In Study 1, English-speaking 3- and 4-year-olds heard a novel adjective used to label one of two objects and were asked for the referent of a different novel adjective. Children were more likely to select the unlabeled object if the two adjectives appeared prenominally (e.g., “a very DAXY dog”) than as predicates (e.g., “a dog that is very DAXY”). Study 2 revealed that this response occurred only when both adjectives were prenominal. Study 3 replicated Study 1 with Hebrew-speaking 3- and 4-year-olds, even though in Hebrew both types of adjectives appear postnominally. Preschoolers understand that prenominal adjectives imply a restriction of the reference of nouns, and this knowledge motivates a contrastive pragmatic inference regarding the referents of different prenominal adjectives.
Although many prior demonstrations of children’s avoidance of lexical overlap can be accounted for by appeal to either of the preceding lexical constraints, these constraints cannot explain a number of recent results observed in this learning situation. One line of research has indicated that children’s avoidance of lexical overlap may reflect a more general understanding of speakers’ communicative intentions rather than a specialized lexical constraint. According to this pragmatic account, children infer that a speaker’s use of different linguistic forms likely implies different referential intents (Clark, 1987, 1990; Diesendruck & Markson, 2001). When asked to find the referent of a novel word, listeners first attempt to establish to which object the speaker intends to refer. Further, they infer that a speaker likely would not intend to use a novel word to refer to an object previously referred to by a different word; as a result, they conclude that the novel word refers to the unnamed object (Clark, 1990; Diesendruck & Markson, 2001). According to this account, what is crucial for the response is that the discourse context and the communicative forms be ones of referring. The specific nature of the communicative forms is secondary. Consistent with this account, Diesendruck and Markson (2001) found that children were as likely to avoid two count nouns for a single object as they were to avoid two facts used referentially. For instance, when shown two novel objects, taught a fact about one of them (e.g., “My uncle gave me this one”), and then asked for the referent of a different fact (e.g., “Show me the one from Mexico”), children tended to select the object that did not receive a fact previously.

A second line of recent research has furnished evidence that children’s avoidance of lexical overlap also stems from knowledge of particular lexical form classes. For example, Hall, Quantz, and Persoage (2000) replicated the standard finding that preschoolers map novel count nouns to unfamiliar over familiar objects, but they also found that children did not consistently map adjectives or proper names to unfamiliar over familiar objects, but they also found that children did not consistently map adjectives or proper names to unfamiliar over familiar objects in the same situation. This result suggests that children’s avoidance of lexical overlap in the standard task was partly driven by their specific knowledge about count nouns (as opposed to adjectives or proper names). That is, these results suggest that children’s avoidance of lexical overlap in the standard task does not follow from their inferences about speakers’ intended uses of words in general. Rather, the finding indicates that the effect stems from children’s inference that a speaker likely would not intend to use a novel count noun to refer to an object previously referred to by a different count noun (i.e., a “familiar” object in the standard task). This inference may derive from the knowledge that count nouns (object category terms) are typically referentially restrictive in a given discourse context, in that an object usually receives only one count noun (see Callanan & Sabbagh, 2004). In this way, children’s avoidance of lexical overlap may result both from an inference about a speaker’s referential intents and from knowledge of the semantics of lexical form classes (i.e., count nouns).

Extending this line of work, Hall and Graham (1999) examined children’s interpretations of novel adjectives and novel proper names in a similar word-learning context. In one condition of their Experiment 1, the experimenter showed children pairs of count-noun familiar animals (e.g., two dogs), taught them a novel proper name for one (“This dog is named Daxy”), and then asked for the referent of a second novel proper name (“Show me a dog that is named Blicky”). In another condition, the experimenter taught a novel adjective (“This dog is very daxy”) for one of the animals, and then asked children for the referent of a different novel adjective (“Show me a dog that is very blicky”). Hall and Graham found that whereas children in the proper name–proper name condition tended to select the animal that lacked a proper name, children in the adjective–adjective condition tended to pick randomly between the two animals. That is, children avoided lexical overlap in the case of two proper names (recalling their tendency to avoid lexical overlap in the case of two count nouns), but appeared more willing to allow overlap for adjectives.

Hall and Graham’s (1999) results offer further evidence that children’s tendency to avoid lexical overlap in the standard task does not result from inferences about speakers’ intended uses of words in general. Instead, the findings indicate that the phenomenon stems more specifically from children’s inferences about speakers’ intended uses of words from particular lexical form classes. In particular, these results suggest that children infer that a speaker likely would not intend to use a novel proper name to refer to an object previously referred to by a different proper name. This inference may arise out of the knowledge that proper names designate individuals and thus are usually referentially restrictive in a particular discourse context. In other words, an object typically receives at most one proper name in a given situation. In contrast, children do not draw an analogous inference about speakers’ uses of adjectives, perhaps because they know that adjectives (object property terms) are not necessarily referentially restrictive in a discourse
setting; one object may receive more than one adjective in a particular context. In this way, the avoidance of lexical overlap can again be accounted for as the result both of a pragmatic inference about a speaker’s referential intents and of knowledge of the semantics of particular lexical categories (i.e., proper names and adjectives).

A closer look at the method used in Hall and Graham’s (1999) experiments raises the question of whether children’s behavior was also guided by pragmatic inferences related to knowledge of syntactically conveyed semantic distinctions within a lexical category. In Hall and Graham’s experiments, the adjectives were always presented as predicates, that is, like the adjective “big” in the sentence, “This dog is big.” As Prasada (1997) has noted, in such sentences, the reference of the noun (i.e., a dog) is independent of the adjective, because the adjective forms a constituent with an entire noun phrase (“this dog”). Hall and Graham never introduced adjectives prenominally, that is, like “big” in the sentence, “This is a big dog.” In sentences like this, the referent is a particular instance of the category labeled by the noun having the property named by the adjective (i.e., a big dog); the adjective forms a constituent with the noun inside the noun phrase (“a big dog”). As a result, unlike predicate adjectives, prenominal adjectives restrict the noun’s reference.

