the same superordinate category as the target (e.g., pig/cow). An attempt was made to use a variety of thematic relations rather than just one, so as not to limit the generality of the results. A complete list of the stimulus materials appears in Table 2. As in Experiment 1, the instructions in the No Word condition were designed to make it as clear as possible that we were looking for a taxonomic match.

On each trial in the No Word condition, the experimenter, using a hand puppet, said, “I’m going to show you a (new) picture. Then you’ll have
TABLE 2
Stimulus Materials for Experiments 2 and 3

<table>
<thead>
<tr>
<th>Standard object</th>
<th>Taxonomic choice</th>
<th>Thematic choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow</td>
<td>Pig</td>
<td>Milk</td>
</tr>
<tr>
<td>Ring</td>
<td>Necklace</td>
<td>Hand</td>
</tr>
<tr>
<td>Door</td>
<td>Window</td>
<td>Key</td>
</tr>
<tr>
<td>Crib</td>
<td>Adult bed</td>
<td>Baby</td>
</tr>
<tr>
<td>Bee</td>
<td>Ant</td>
<td>Flower</td>
</tr>
<tr>
<td>Hanger</td>
<td>Hook</td>
<td>Dress</td>
</tr>
<tr>
<td>Cap</td>
<td>Glass</td>
<td>Kettle</td>
</tr>
<tr>
<td>Car</td>
<td>Bicycle</td>
<td>Car tire</td>
</tr>
<tr>
<td>Sprinkler(^a)</td>
<td>Watering can</td>
<td>Grass</td>
</tr>
<tr>
<td>Paintbrush(^a)</td>
<td>Crayons</td>
<td>Easel</td>
</tr>
<tr>
<td>Train(^b)</td>
<td>Bus</td>
<td>Tracks</td>
</tr>
<tr>
<td>Dog(^b)</td>
<td>Cat</td>
<td>Bone</td>
</tr>
</tbody>
</table>

\(^a\) This set was used only in Experiment 2.
\(^b\) This set was used only in Experiment 3.

to find another one that is the same kind of thing.” The experimenter then placed the target picture face up on the table directly in front of the child, and said, “See this?” She placed the two choice pictures to the left and right of the target, then said, “Can you find another one that is the same kind of thing as this one? Find another one that is the same kind of thing as this one.” The left-right position of the choice pictures was randomized for each child in such a way that thematic and taxonomic choices each appeared half the time on the left and half the time on the right, across the 10 stimulus triads. The order of presentation of triads was also randomized for each subject. After children made a choice, they were asked to justify their response: “How do you know these two are the same kind of thing?”

**Novel Word condition.** The materials and procedure for this condition were identical to those of the No Word condition, except that the target picture was now labeled with a novel word. Children were told that the puppet could talk in puppet talk, and that they were to listen carefully to what he said. The instructions now included an unfamiliar label for the target: “I’m going to show you a kind of dax. Then you’ll have to find another kind of dax. See this? It’s a kind of dax. Can you find another kind of dax?” A different meaningless one-syllable word was used for each target picture. Children again were asked to justify their choices. Because they were given a label, we expected children in the Novel Word condition to choose the taxonomically related picture more often than children in the No Word condition.

Two additional control conditions were included to attempt to rule out
one alternative explanation for increased taxonomic responding in the Novel Word condition. We are arguing that when children hear a word, they focus on categorical relationships because of general knowledge of what nouns encode, and not because of specific knowledge about the word’s meaning. But children already knew real word names for the target pictures and they conceivably could have translated the unfamiliar labels. Translation of the unfamiliar words into known words might help children choose taxonomically. We could not control for the possibility that children were translating, but we did run one condition to determine what word children might translate into if they were translating, and another condition to determine what effect such translation would have on understanding.

Translation condition. Children might translate the unfamiliar word into either a basic level word or into a superordinate level word. For instance, given a cow as a target picture and told that it was a “dax,” they might translate “dax” into “cow” (basic level) or they might translate “dax” into “animal” (superordinate level). In the Translation condition, we looked at the kinds of translations children make when they are explicitly asked to translate the unfamiliar word. The procedure was identical to that of the Novel Word condition except children were also asked “What do you think dax means?”—once right after the target picture was introduced (but before children saw the choice pictures), and again after they made a choice.