Prasada (1997) argued that the preceding difference between predicate and prenominal adjectives had implications for the acquisition of word meaning. In particular, he proposed that children who understand this difference should assume, upon hearing an object labeled with a novel prenominal adjective, that the word labels a property value on a restrictive dimension, that is, a dimension on which the kind of object named by the noun has more than one value. For example, seeing a dog and hearing that “this is a very blicky dog” should tend to lead children to infer not only that “blicky” names a property but also that there are other dogs that are not “blicky.” In contrast, hearing that “this dog is very blicky” should not drive children to make the same inference about other dogs.

Several findings in the word-learning literature are consistent with the proposal that children tend to interpret novel prenominal (but not predicate) adjectives restrictively, that is, as naming values on property dimensions along which objects of a given kind vary. For example, Gelman and Markman (1985) asked children for the referent of a novel prenominal adjective (e.g., “Show me the dax one”) and found that 4-year-olds picked either of two objects of a given kind bearing contrasting properties on one dimension (e.g., a red cat or a blue cat) rather than a single object of a different kind bearing one of the properties (e.g., a red dog). Prasada (1997) directly compared 2–4-year-old children’s interpretation of novel prenominal and predicate adjectives. In his study, children saw a set of three novel objects (“blickets”) that shared the same value on two property dimensions, but contrasted on a third property dimension. Children were taught either a novel prenominal adjective (“This is a fep blicket”) or a novel predicate adjective (“This blicket is fep”) for one of the objects. Children were then shown a set of three objects of a different kind, and were asked to retrieve a referent for the novel adjective. Prasada found that children were more likely to pick the object that matched the original object in the value of its contrasting (restrictive) dimension if the adjective was presented prenominally than if it was given as a predicate. (For related investigations of children’s restrictive interpretation of familiar prenominal adjectives used with novel nouns, see Nadig, Sedivy, Joshi, & Bortfeld, 2002; Prasada & Cummins, 2000.)

The preceding analysis suggests that children’s previously observed tendency to allow lexical overlap with novel adjectives reflected not just a pragmatic inference deriving from their knowledge of the semantics of adjectives but, more specifically, a pragmatic inference stemming from their understanding of the semantics of adjectives appearing in predicate sentence structures. Recall that, under the pragmatic account of children’s avoidance of lexical overlap, what is crucial for the response to arise is that the communicative forms be referring (Diesendruck & Markson, 2001). In addition, children need to infer that a speaker likely would not intend to use a novel form to refer to an object previously referred to by a different form. Hall and Graham (1999) found that, after hearing an animal referred to by a novel predicate adjective (e.g., “This dog is very daxy”), preschoolers did not systematically avoid that animal as the referent of a second novel predicate adjective (e.g., “Show me a dog that is very zavy”). If children understand that predicate adjectives do not imply a restrictive interpretation of the reference of the noun, then this is the pragmatically expected response. Children inferred that a speaker could reasonably intend to describe the same object with two different novel predicate adjectives, because they knew that one object could be labeled with more than one adjective. As a result, they did not systematically infer that the speaker intended the second predicate adjective to refer to a different object.

Suppose, however, that the very same novel adjectives used in Hall and Graham (1999) had been
presented prenominally (e.g., “This is a very daxy dog. Show me a very zavy dog”). If children know that a novel prenominal adjective labels a value on a restrictive property dimension, this understanding may fuel the pragmatic inference that a speaker would not use a second novel prenominal adjective with the intent to refer to an object previously labeled with a different novel prenominal adjective. In other words, even if children know that adjectives label object properties and believe that a speaker could intentionally use two different predicate adjectives for the same object in a given situation, they may still infer that a speaker likely would not intend to use two different novel prenominal adjectives for the same object in that situation.

The goal of the current studies was to determine whether children are more likely to avoid lexical overlap in interpreting novel adjectives modeled in prenominal structures than in interpreting those presented as predicates. Studies 1 and 2 addressed this question by comparing English-speaking preschool children’s adjective interpretations in conditions in which we varied the structural placement of the adjective, using a task similar to the one used in previous studies of the avoidance of lexical overlap. Study 3 examined this question with Hebrew-speaking children. Like English, Hebrew has alternative adjectival structures, such that in some cases the adjective forms a constituent with a noun phrase (as in predicate adjectives), whereas in other cases the adjective forms a constituent with a noun (as in prenominal adjectives). Unlike English adjectives, however, Hebrew adjectives always come after the noun. Thus, the study with Hebrew speakers enabled us to examine whether children’s responses result from a sensitivity to the order of words within the sentences (i.e., whether adjectives come before the noun, as with prenominal adjectives, or after the noun, as with predicate adjectives) or from a sensitivity to the underlying sentential structures (i.e., whether adjectives form a constituent with a noun or with an entire noun phrase).

Study 1

English-speaking 4-year-old children were presented with pairs of identical-looking stuffed animals. Children heard one of the objects labeled with a novel adjective and were then asked for the referent of a different novel adjective. One group of children heard both adjectives presented prenominally (e.g., “This is a very DAXY dog. Show me a very JOPPY dog”). The second group heard both presented as predicates (e.g., “This dog is very DAXY. Show me a dog that is very JOPPY”), that is, the way the adjectives were presented in Hall and Graham (1999). We used familiar identical-looking animals, rather than animals that contrasted on a visible property, because Hall and Graham (1999; Experiments 1 and 3) found that children showed no tendency to avoid lexical overlap when shown such pairs and given predicate adjectives in a similar task. Thus, using these identical pairs provided us with an optimal basis for testing our hypothesis that the use of prenominal (as opposed to predicate) adjectives would lead children to avoid lexical overlap. The use of identical-looking objects implies that children could not map the adjectives to any obvious visible contrasting properties of the objects. However, there were still many possible nonvisible properties onto which children could have mapped the adjectives (e.g., dispositional properties, such as friendly; physiological state properties, like hungry; emotional state properties, such as happy).

If children expect that a novel prenominal adjective labels a value on a restrictive property dimension, we predicted that they would be more likely to select the unlabeled object as the referent of the puppet’s request in the prenominal–prenominal than in the predicate–predicate condition.

Method

Participants

Participants were 32 English-speaking preschoolers, 16 boys and 16 girls (M = 4 years 1 month, SD = 2 months, range = 3 years 9 months to 4 years 6 months). Children were primarily from middle- and upper-middle-class socioeconomic backgrounds. Approximately 90% of the children were Caucasian, 5% Asian, and the remaining 5% East Indian. Some were recruited from and tested in preschools around the university. Others were recruited from the local community through advertisements in local media and tested in the laboratory at the university. Only children with signed parental consent participated.

Materials

On warm-up trials, we used two pairs of stuffed animals, one pair consisting of identical-looking monkeys and another consisting of a lion and a duck. On test trials, we used four pairs of identical-looking stuffed animals: dogs, cats, rabbits, and bears. All animals were approximately 10 cm tall. In addition, we used a hand puppet to present the labels and to make requests.
Design

Children were randomly assigned to one of two conditions, predicate–predicate or prenominal–prenominal (n = 16 per condition, each with roughly equal numbers of boys and girls). There was no significant age difference between the two conditions. Children participated in two warm-up trials followed by four experimental trials.

Procedure

Children were tested at a small table (or sometimes on the floor) and were seated across from the experimenter.

Warm-up trials. These two trials were meant to familiarize children with the task and to elicit both a “yes” and a “no” answer to yes–no questions similar in structure to the ones they would hear on test trials. Children were told that the puppet was going to ask some questions, and that it was okay to answer “yes,” answer “no,” or simply guess if they were not sure.

Trial one was intended to elicit a choice followed by a “yes” answer. The experimenter placed the two monkeys facing the child on the table, and the puppet asked children to show him a monkey. Once children responded, the puppet pointed to the animal not chosen and asked, “Could this also be a monkey?” We anticipated (and always received) a “yes” answer to this question. Trial two was designed to evoke a choice followed by a “no” answer. The experimenter placed the lion and the duck on the table, and the puppet asked children to show him a lion. After children answered, the puppet pointed to the unselected animal and asked, “Could this also be a lion?” We expected (and always received) a “no” answer to this question. The order of the two warm-up trials was counterbalanced across participants in each condition.

Test trials. There were four test trials. At the beginning of each trial, the experimenter gave children one member of a pair of animals to play with for 15 s. She then placed the animal on the table and labeled it using the basic-level count noun. For example, on the dogs trial, she said, “Look, this is a dog. See, it’s a dog. Can you say ‘dog’?” [She continued with or without a response.] Right, this is a dog.

(b) Prenominal–prenominal condition. The puppet said, “This is a very DAXY dog. Can you say ‘DAXY?’ [The puppet continued with or without a response.] Right, this is a very DAXY dog.”

In both conditions, the experimenter then said, “Listen. My puppet has to go away for a little while. [She placed the puppet on her lap.] While he is away, look, here comes another dog! Do you see? It’s a dog. See I am going to put him right here. [She placed the second identical-looking dog about 10 cm beside the first dog, and about 10 cm behind it.] See, they look the same! Now there are two dogs.” The experimenter then said, “Now here comes my puppet again, and he has a question for you. Get ready. Listen carefully. Now we’re going to hear a new word.” The procedure again diverged here in the two conditions.

(a) Predicate–predicate condition. The puppet said, “I want a dog that is very BLICKY. I want a dog that is very BLICKY. Show me a dog that is very BLICKY.” After children responded, the puppet pointed to the object not chosen and asked, “Could this dog also be very BLICKY?”

(b) Prenominal–prenominal condition. The puppet said, “I want a very BLICKY dog. I want a very BLICKY dog. Show me a very BLICKY dog.” After children responded, the puppet pointed to the object not chosen and asked, “Could this dog also be very BLICKY?”

In both conditions, all adjectives were marked with normal stress patterns. Children’s object choice and answer to the yes–no question were both recorded. Children were thanked in a neutral tone, the objects were removed from the table, and three other test trials were administered. The other trials involved identical-looking cats, identical-looking rabbits, and identical-looking bears. The novel words were MODY and FEPPY, PIFFY and WOGY, and GOPY and RUVY. Across participants within each condition, we counterbalanced the order of presentation of the animal pairs and the words.

Results

Forced-Choice Selections

We will use the term “unlabeled object” to refer to the animal that did not receive the first novel adjective on each test trial. Recall that our prediction was that children would be more likely to select the unlabeled object as the referent of the puppet’s request in the prenominal–prenominal than in the predicate–predicate condition. To address this hypothe-
sis, we first used as the dependent measure the mean number of unlabeled animal selections (0–4) made by children. A preliminary analysis revealed no effect of gender on this measure, and therefore gender was not entered as a factor in subsequent analyses.

Consistent with our prediction, an ANOVA with condition as a between-subjects factor revealed that children in the prenominal–prenominal condition were more likely than children in the predicate–predicate condition to select the unlabeled object, $F(1, 30) = 7.38$, $p < .05$ (see Table 1 for the means). Analyses against chance (chance $= 2$ out of 4 selections of the unlabeled animal) confirmed that whereas children in the prenominal–prenominal condition selected the unlabeled animal more often than would be expected by chance, $t(15) = 4.20$, $p < .005$, children in the predicate–predicate condition did not, $p > .7$.

In addition to the parametric analyses, we also evaluated children’s individual selection strategies. For this purpose, we classified children as “accepters of overlap” if they selected the unlabeled animal on fewer than three out of the four trials, and as “avoiders of overlap” if they selected the unlabeled animal on three or four trials (see Table 2). A chi-square analysis revealed that the distribution of children in the two conditions differed significantly, with more avoiders in the prenominal–prenominal than in the predicate–predicate condition, $\chi^2(1, n = 32) = 6.34$, $p < .05$.

Finally, on the assumption that there is a 0.50 chance of any given child’s selecting either animal on any given trial, the binomial theorem stipulates that the probability of any given child’s choosing the unlabeled animal on three or four trials is 0.3125. Translating this probability in terms of the distribution of 16 children renders the chance expectation of 11 children being classified as accepters and 5 as avoiders of overlap. Chi-square tests against this chance distribution confirmed that whereas the distribution of children in the prenominal–prenominal condition was significantly different from chance, $\chi^2(1, n = 16) = 18.62$, $p < .001$, the distribution in the predicate–predicate condition was not, $p > .5$.