When we analyzed the children’s translations of these novel words, we found that on the first translation, before seeing the choice pictures, children almost never translated the unfamiliar labels into superordinate terms (only 6.7% of the time). Forty-seven percent of the first translations were basic level words. The rest of the translations were descriptive phrases. Even after making a choice, subjects still produced superordinates only 7.3% of the time, while the mean percentage of basic level translations decreased to 19%. Thus if children in the Novel Word condition spontaneously translated the unfamiliar word, they would be very unlikely to translate it into a superordinate level word.

Basic Word condition. If children are going to translate into a single known word, it will be into a basic level category term. The Basic Word condition tested whether translation into a basic level word would facilitate taxonomic responding.

The materials and procedure for this condition were identical to those in the Novel Word condition. The instructions simply substituted the basic level word for the target, in place of the unfamiliar label. For the example with the cow target, the experimenter said: “I’m going to show you a picture of a cow. Then you’ll have to find another picture that is the same kind of thing. See this? It’s a cow. Can you find another one
hat is the same kind of thing as this one?’ As in the other three conditions, children were asked to justify their choices.

Results

As is typical for children this age, when no word was present they made a number of thematic choices. When children in the No Word condition had to select between another member of the same superordinate category and a thematically related object, they chose the categorical relation only 4.93 times out of 10 (49%), $SD = 2.88$. This was not different from chance. As predicted, the presence of a new word caused children to focus more attention on taxonomic relations. When the target picture was labeled with an unfamiliar word, children now chose the other category member a mean of 6.87 times out of 10 (69%), $SD = 2.55$. This was more often than would be expected by chance, $t(14) = 2.75, p < .05$. The difference between the conditions was significant by a one-tailed $t$ test, $t(28) = 1.88, p < .05$.

Children who heard the target described with a basic level word chose the categorically related object 57% of the time. This was not significantly different from either the Novel Word or the No Word condition. It was also not significantly different from chance.

The results were more clear-cut when items were treated as a random factor and conditions as a within groups factor. Pictures labeled with unfamiliar words elicited significantly more taxonomic responses than the same pictures not labeled, paired $t(9) = 4.95, p < .002$. This effect held up for 9 out of the 10 stimulus triads. Pictures labeled with a basic object word elicited an intermediate number of taxonomic responses: significantly more than in the No Word condition, paired $t(9) = 4.14, p < .01$, but significantly fewer than in the Novel Word condition, paired $t(9) = 2.49, p < .05$.

Converging evidence for the hypothesis came from the justifications that children gave for their choices. Two raters coded the justifications as thematic, categorical, or irrelevant, and agreed on 90% of the classifications. Thematic justifications expressed an interactive relationship between the target and the object chosen. An example is “The cow makes milk.” Children justified more of their choices thematically when they heard no word (51%) than when they heard an unfamiliar word (19%), $t(28) = 3.17, p < .005$. Likewise, they justified more of their choices thematically when they heard a familiar basic level word (38%) than when they heard an unfamiliar word, $t(28) = 1.92, p = .062$. There was no difference in the numbers of thematic justifications given in the No Word and Basic Word conditions.

Justifications and choices were not perfectly correlated, as the kind of
justification children gave did not always match the kind of choice they made. Children seemed to explain their choices in terms of the task they saw it. For example, when children chose thematically in the Novel Word condition, they seemed reluctant to justify the thematic choice with a thematic explanation. When they heard a novel word, they justified thematic choices with a thematic explanation an average of only 44% of the time. The children seemed to be in conflict between having chosen thematically but believing that the word implies a taxonomic relation. After choosing a cow and milk as being the same kind of thing, for example, many children did not justify their selection in the most natural way (stating that milk comes from a cow). They had to manufacture some justification to satisfy the experimenter, and so ended up giving a relatively high proportion of irrelevant justifications for their thematic choices such as “I don’t know” (mean = 39%), compared to children in the No Word condition (mean = 6%), t(24) = 2.52, p < .02. When children in the No Word condition made a thematic choice they did not have the same conflict and were quite willing to give thematic justifications. These children, who did not hear a word, justified their thematic choices thematically the majority (a mean of 84%) of the time. The difference between the Novel and No Word conditions in propensity to justify thematic choices thematically was significant, t(24) = 2.71, p < .02. Children in the Basic Word condition justified thematic choices thematically an average of 67% of the time. This was not significantly different from either the Novel Word or No Word condition.

In sum, when an object was labeled with an unfamiliar word, children were more likely to look for another object from the same superordinate level category than when the object was not labeled. Children almost certainly were not translating the novel word into a superordinate level term, so that cannot account for the effect. If children were translating the term into a basic level word for the object, that would have helped them to choose a categorically related object. However, the justification from children hearing a novel word differed from those of children hearing a basic level word, suggesting that translation into known terms was not accounting for the results.

EXPERIMENT 3

Experiment 3 is a modified replication of Experiment 2. In Experiment 2 the No Word instructions (“Find another one that is the same kind of thing”) were designed to promote as much taxonomic responding as possible. The No Word condition was the baseline measure of taxonomic responding, and we hypothesized that the presence of a new word would elevate taxonomic responses above even this baseline. Thus, this was a conservative test of the hypothesis.
In Experiment 3 we attempted to make the No Word instructions more neutral. A neutral instruction is more like the natural language learning context since in both cases, children view objects and hear them labeled without instructions about what relations to attend to. In this study, children were asked to “Find another one.” This is less explicit than the earlier instructions, but for adults still clearly implies that taxonomic similarity is called for. In this way we could compare what children naturally found salient to their choices when they heard a novel word. In Experiment 3 we also used slightly younger children, who would be expected to show a greater baseline preference for thematic relations.

Methods

Subjects

Sixty children attending nursery schools in Palo Alto, California, and surrounding towns participated in the study. They ranged in age from 4 years 0 months to 4 years 10 months, with a mean age of 4 years 5 months. An additional seven children were dropped from the study because they showed response bias, always choosing the picture on the same side. The children were randomly assigned to three conditions, 20 per condition, with the constraint that the conditions be roughly equated for age and sex.

Procedure

No Word condition. The procedure used in this condition was very similar to that used in the No Word condition of Experiment 2. Subjects were shown 30 colorful pictures of common objects. Ten of the pictures served as targets. Associated with each of the target pictures were two choice pictures, one thematically related to the target and one taxonomically related to the target. Eight out of ten of the picture sets were the same as those used in Experiment 2. The two new sets are noted in Table 2.

On each trial in the No Word condition, the experimenter said, “I’m going to show you something. Then I want you to think carefully, and find another one. See this? Can you find another one?” After children selected a picture, the experimenter asked them to justify their choice: “How did you know it was this one?” The left-right position of the choice pictures was again randomized for each child in such a way that thematic and taxonomic choices each appeared half the time on the left and half the time on the right. The order of presentation of triads for each subject was also randomized.

Novel Word condition. The materials and procedure for this condition were identical to those of the No Word condition, except that a novel word was used to describe the target picture. Children were told that the puppet could talk in puppet talk, and that they were to listen carefully to what he said. The instructions included an unfamiliar label for the target, which the child was asked to repeat, in order to ensure attention to the word: “I’m going to show you a dax. Then I want you to think carefully, and find another dax. See this dax? Can you say dax? Can you find another dax?” Children were again asked to justify their choices.

Basic Word condition. The materials and procedure for this condition were identical to those in the Novel Word condition. The instructions simply substituted the basic level word for the target in place of the unfamiliar word. For the example with the cow target, the experimenter said: “I’m going to show you a cow. Then I want you to think carefully, and find another cow. See this cow? Can you say cow? Can you find another cow?”
Children seemed willing to make a choice, despite the fact that neither of the choice picture was a cow (the two choices were pig and milk). As in the other two conditions, children were asked to justify their choices.

Results

As usual, when children in the No Word condition had to choose between another member of the same superordinate category and a thematically related object, they often chose the thematic relation. They selected the other category member a mean of only 2.50 times out of 10 (25%), $SD = 2.11$. This was less often than would be expected by chance, $t(19) = 5.17, p < .001$. When the target picture was labeled with an unfamiliar word, children were much more likely than children hearing no label to select categorically. They now chose the other category member a mean of 6.45 times out of 10 (65%), $SD = 1.60$. This was more often than would be expected by chance, $t(19) = 3.96, p < .001$. Children in the Novel Word condition selected the other category member significantly more often than children in the No Word condition, $t(38) = 6.50, p < .001$.

When the data were analyzed with items as a random factor and conditions as a within groups factor, we again found the predicted difference. Pictures labeled with novel words elicited significantly more taxonomic responses than the same pictures not labeled, paired $t(9) = 8.90, p < .001$, and the difference held up for every item.