Yes–No Answers

Children’s answers to the yes–no questions offer an insight into whether they rejected the object they did not choose as a possible referent of the second novel adjective. We were interested in children’s answers on those trials on which they selected the unlabeled object as a referent of this second adjective, because these answers provide information about whether the avoidance of lexical overlap in their object choices reflected a belief that the second adjective could not refer to the labeled object. Hall and Graham (1999) found that preschoolers who mapped a second novel adjective to the unlabeled object over an object that already had received an adjective label were nevertheless often willing to extend the second adjective to the labeled object. Children did not show this willingness under all conditions; for example, they were rarely willing to extend a second proper name to an already-labeled object. These results provided evidence that children believe that multiple adjectives could be applied to one object in a given nonreferential context, but multiple proper names could not.

We found that children in both conditions who chose the unlabeled object nevertheless were often willing to allow the second novel adjective to be extended to the labeled object. On any trial where children selected the unlabeled object, we determined whether they also answered “no” to our follow-up question about extending the second novel adjective to the labeled object. Any child who made at least one unlabeled object choice received a score to reflect the proportion of those choices followed by a “no” answer. Consistent with the findings from Hall and Graham (1999), children in both conditions did not strongly reject the second adjective as a possible referent for the labeled object: The mean proportion of “no” answers was 0.55 in the predicate–predicate condition and 0.37 in the prenominal–prenominal condition. Neither mean departed significantly from chance (0.50). These findings suggest that children who avoided lexical overlap for adjectives did not reject the labeled object as a potential referent of the second adjective; rather, they often appeared to accept that one object could receive

### Table 1

<table>
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<th>Study</th>
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<th>$SD$</th>
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<td></td>
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</table>

*Significantly different from chance (chance $= 2$) at $p < .005$.

**Significantly different from chance at $p < .001$. $N = 16$ per condition in Study 1 and 3; $N = 12$ per condition in Study 2.
two adjective labels, as long as the communicative context was not one like that in our forced-choice task in which they had to disambiguate a speaker’s referential intent.

It is important to note that the results of our forced-choice task and yes–no task are not in conflict, because they reflect different types of knowledge. In particular, we have argued that performance in the forced-choice task depends fundamentally on a pragmatic inference about a speaker’s intended referent of the second novel adjective. As a result, our findings from this task reflect differences in children’s pragmatic inferences about a speaker’s intended referent of prenominal (restrictive) as opposed to predicate (nonrestrictive) adjectives. In contrast, in the yes–no task, the referent object is already singled out for children, and they must make a semantic inference about whether the second adjective could apply to it. As a result, our findings from this task reflect differences in children’s pragmatic inferences about a speaker’s intended referent of prenominal (restrictive) as opposed to predicate (nonrestrictive) adjectives. In contrast, in the yes–no task, the referent object is already singled out for children, and they must make a semantic inference about whether the second novel adjective could apply to it. As a result, our findings from this task reflect children’s assumption that the second adjective had a meaning such that it conceivably could apply to the first-labeled object. Indeed, given that the two objects in each pair looked identical, it is not surprising that many children believed that an adjective that applied to one member of the pair could also be applied to the other.

Discussion

English-speaking 4-year-olds avoided mapping a novel prenominal adjective to an object that had been previously labeled with a different prenominal adjective, but they did not avoid lexical overlap when the same adjectives were modeled as predicates. The results offer evidence that preschoolers assume that novel prenominal (but not predicate) adjectives label values on restrictive property dimensions; that is, dimensions on which different objects of a given kind may vary. As a result, children appeared to infer that speakers likely would not intend to use a prenominal adjective to refer to an object to which they had just referred using a different prenominal adjective. Children appeared to draw no such pragmatic inference when the same adjectives were presented as predicates. The results provide striking evidence of preschoolers’ use of both structural information about adjectives and pragmatic understanding to guide their inferences about word reference.

Study 2

The results of Study 1 leave open the question of whether the appearance of both adjectives in a prenominal structure was necessary to elicit the pragmatic inference that the speaker intended the second adjective to be mapped to the unlabeled object. Perhaps it would have been sufficient for just one adjective to be presented in a prenominal structure in order for children to draw the same inference. For instance, if children heard one object labeled with a prenominal (reference-restricting) adjective, they may have inferred that the second adjective should also be interpreted restrictively, regardless of whether it appeared prenominally or as a predicate. After all, our proposal is that preschoolers interpret prenominal adjectives restrictively by virtue of their structural position inside sentences, but this proposal does not imply that children are unable to interpret predicate adjectives as restrictive. To address this issue, we conducted Study 2.

Study 2 was a modified replication of Study 1, with one change. Instead of presenting the two adjectives in the same structural position, we presented them in contrasting positions (i.e., predicate–prenominal or prenominal–predicate). The goal was to
determine whether the significant tendency to select the unlabeled object in the prenominal–prenominal condition of Study 1 required the appearance of both adjectives in prenominal structures, or whether it would suffice for only the first or only the second adjective to appear prenominally.

Method

Participants

Participants were 24 English-speaking preschoolers, 11 boys and 13 girls ($M = 4$ years 2 months, $SD = 3$ months, $range = 3$ years 9 months to 4 years 6 months). Children were from the same population as in Study 1, and they were recruited and tested in the same fashion.

Materials

The materials used in Study 2 were the same as those used in Study 1.

Design

Children were randomly divided into two conditions, predicate–prenominal and prenominal–predicate ($n = 12$ per condition, with roughly equal numbers of boys and girls in each condition). There was no significant age difference between the two conditions. As in Study 1, children participated in two warm-up trials followed by four experimental trials.

Procedure

The procedure in Study 2 was the same as in Study 1, except for one change. Children in the predicate–prenominal condition heard the first novel adjective modeled in a predicate structure and the second in a prenominal structure. In contrast, children in the prenominal–predicate condition heard a prenominal and then a predicate adjective. As in Experiment 1, all adjectives were marked with normal stress patterns.

Results

Forced-Choice Selections

If preschoolers' strong tendency to avoid lexical overlap by picking the unlabeled object in the prenominal–prenominal condition of Study 1 required only one prenominal adjective, we expected to obtain a similar result in both conditions of Study 2. But if the Study 1 result depended on both adjectives being modeled prenominally, we anticipated that children's tendency to select the unlabeled object in the two conditions in Study 2 would fall at chance levels, as it did in the predicate–predicate condition of Study 1. As in Study 1, our first dependent measure was the mean number of unlabeled animal selections (0–4) made by children. A preliminary analysis revealed no effect of gender on this measure, and therefore gender was not entered as a factor in the subsequent analyses.