As in Experiment 2, converging evidence for the hypothesis came from the justifications that children gave for their choices. Children who heard a novel word tended to give more justifications that referred to the categorical relations between the objects, while children who did not hear a label for the objects referred more to thematic relations. Children were credited with referring to a categorical relationship if they attempted to find a common property for the objects (e.g., "They are both round") or a common function (e.g., "You can wear both of them"), or if they gave the two objects a common label (e.g., "They are both animals"). Children were scored as giving a thematic justification, if they described an interactive relationship between the two objects (e.g., "The cow makes milk"). Two raters coded the justifications into categorical, thematic, and miscellaneous categories and agreed on 94% of the classifications.

Children who heard a novel label for the picture justified 34% of their choices by referring to a categorical relation while children who did not hear a label gave categorical justifications only 10% of the time, $t(38) = 2.99, p < .005$. Children justified fewer of their choices thematically when they heard an unfamiliar word (25%) than when they heard no word (67%), $t(38) = 4.34, p < .001$. Thus, children focused more on categorical relationships when they heard an unfamiliar word than when they heard
to word. Moreover, as in Experiment 2, even when children chose thematically in the Novel Word condition, they seemed reluctant to justify the thematic choice with a thematic explanation. When they heard an unfamiliar label, they justified thematic choices with a thematic explanation only an average of 44% of the time. Children in the No Word condition who did not hear a label justified thematic choices thematically an average of 79% of the time, \( t(38) = 2.02, p < .06 \).

In sum, when young children are asked to classify things, they often classify them thematically. But simply hearing a new word induces children to focus more on categorical relationships. These results, although supporting the hypothesis, need to be interpreted in light of the results from the Basic Word condition. Children in the Basic Word condition gave just as many taxonomic responses as children in the Novel Word condition. The mean percentage of taxonomic responses in the Basic Word condition was 62%, as compared to 65% for the Novel Word condition. The percentage of choices justified thematically in the Basic Word condition (38%) also did not differ significantly from the percentage of choices justified thematically in the Novel Word condition (25%). The question is, were children in the Novel Word condition really translating into a basic level word?

A closer examination of the data suggests that translation into a basic level word is not accounting for the advantage of the novel word. That is, the Novel Word condition and Basic Word condition differ in several ways. One piece of evidence for a difference is a significant condition \( \times \) item interaction, \( F(18,513) = 2.34, p < .002 \). The relative difficulty of different items, in terms of how many taxonomic responses they elicit, stays approximately the same for the Novel Word and No Word conditions, but changes for the Basic Word condition. Some items received a high number of taxonomic responses in the Basic Word condition and a low number of taxonomic responses in the Novel Word condition, or vice versa. For example, one target picture was a cup. The taxonomic choice was a glass. Children who heard the basic level word "cup" chose the glass much more often (95% of the time) than children who heard the unfamiliar word "biv" (40% of the time). It seems that children were very willing to overgeneralize the word "cup" to mean "glass," too. Cup functioned almost as a superordinate term for both cup and glass. Children were probably not translating "biv" into "cup," or they would have chosen the glass a high percentage of the time in the Novel Word condition as well.
It may be that the basic word can only help children to choose taxonomically when they can easily overgeneralize it. We examined the justifications children gave to see if there was evidence for overgeneralization of basic level terms. Children’s justifications in the Novel Word and Basic Word conditions, and also their translations in the Translation condition of Experiment 2, were coded for the number of times children spontaneously called both the target and the taxonomic choice by the same basic level word. We had tried to choose the target pictures so that their basic word names could not function as names for both the target and the taxonomic choice. But apparently, we were not totally successful, as we found three items for which children naturally seemed willing to overgeneralize the basic word name: cup overgeneralized to glass, hanger overgeneralized to hook, and bee overgeneralized to ant.

The data were reanalyzed without these three ill-chosen items. When this was done the condition × item interaction disappeared. The new mean percentages of taxonomic responses for each condition were 64% for the Novel Word condition, 50% for the Basic Word condition, and 24% for the No Word condition. The difference between the Novel Word condition and the Basic Word condition in number of taxonomic responses now approached significance, $t(38) = 1.81, p = .075$. The Basic Word condition still had significantly more taxonomic responses than the No Word condition, $t(38) = 3.48, p < .002$. When the results were reanalyzed with items as a random factor and conditions as a within group factor, the differences were more striking. Items described by basic level words elicited significantly fewer taxonomic responses than items described by unfamiliar words, paired $t(6) = 2.46, p < .05$. More taxonomic responses were still given to items in the Basic Word condition than to the same items in the No Word condition, paired $t(6) = 3.90, p < .01$.

One argument that children were not translating the unfamiliar word, then, is that the pattern of responses to items in the Novel Word and Basic Word conditions was different. Moreover, the pattern for the Basic Word condition suggests that the basic word was more likely to lead to taxonomic responding when children could overgeneralize it.

Other evidence that children in the Novel Word condition were not simply translating the word into a basic level term comes from the justifications for thematic choices. Children who heard a basic level word did not seem as reluctant to justify thematic responses thematically as children who heard an unfamiliar word. The proportion of thematic responses justified thematically was 70% in the Basic Word condition, as opposed to 44% in the Novel Word condition, $t(38) = 2.28, p < .05$. Thus the justification data show that the basic level word did not shift children’s attention away from thematic relations as much as the unfamiliar word did. One possible explanation for this is that children in the Novel Word condition were trying to figure out the meaning of the new word,
and were therefore more aware that a word was involved. Consequently, they were more aware than children in the Basic Word condition that they should be searching for categorical relations.

There is one last piece of evidence that something different was going on in the Novel Word and Basic Word conditions. If children in the Novel Word condition were translating into a basic level word, then we might suppose that the basic word should be salient to them and should appear fairly often in their justifications. But the proportion of justifications in which a basic word name for the target appeared was only 28% for the Novel Word condition, compared to 49% for the Basic Word condition, \( t(38) = 2.78, p < .01 \).

In sum, the results for Experiment 3 replicated the findings of Experiment 2, providing even stronger support for the hypothesis. Hearing a new word diminishes children's tendency to look for thematic relationships, and causes them to look for categorical relationships instead. There is at least some evidence that children focus on categorical relationships because of the sheer presence of the word, and not because of any particular knowledge about the meaning of the word.

EXPERIMENT 4

Post hoc analyses from Experiment 3 were used to argue that translation of the novel word into a basic level word could not account for children's categorical choices. Experiment 4 is designed to provide additional evidence that children use abstract knowledge about words rather than specific known meanings to facilitate taxonomic responding. In this study, pictures of artificial objects were used instead of real objects. Children are not likely to translate unfamiliar names for these pictures into known words, because they do not know real word names for them. If the presence of an unfamiliar word still causes children to shift from thematic to taxonomic responding when the materials are also unfamiliar, then this would rule out translation as an explanation for the effect.

Methods

Subjects

Thirty-two children attending nursery schools in Palo Alto, California, and surrounding towns participated in the study. The children ranged in age from 4 years 6 months to 5 years 11 months, with a mean age of 5 years 2 months. An additional three children were dropped from the study because of response bias. The children were randomly assigned to two conditions, 16 per condition, with the constraint that the conditions be roughly equated for age and sex.

Procedure

The design and procedure for this study are essentially the same as that of Experiment 3. The main difference is that the experimenter first described the taxonomic and thematic relations for the artificial objects before asking children to select the picture that was like the target.
No Word condition. Each child was seen individually for one 20-min session. Subjects were shown eight sets of pictures in random order. Each set included a target picture, and two choice pictures, one thematically related and one taxonomically related to the target. Before children saw the target picture and the two choices, they were shown two training pictures that illustrated how the target picture related to each of the choice pictures. One picture showed the target object and the taxonomic choice, side by side. For these pairs, children were told a common function that the two objects shared. An example taxonomic training picture is shown in Fig. 1. For this example, the experimenter said, "This swims in the water" (pointing to the left hand object) and "This swims in the water" (pointing to the right hand object).

A second training picture showed the target and the thematic choice in an interactive relationship. The experimenter told the children how the two objects interacted. The thematic training picture for the set just given is shown in Fig. 2. For this example, the experimenter said, "This catches this" (pointing to the objects she was referring to as she said the sentence). Children were asked to repeat the spoken information to make sure that they were paying attention. The first training picture was left on the table as the second training picture was introduced, so that children could see the connection between the target in the first picture and the target in the second picture. The order of presentation of training pictures was randomized so that taxonomic and thematic training pictures were each presented first half of the time.

A second example taxonomic training picture is shown in Fig. 3. For this example the experimenter said, "This pokes holes in things" (pointing to the left hand object). "This pokes holes in things" (pointing to the right hand object). The thematic training picture for the same set is shown in Fig. 4. For this picture, the spoken information was "You keep this in here."