The findings suggest that the avoidance of lexical overlap requires two prenominal adjectives. First, an ANOVA with condition as a between-subjects factor revealed that children in the predicate–prenominal condition were as likely as those in the prenominal–predicate condition to select the unlabeled object (see Table 1 for the means). Moreover, analyses against chance (chance = 2 out of 4 selections of the unlabeled animal) confirmed that children in both conditions selected the unlabeled animal at levels that would be expected by chance ($p_s > .4$).

In addition to the parametric analyses, we also evaluated children's individual selection strategies. We classified children as “accepters of overlap” and as “avoiders of overlap” as we did in Study 1 (see Table 2). A chi-square analysis revealed that the distribution of children in the two conditions did not differ significantly, with similar numbers of accepters and avoiders in the two conditions.

Finally, on the assumption that there is a 0.50 chance of any given child selecting either animal on any given trial, the binomial theorem indicates that the probability of any given child choosing the unlabeled animal on three or four trials is 0.3125. Translating this probability in terms of the distribution of 12 children gives the chance expectation of 3.75 children being classified as accepters and 8.25 as avoiders. Chi-square tests against this chance distribution revealed that the distribution of children in both conditions was no different than chance.

Yes–No Answers

As in Study 1, children’s yes–no answers provided evidence that the avoidance of lexical overlap for adjectives did not reflect a rejection of two adjectives for one object. We again focused on trials in which children selected the unlabeled object and asked whether these trials were accompanied by a “no” answer to our follow-up question about whether the second adjective could be extended to the labeled object. Any child who made at least one unlabeled object choice received a score to reflect the
proportion of those choices followed by a “no” answer. Consistent with the results of Study 1 (and those of Hall & Graham, 1999), children in both conditions were willing to apply the second adjective to the labeled object. The mean proportion of “no” answers was 0.71 in the predicate–prenominal condition and 0.48 in the prenominal–predicate condition. Neither mean departed significantly from chance (0.50). These findings again indicate that children who avoided lexical overlap for adjectives in the communicative context of the experimental trials did not reject the labeled object as a potential referent of the second adjective; instead, they often were willing to allow that one object could receive two adjective labels.

Comparisons Between Study 1 and Study 2

We carried out analyses to compare directly children’s performance in the first two studies. First, we focused on choices of the unlabeled object. We conducted an ANOVA to compare the mean number of these selections in the prenominal–prenominal condition of Study 1 with the number in the combined conditions of Study 2. The result was significant, $F(1, 38) = 5.47, p < .05$. A chi-square test comparing the numbers of accepters and avoiders of overlap in the Study 1 prenominal–prenominal condition with the numbers in the combined conditions of Study 2 was also significant, $\chi^2(1, n = 40) = 4.00, p < .05$. Both results support the claim that the presence of only one prenominal adjective in our task was not sufficient to promote the avoidance of lexical overlap observed in the prenominal–prenominal condition of Study 1.

Discussion

The results of Study 2 help to clarify the finding that English-speaking 4-year-olds in the prenominal–prenominal condition of Study 1 tended to avoid lexical overlap. The findings of Study 2 indicate that this effect depended on both adjectives appearing prenominally. When only one novel adjective (either the first or the second) was presented prenominally, we did not observe the overlap avoidance effect. This discovery suggests that children used the structural information accompanying both prenominal adjectives to fuel their pragmatic inferences about the speaker’s referential intentions concerning the words’ referents. Specifically, children appeared to use their knowledge that each prenominal adjective named a value on a restrictive property dimension to drive their inference that the speaker likely intended to use the second adjective to refer to a different object than the one labeled with the first.

Study 3

The results of Studies 1 and 2 provided evidence that English-speaking 4-year-olds are sensitive to the structural difference between prenominal and predicative adjectives and, furthermore, that they can use this sensitivity to draw inferences about a speaker’s intentions concerning reference (i.e., whether to avoid or allow lexical overlap). We interpreted the findings as indicating that children have knowledge of the semantic implications of differences in the structural relation of adjectives to nouns inside sentences (cf. Prasada, 1997). In particular, we suggested that the results reflect an understanding that a prenominal adjective forms a constituent with a noun and thus modifies it, resulting in a relation of restriction between the adjective and noun; however, a predicative adjective forms a constituent with an entire noun phrase, and therefore it does not modify the noun itself; no restrictive relation results.

However, an alternative interpretation of Study 1 findings is that children’s responses did not derive from sensitivity to the semantics of the underlying syntactic structures in which the adjectives appeared, but rather from sensitivity to a more superficial feature. Prenominal adjectives are so called because they appear in front of the noun. In contrast, our predicate adjectives appeared after the noun. It could be argued that the difference between conditions observed in Study 1 resulted from sensitivity to this word order distinction. For instance, perhaps the prenominal adjectives were encoded differently from the predicate adjectives because they occurred earlier in the sentences, or because they were associated with different prosodic cues that affected their salience (e.g., our predicate adjectives occupied sentence-final positions, but our prenominal adjectives did not).

The goal of Study 3 was to address this alternative interpretation by conducting a replication of Study 1 using Hebrew-speaking children. Like English, Hebrew allows adjectives to appear in sentences forming constituents with a noun, or in sentences creating constituents with an entire noun phrase. However, unlike English, the adjective appears after the noun in both cases, and in both cases, the adjective may appear in sentence-final position (Ninio, 2004). The distinction between the two types of adjectival structures is marked primarily by the addition of a
pronoun between the noun and the adjective in the latter case. Consider these examples:

1. "Ze kelev gadol" ("prenominal")
   this – dog – big
2. "Kelev ze hu gadol" ("predicate")
   dog – this – he – big

Importantly, the semantic implications of these two structures in Hebrew are similar to those in English. That is, adjectives appearing in sentences such as (1) arguably restrict the reference of the noun with which they appear, whereas adjectives appearing in sentences such as (2) do not (Ninio, 2004).

In Study 3, Hebrew-speaking preschoolers were exposed to the same procedure and conditions as the English-speaking children of Study 1. If the results of Study 1 were due to children’s sensitivity to the underlying structural position of the adjectives, then we expected Hebrew-speaking children in Study 3 to manifest the same effect. However, if the results of Study 1 were due to children’s sensitivity to the more superficial property of whether the adjectives preceded or followed the nouns, then we expected Hebrew-speaking children in Study 3 to respond similarly in both conditions. More generally, Study 3 allowed us to address the generality of the phenomenon across languages.