After children saw the two training pictures in a set, the pictures were removed from the table. The rest of the trial was a match to sample task following the same procedure as the No Word condition of Experiment 3. The experimenter said, "I'm going to show you
something. Then I want you to think carefully, and find another one.' The experimenter then placed the target picture face up on the table directly in front of the child and said, "See this?" She placed the two choice pictures to the left and right of the target and said, "Can you find another one?" Note that the choices were pictures of the individual objects as in the previous studies, rather than pictures of two objects together. After children made a choice, the experimenter asked them to justify their response: "How did you know it was this one?" The left–right order of choices was randomized so that taxonomic choices each appeared half the time on the left and half the time on the right.

**Novel Word condition.** The materials and procedure for this condition were identical to those of the No Word condition, except that a novel word was used to label the target picture during the match to sample task. After children saw the training pictures, the experimenter said, "I'm going to show you a dax. Then I want you to think carefully, and find another dax. See this dax? Can you say dax? Can you find another dax?" A different unfamiliar word was used for each set. Children again were asked to justify their choices.

Because of the unfamiliarity of the materials, children in both conditions found it difficult to justify their responses, so the justifications will not be discussed.

**Results**

The results for the choices were parallel to those found for Experiments 2 and 3. As usual, when children in the No Word condition had to select between another member of the same category and a thematically related object, they often chose the thematic relation. They selected the other category member a mean of only 3.00 times out of 8 (37%), $SD = 1.79$. This was significantly less than chance, $t(15) = 2.24$, $p < .05$. When the
target picture was labeled with an unfamiliar word, children were not likely to select categorically. They now chose the other category memb er a mean of 5.06 times out of 8 (63%), SD = 2.38. This was more than chance by a one-tailed t test, t(15) = 1.78, p < .05. Children hearing novel word were significantly more likely to select an object from the same category than children not hearing a label, t(30) = 2.77, p < .01.

When the results were analyzed with items as a random factor and conditions as a within groups factor, we again found the predicted difference. Pictures labeled with unfamiliar words elicited significantly more taxonomic responses than the same pictures not labeled, paired t(7) = 4.07, p < .005, and the difference held up for every item.

DISCUSSION

The hypothesis tested by these studies is that children place an abstract constraint on what single nouns might mean. Children limit words to refer mainly to objects that share some property or function rather than allowing words to refer to objects that are united by thematic relations. This would help explain how children acquire words that refer to categories even though, in many other situations, they seem to find the thematic associations between objects to be more salient. The simple presence of a noun, even an unfamiliar one such as "dax," should cause children to search for objects that share perceptual or functional properties. Thus, labeling a picture as "a dax" and asking children to find "another dax" should help override their preference for choosing the matically.

Overview of Results

The results from four studies supported the hypothesis. The main results from all of the studies are summarized in Table 3.

As can be seen from the results of Experiment 1, even children as young as 2 and 3 years place constraints on what an unfamiliar word might mean. When presented with two basic level objects—for example, two different kinds of dogs—and a third object that was thematically related, such as dog food, very young children often selected a dog and dog food as being the same kind of thing. If, however, one of the dogs was called by an unfamiliar label, e.g., "dax," and children were told to find another dax, they were now much more likely to select the two dogs.

By 4 or 5 years of age, children have set further constraints on what a word might mean, as Experiments 2 and 3 demonstrate. A word induces them to search for categorical relations even among objects that can only be related at the superordinate level of categorization. For example, with no word present, children often selected a dog and dog bone as being the
same kind of thing because of the strong thematic association between dog and bone. When one of the dogs was called a "dax," however, and children were asked to find another dax, they more often selected a dog and a cat as being the same, because they are both in the same superordinate category, animals.

At the superordinate level of categorization, the same pattern of choices was obtained for two different sets of instructions. Even when the No Word instructions emphasized taxonomic relations, as in Experiment 2 ("Find another one that is the same kind of thing as this one.") we found an increase in taxonomic responding in the Novel Word condition. In Experiment 3 when the No Word instructions were more neutral ("Find another one."), there was an even bigger shift toward more taxonomic responding in the presence of a new word.

The justification data corroborated the choices. Children who heard a novel word tended to give more justifications that referred to the categorical relations between the objects, whereas children who did not hear a label for the objects referred more to thematic relations (see column 2 of Table 3). Even when children chose thematically in the Novel Word condition, they seemed reluctant to justify the thematic choice with a thematic explanation (see column 3 of Table 3). For example, when children select a dog and a dog bone as being the same, they ordinarily justify

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this by saying that the dog eats the bone. However, those children who had heard the dog labeled with an unfamiliar term, yet nevertheless selected the dog bone, now justified their choice by saying that the dog and the bone were both white, for example, or refused to explain their selection. There was no such reluctance to justify thematic choices thematically when no label was given.

The hypothesis is that the presence of an unfamiliar word shifts children's attention to taxonomic relations because of an abstract constrain children place on possible word meanings, and not because they know the meaning of the word. Thus, we would like to rule out translation into a known word as accounting for the effect. Based on our results and other research on language acquisition (e.g., Anglin, 1977; Clark, 1973; Mervis & Rosch, 1981), it is extremely unlikely that children would translate the unfamiliar terms into superordinate level terms. Children seeing a dog and hearing the word “dax,” for example, would be very unlikely to translate “dax” into “animal” or “mammal” or even “pet.” If they were translating at all, they would think that “dax” meant “dog.” Even when children were specifically asked to translate the novel word in the Translation condition of Experiment 2, they rarely translated it into a superordinate level term. Thus translation into a superordinate level word cannot account for the increase in taxonomic responding for children who heard the picture labeled with an unfamiliar word.

Had children been translating into a basic level term, it would have helped them to select taxonomically. When the target picture was labeled with a basic object word, children selected more taxonomically related pictures than children who heard no label (see column 1, Experiments 2 and 3 in Table 3). However, the increase in taxonomic responding when children heard a novel word cannot be fully accounted for by translation of the novel word into a basic level word. Children's justifications provide one source of evidence that they were not simply translating the word into a basic level term. When children heard the novel words they seemed reluctant to justify their choices thematically, even in those cases where they had selected a thematically related picture. In contrast, when children heard familiar basic level words, they were happy to justify their choices in terms of thematic relationships (see columns 2 and 3 of Table 3). In the Basic Word condition, children heard, for example, the dog called “dog” and were told to “find another dog.” When these children selected the dog and dog bone, they showed no reluctance to justify their choice by saying that the dog eats the bone. Perhaps when children heard the basic level term they tried to generalize it to other items. When they failed, the fact that the familiar term was a count noun may not have been salient enough to prevent them from claiming that it referred to a
thematic relationship. In contrast, children who heard the novel word tried to figure out what it might mean. This may have heightened their awareness that a word was involved. As a consequence, children in the Novel Word condition may have felt more reluctant than children in the Basic Word condition to describe the word as referring to a thematic relation.

The most compelling evidence that translation into known terms cannot account for the results comes from the fourth study, where unfamiliar objects were used as well as unfamiliar words. Here children were shown three novel objects. They were taught a taxonomic relation for two of the objects and a thematic relation for two. When no label was used children often selected the two objects that were related thematically as being the same. When an unfamiliar word was used to label the target picture, children now selected the two objects that were related taxonomically. Children could not have been translating in this study because they did not know what these unfamiliar objects were and had no familiar labels for them. Nevertheless, the results from this study replicated the results from the studies that used familiar objects. Again, the presence of an unfamiliar meaningless word caused children to shift from selecting objects that are thematically related to selecting objects that are taxonomically related. This suggests that children have placed an abstract constraint on what words can mean that is not mediated by the meaning of known terms.

By constraining the meaning of a term to categorical relations, children are able to rule out a huge number of other potential meanings for any given term. For example, suppose an adult points to a cup and says "cup." With no constraints on possible meanings, a child would have to consider that the table might also be a "cup" because the cup was on the table, or that coffee is also called "cup" because the cup was filled with coffee, or that mother might be a "cup" because mother was lifting the cup. All of these relational meanings would be eliminated from consideration by the constraint that nouns refer to object categories. By limiting the number and kind of hypotheses that children need to consider, this constraint tremendously simplifies the problem of language learning.

*Origins of Sensitivity to Constraints on Word Meaning*

These findings raise the question of how children come to constrain their hypotheses about what a word can mean. What leads children to assume that a word is likely to refer to objects that are similar in some way rather than to objects that participate in the same event or context? There are at least two possibilities. One is that sensitivity to the constraint is innate—from the start, children assume words will refer to categories
of similar objects. Having such implicit knowledge would provide children with an entry into the formidable problem of learning language. Children would at least be able to readily acquire count nouns, and once they had a reasonable vocabulary of category terms, they could then begin to comprehend other linguistic forms. In fact, the huge majority of children’s first words are count nouns (Clark, 1983; Nelson, 1973; Huttenlocher, 1974).

Another possibility is that the constraint is induced from early language experience. Having learned many count nouns, almost all of which refer to objects that are taxonomically related, children may come to expect this to be true of subsequent terms they learn. If so, then this induction must take place fairly rapidly at an early point in language acquisition, since we found that even 2-year-olds believe that count nouns are more likely to refer to objects that belong to the same category than to objects that are thematically related.