Method

Participants

Thirty-two Hebrew-speaking preschoolers, 15 boys and 17 girls, participated in this study (M = 4 years 4 months, SD = 4 months, range = 3 years 9 months to 4 years 11 months). All children were Jewish, from European, Middle Eastern, and North African descent, and were from various socioeconomic backgrounds. They were recruited from and tested in preschools around the university. Only children with signed parental consent participated.

Materials

The materials used in Study 3 were equivalent to those used in Study 1.

Design

As in Study 1, children were randomly divided into a predicate–predicate and a prenominal–prenominal condition (n = 16 per condition, with roughly equal numbers of boys and girls in each condition). Even though in Hebrew the adjectives do not appear before the nouns, in order to make the equivalence between Studies 1 and 3 more evident, we will refer to the Hebrew condition in which the adjectives form constituents with the nouns as the prenominal–prenominal condition. There was no significant age difference between the two conditions. Children participated in two warm-up trials followed by four experimental trials.

Procedure

The procedure in Study 3 was exactly the same as in Study 1, with the obvious exception that it was carried out in Hebrew. The Hebrew wording used in the instructions is presented in the Appendix. The Hebrew-sounding novel labels used were TIGAL, SHAMIK, DUSHIK, CHIPON, SHIBAN, BOODAL, PATOL, and KOOLA. As in the English sentences, all adjectives were marked with normal stress patterns. Furthermore, the prosody in the two Hebrew conditions was very similar, and followed a natural stress pattern. Both Hebrew adjectives always received the same kind of stress that applies to a sentence-final word.

Results

Forced-Choice Selections

If children were sensitive to the underlying structural positions of the prenominal and predicate adjectives, we predicted that children would be more likely to select the unlabeled animal as the referent of the puppet’s request in the prenominal–prenominal than in the predicate–predicate condition. As in the two previous studies, we used the mean number of unlabeled animal selections (0–4) as the dependent measure. A preliminary analysis revealed no effect of gender, and so gender was not entered as a factor in the subsequent analyses.

Consistent with our prediction, an ANOVA with condition as a between-subjects factor revealed that children in the prenominal–prenominal condition were more likely than children in the predicate–predicate condition to select the unlabeled object, F (1, 30) = 4.92, p < .05 (see Table 1). Analyses against chance (chance = 2 out of 4 selections of the unlabeled animal) confirmed that while children in the prenominal–prenominal condition selected the unlabeled animal more often than would be expected by chance, t(15) = 4.84, p < .001, children in the predicate–predicate condition did not, p > .1.

In addition to the parametric analyses, we also evaluated children’s individual selection strategies.
First, applying the same criteria used in Studies 1 and 2, we classified children as “accepters of overlap” and “avoiders of overlap” (see Table 2). A chi-square analysis revealed that the distribution of children in the two conditions did not differ significantly, \( p > .1 \). Nonetheless, analyses against chance revealed that while the distribution of children in the prenominal–prenominal condition was significantly different from chance, \( \chi^2(1, n = 16) = 7.27, p < .01 \), the distribution in the predicate–predicate condition was not, \( p > .5 \).

Yes–No Answers

As in Study 1, children’s yes–no answers suggested that the avoidance of lexical overlap for adjectives did not reflect a rejection of the possibility of two adjectives applying to one object. We again focused on trials on which children selected the unlabeled object and asked whether these trials were accompanied by a “no” answer to our follow-up question about whether the second adjective could be extended to the labeled object. Any child who made at least one unlabeled object choice received a score to reflect the proportion of those choices followed by a “no” answer. Consistent with the results of Studies 1 and 2 (and Hall & Graham, 1999), children in both conditions often allowed the second adjective to be applied to the labeled object: The mean proportion of “no” answers was 0.71 in the predicate–predicate condition and 0.48 in the prenominal–prenominal condition. Neither mean departed significantly from chance (0.50). These findings again indicated that children who avoided adjective overlap nevertheless did not reject the labeled object as a potential referent of the second adjective; rather, they often allowed that one object could receive two adjective labels.

Comparisons Between Study 1 and Study 3

To address potential differences between languages, we conducted analyses directly comparing the responses of children in Studies 1 and 3. A comparison between the mean age of children in the two studies revealed that the Hebrew-speaking children of Study 3 were on average 3 months older than the English-speaking children of Study 1, \( F(1, 60) = 15.34, p < .001 \). However, it is important to note that, taking the two samples together, we found no significant difference between conditions in terms of mean age, and no interaction between condition and language.

We then focused on children’s tendency to select the unlabeled object. First, an ANOVA on the number of unlabeled animal selections, with language and condition as between-subjects factors, revealed a significant effect of condition, \( F(1, 60) = 12.23, p < .005 \). As expected, children in the prenominal–prenominal conditions were more likely than children in the predicate–predicate conditions to select the unlabeled animal. More importantly, neither the effect of language, \( p > .5 \), nor the interaction, \( p > .3 \), was significant. Second, a chi-square analysis comparing the distribution of accepters and avoiders of overlap between languages was also not significant. Taken together, these comparisons reveal that despite differences in the superficial manifestation of the different adjectival structures in English and Hebrew, young speakers of these two languages responded in similar fashion to the experimental questions.

Discussion

The results of Study 3 further clarify the findings from Study 1, lending support to the claim that the observed difference between children’s performance in the prenominal–prenominal and predicate–predicate conditions of Study 1 reflected a sensitivity to the different underlying structural relations between adjectives and nouns inside sentences rather than a sensitivity to a more superficial difference pertaining to whether the adjective precedes or follows the noun. More generally, the findings provide evidence of the cross-linguistic generality of the observed tendency for children to avoid lexical overlap when interpreting novel prenominal (but not predicate) adjectives.

The results of Experiment 3 help to rule out one superficial interpretation of children’s performance in Experiment 1. However, another superficial interpretation might still be advanced. In both the English and Hebrew sentences we used, the adjective and noun were in closer proximity to each other (separated by fewer words) in the prenominal than in the predicate condition, offering another possible explanation for children’s performance in Experiments 1 and 3.

We think it is unlikely that this surface-level difference is itself the basis for children’s restrictive interpretation of prenominal but not predicate adjectives, although we cannot rule it out definitively. First, if children were simply responding to whether the adjective sits closer or further away from the noun, there is no principled explanation for why adjectives that sit closer (the prenominal adjectives) get interpreted restrictively whereas the ones that appear further away (the predicate adjectives) do not. In contrast, if children were responding on the
basis of the structural relation between the adjective and the noun inside the sentence, there is an explanation for the difference in interpretation (i.e., the account we have proposed; cf. Prasada, 1997). Second, our data in fact speak against a simple version of the proximity-to-noun interpretation of our findings, a version stating that children interpret adjectives adjacent to nouns as restrictive and adjectives nonadjacent to nouns as nonrestrictive. In English (Experiments 1 and 2), the prenominal adjectives always appeared adjacent to the modifying nouns, whereas the predicate adjectives sat four words away. In contrast, in Hebrew (Experiment 3), both prenominal and predicate adjectives were nonadjacent to the nouns. As in English, the predicate adjective sat four words away from the noun, but unlike in English, the prenominal adjective now appeared two words away (i.e., there was an intervening word). The fact that children performed similarly in English and Hebrew thus offers evidence against the possibility that children were following a superficial rule of interpreting adjacent adjectives as restrictive and nonadjacent adjectives as nonrestrictive.

General Discussion

Children’s well-documented tendency to avoid lexical overlap has been the focus of considerable interest in the word-learning literature, at least partly because of questions surrounding the knowledge sources that give rise to the effect. To account for the full range of previous findings about the avoidance of overlap, we have proposed that word learners draw on pragmatic knowledge about speakers’ referential intentions (e.g., Clark, 1987, 1990; Diesendruck & Markson, 2001) along with knowledge of the semantics of specific lexical form classes (e.g., Hall & Graham, 1999; Hall et al., 2000). The goal of the present studies was to investigate whether preschoolers’ avoidance of lexical overlap also stems from an interaction between their pragmatic knowledge and their understanding of the semantic implications of structural variation within a lexical form class, namely, adjectives.

In Study 1, English-speaking 4-year-olds were more likely to avoid lexical overlap when two adjectives were modeled prenominally (e.g., “This is a very zavy dog. Show me a very daxy dog”) than when they were presented as predicates (e.g., “This dog is very zavy. Show me a dog that is very daxy”). The results of Experiment 2 helped clarify these findings by demonstrating that children needed to hear both adjectives presented in prenominal structures in order to show the overlap avoidance effect. When only one novel adjective (the first or the second) was presented prenominally, children did not demonstrate the effect. Study 3 furnished another important clarification and an extension of the observed lexical overlap avoidance with adjectives by replicating the results of Study 1 with Hebrew-speaking preschoolers. Hebrew draws an analogous distinction between prenominal and predicate adjectives, except that both appear after the noun, and both may appear in the sentence-final position. The replication of the English results in Hebrew thus provides evidence against the argument that the Study 1 findings merely reflect sensitivity to a surface distinction between adjectives that precede or follow nouns inside sentences. Together, the results of these studies provide evidence that preschoolers’ avoidance of lexical overlap with adjectives involves two crucial sources of knowledge. First, the findings suggest that the phenomenon reflects knowledge of the semantics of different syntactic structures within a lexical form class. Specifically, English-speaking and Hebrew-speaking 4-year-olds appeared to understand that novel adjectives presented in structural relations with nouns (prenominal adjectives) restrict the reference of those nouns. That is, the findings are consistent with the claim that children appreciated that prenominal adjectives label values on property dimensions along which objects of a particular kind may vary. In contrast, adjectives appearing in structural relations with noun phrases (predicate adjectives) did not appear to carry the same semantic implication.

The preceding findings are consistent with previous demonstrations of English-speaking children’s tendency to infer that prenominal (but not predicate) adjectives pick out values on property dimensions along which different objects of a given kind may vary (e.g., Gelman & Markman, 1985; Prasada, 1997). The results also extend Hall and Graham’s (1999) finding that English-speaking preschool children did not avoid lexical overlap for two adjectives when the adjectives were presented as predicates. The findings suggest, however, that Hall and Graham’s result with adjectives may have reflected not only preschoolers’ knowledge of the semantics of adjectives as a form class (i.e., that they designate properties and that more than one may apply to a given object), but also their knowledge of the semantics of predicate sentence frames, which do not call for a restrictive interpretation.

Second, preschoolers’ avoidance of lexical overlap with adjectives reflects their understanding of speakers’ referential intentions. Even if preschoolers
possess the semantic knowledge that prenominal adjectives label properties on restrictive dimensions, this understanding by itself is not sufficient for children to reject a second prenominal adjective as referring to an object already labeled with a different prenominal adjective. In addition, the avoidance of two prenominal adjectives for the same object must stem from the pragmatic inference that, if a speaker uses two such forms, it is likely because he or she has two different intents in mind (Clark, 1987). For example, upon hearing a speaker label one dog as a "very daxy dog" and then ask for a "very blicky dog," preschoolers must assume that the speaker would not intend to use the second restrictive form to refer to an object previously referred to by a different restrictive form. Children thus conclude that the speaker must intend to refer to the unlabeled object and consequently map the second prenominal adjective to that object. This pragmatic inference appears to derive specifically from an understanding of prenominal adjectives used in our indirect word-learning context, because children did not avoid lexical overlap when the speaker used predicate adjectives that did not call for a restrictive interpretation. Moreover, the results of our yes–no questioning revealed that in a different communicative context not requiring the same type of pragmatic inference, children in all conditions of these studies were willing to allow that a second adjective could be applied to an object previously labeled with a different adjective.