It is not clear whether or not very young language learners limit the constraint to count nouns. Particularly if children have some innate knowledge of the constraint, they may at first overextend it, indiscriminately believing that any word they hear must refer to a taxonomic category. Only somewhat later might they become sensitive to form class and expect count nouns to be more likely than other classes of words to refer to categorical relations.

The Role of Language in Aiding Concept Acquisition

Children’s sensitivity to this constraint raises the possibility that language may help children acquire new categories. In contrast, it is often argued that words must map onto concepts that have already been worked out nonlinguistically (Clark, 1973; Huttenlocher, 1974; Macnamara, 1972; Nelson, 1974; Wittgenstein, 1953, 1958). In this view, language plays little role in concept learning. But this view may underestimate the importance of language. Young children may create concepts to fit new words, guided by abstract constraints on word meaning. This alternative view is a mild form of linguistic determinism (Whorf, 1956), in that language is believed to shape thought. It is quite different, however, from Whorf’s conception that each language imposes a particular world view on its speakers and that cognition is determined and limited by the specific language one speaks. First, all languages are likely to share similar constraints on possible meanings for count nouns. Thus the hypothesis is that, regardless of native language, children look for categories of similar objects when they hear new nouns. Second, although nouns help focus children’s attention on categorical relations, we are not arguing that children would be incapable of forming categories without exposure to language.
The small amount of research that bears on this milder form of linguistic determinism suggests that children can use abstract knowledge of the semantic correlates of form class to help them discover the concept to which a word refers. Brown (1957) found that 3- to 5-year-old children interpreted an unfamiliar count noun ("a dax") as referring to a new concrete object, whereas they interpreted an unfamiliar mass noun ("some dax") as referring to a novel undifferentiated mass. In a study by Katz, Baker, and Macnamara (1974), children as young as 1½ years old interpreted an unfamiliar proper noun ("Dax") as referring to an individual. At the same time, these young children understood an unfamiliar count noun ("a dax") as referring to a category of similar objects.

To return to our findings, hearing a noun caused children to shift their attention from thematic to taxonomic organization. These results lead us to speculate that linguistic input may serve more generally to shape the conceptual structure of the child in the direction of greater taxonomic organization. A word may draw members of a category together for a child, highlighting their common category membership. Language may thus play a direct role in making categorical relations a salient and highly structured mode of organization.

Possible Reasons for Taxonomic Organization of Language

The question arises as to why language is organized this way. Why don't words refer typically to objects that are thematically related? As we earlier pointed out, thematic relations between objects certainly are important for adults as well as for children. In naturally occurring situations, objects are not found organized by category, but rather are embedded in spatial, temporal, and causal contexts. Such relational structures as events and themes are a common way of organizing information to make sense of what we encounter (cf. Mandler, 1979; Markman, 1981).

Given that these thematic event-like organizations are a natural way of construing the world, why should languages force a taxonomic or categorical structure rather than capturing this thematic bias? Why don't we have single words for a boy and his bike, a baby and its bottle, a spider and its web? One reason may be that if nouns referred exclusively to relations such as a baby and its bottle or a boy and his bike, there would be no easy way to express hierarchical taxonomic relations. Because a taxonomy groups objects into categories nested within broader categories, it allows deductive inferences to be made that go beyond the first-hand knowledge one has about a specific object. If one knows, for example, that a particular object is an animal, one can be fairly sure that it takes in food, moves about, reproduces, and has internal organs. In contrast, knowing that something is a "dax," where "dax" could be a boy or his bike, tells one very little else about it. One reason why nouns tend
not to refer to thematically related objects, then, may be because of the advantages of hierarchical organization.

Another more important reason may be that if a language had single nouns refer exclusively to pairs of thematically related objects, it would be at great cost. The enormous expressive power of language would be lost. The expressive power of language derives from its ability to convey new relations through combinations of words. There are a potentially infinite number of thematic relations that one might want to express. The many thematic relations can easily be described through combinations of words—e.g., sentences and phrases. If single words referred only to thematic relations, however, there would be an extraordinary proliferation of words, probably more than humans could learn. One would need separate words for a baby and its bottle, a baby and its crib, a baby and its mother, a baby and its diaper, etc. Thus, the combinatorial power of language would be wasted. This, then, may be the major reason why nouns refer primarily to taxonomic categories rather than to thematically related objects.

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