Other recent studies have also found that if two different referentially restrictive forms are used, then children avoid lexical overlap in this type of situation. For example, Diesendruck (2005) showed children pairs of animate-like creatures, taught children either a novel proper name or common count noun for one of them, and then asked children for the referent of either a different novel common noun or proper name, respectively. Children in both conditions (i.e., proper–common and common–proper) selected the unlabeled creature, thus avoiding overlap between the two different restrictive referential forms. Similarly, in Diesendruck and Markson’s (2001) studies, children avoided overlap with either count nouns or facts when they were applied to novel objects. In these studies, the facts could have been interpreted as referentially restrictive, because they appeared in the same sentence position as the count nouns. For example, in the request, “Show me the one from Mexico,” the fact “one from Mexico” occupies the same position as does the count noun “dax” in the request, “Show me the dax.” Conversely, other research has demonstrated that if at least one of the forms is not referentially restrictive (i.e., a predicate adjective), children do not avoid lexical overlap. For example, Hall and Graham (1999) found that when the experimenter gave a novel proper name to one of two identical-looking stuffed animals, and then requested the referent of a novel predicate adjective (or vice versa), children showed no avoidance of lexical overlap, selecting randomly between the two stuffed animals. Together, these findings suggest that children’s avoidance of lexical overlap stems from a pragmatic inference about the intentions of a speaker who uses not just any two different forms, but specifically two different referentially restrictive forms.

Our results raise several issues that merit attention in future research. For example, it will be important to investigate how younger children (as well as adults) treat prenominal and predicate adjectives in learning contexts like the one studied in this research. This future work should also explore the potential role of caregiver input in children’s learning about prenominal and predicate adjectives. Although there is evidence that English-speaking and Hebrew-speaking children acquire the distinction between them by the age of 2 years 6 months (Nelson, 1976; Ninio, 2004; Prasada, 1997), we know of no studies that document the circumstances surrounding caregivers’ use of prenominal and predicate adjectives in input to children. The study of how children learn about prenominal and predicate adjectives will also have to account for the fact that, in addition to linguistic knowledge, there is much nonlinguistic knowledge that must be acquired. For example, children must learn what counts as a restrictive property dimension for a particular kind of thing. Color is a restrictive dimension for lollipops (which come in many colors) but not for strawberries (which are always red when ripe). Furthermore, children must learn what values on a given dimension are more restrictive for a particular type of thing. Prasada (1997) has proposed and provided evidence that children are more likely to interpret a prenominal adjective as labeling a nonstandard (more restrictive) value for a particular kind of thing than a standard (less restrictive) value for that same kind of thing. Consider hearing that a transparent, spotted dress is a “daxy dress.” Transparent is a nonstandard value on the dimension of opacity for dresses (few dresses are transparent), but spotted is more standard on the dimension of surface pattern (many dresses are spotted). As a result, it would be more restrictive to interpret “daxy” as meaning transparent. In contrast, consider hearing that a transparent, spotted drinking glass is a “daxy glass.”
In this case, it would be more restrictive to interpret “daxy” as meaning spotted, because glasses are typically transparent but less typically spotted (see Mintz & Gleitman, 2002, for further discussion).

Another issue deserving attention in future research surrounds the actual meanings that children assigned to the two adjectives used on each trial in our studies. According to our pragmatic account, a listener infers that a speaker who uses a reference-restricting term (such as a prenominal adjective) has a different referent in mind than the referent of a different reference-restricting term (such as a different prenominal adjective) used previously by a speaker. On this account of performance on our forced-choice task, the listener does not necessarily infer that the second prenominal adjective labels a property value on the same semantic dimension as the first prenominal adjective. For example, the listener does not necessarily infer that the second prenominal adjective labels a dispositional property (e.g., friendly) just because he or she interpreted the first adjective as labeling a dispositional property (e.g., grumpy). It is, however, an open question whether children actually do make this inference. Our studies were not designed to allow us to answer this question definitively, but the findings do offer some clues. Specifically, recall that our yes–no task results revealed that many children agreed that both adjectives on a given trial could apply to the same object. This finding provides some insight into the meanings children assigned to the two adjectives, because it suggests that the two meanings were both potentially applicable to the same object. One possibility is that children did not assume the two adjectives mark contrasting values along the same property dimension. For example, if they interpreted the first adjective as labeling a dispositional property such as friendly, they may have interpreted the second adjective as labeling a dispositional property such as hungry. Another possibility is that children did assume the words mark a contrast along the same property dimension, but the dimension was such that the same object could possibly be labeled by more than one value. For example, if they interpreted the first adjective as labeling a physiological state property such as hungry, they may have interpreted the second adjective as labeling a different physiological state property such as thirsty. After all, the same object could be both hungry and thirsty.

These findings advance our understanding of early word learning in four primary ways. First, the results provide new evidence that children’s knowledge of the semantics of syntactic structures can be an important guide to word interpretation, even for differences in sentence frames that arise within a single lexical category. In this case, the variation in syntactic structure occurred within the category of adjectives. This discovery is consistent with other recent research documenting the important role of knowledge of the semantics of different syntactic frames in constraining interpretation within the category of verbs (cf. Fisher, Hall, Rakowitz, & Gleitman, 1994; Gleitman, Cassidy, Nappa, Papafragou, & Trueswell, 2005). Second, the results furnish new support from the study of adjective interpretation for the argument that children’s avoidance of lexical overlap is not due to biases specific to the processing of words in general, but rather stems from pragmatic inferences applicable in a variety of referential contexts, including those involving count nouns, proper names (Diesendruck, 2005; Hall & Graham, 1999; Hall et al., 2000), or even facts (Diesendruck & Markson, 2001). Third, the results offer new insight into how children draw together their knowledge about syntactic structures and their pragmatic knowledge in the task of interpreting novel words. In this way, the findings illuminate how learners integrate multiple sources of knowledge to determine the meanings of new words. Finally, the replication of our primary English results in Hebrew lends support to the view that the use of pragmatic and syntactic knowledge in word learning is not peculiar to children learning English but instead is a phenomenon that arises in typologically distinct languages around the world.

References


Appendix

Hebrew Instructions in Experimental Trials of Study 3

Prenominal–Prenominal Condition


This is a very tigal bear. This is a very tigal bear. Can you say tigal? This is a very tigal bear.


I want a very shamik bear. I want a very shamik bear. Show me a very shamik bear.

“Ha-im hadubi haze yachol gam lihiot meod shamik?”

Can this bear also be very shamik?

Predicate–Predicate Condition


This bear is very tigal. This bear is very tigal. Can you say tigal? This bear is very tigal.

“Ani rotze dubi she-hu meod shamik. Ani rotze dubi she-hu meod shamik. Tar-e li dubi she-hu meod shamik.”

I want a bear that is very shamik. I want a bear that is very shamik. Show me a bear that is very shamik.

“Ha-im hadubi haze yachol gam lihiot meod shamik?”

Can this bear also be very shamik?”