Developmental Psychology
2001, Vol. 37, No. 3, 298–307

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0012-1649/01/$5.00 DOI: 10.1037//0012-1649.37.3.298

# Young Children's Use of Syntactic Cues to Learn Proper Names and Count Nouns

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In 6 experiments, 144 toddlers were tested in groups ranging in mean age from 20 to 37 months. In all experiments, children learned a novel label for a doll or a stuffed animal. The label was modeled syntactically as either a count noun (e.g., "This is a ZAV") or a proper name (e.g., "This is ZAV"). The object was then moved to a new location in front of the child, and a second identical-looking object was placed nearby. The children's task was to choose 1 of the 2 objects as a referent for the novel word. By 24 months, both girls (Experiment 2) and boys (Experiment 5) were significantly more likely to select the labeled object if they heard a proper name than if they heard a count noun. At 20 months, neither girls (Experiments 1 and 6) nor boys (Experiment 1) demonstrated this effect. By their 2nd birthdays, children can use syntactic information to distinguish appropriately between labels for individual objects and those for object categories.

Any object in the world (e.g., a cat) can be conceptualized as a member of a category (e.g., as a cat) or as an individual in its own right (e.g., as Felix), and a sensitivity to this distinction is fundamental to human cognition (e.g., Bloom, 1996, 2000; Macnamara, 1982, 1986). Reflecting this conceptual difference, human languages have one class of words that is used to label individuals as category members (i.e., count nouns, such as "cat") and another that is used to mark individuals as individuals (i.e., proper names, such as "Felix"). In this article, we examine young children's ability to use syntactic cues to distinguish between count nouns and proper names, and we explore the nature of their understanding of the meanings of words from these two lexical classes.

In a seminal study, Macnamara and his colleagues (Katz, Baker, & Macnamara, 1974, with additional data reported in Macnamara, 1982) examined 15–28-month-old children's ability to use a single syntactic cue to identify a novel word (e.g., ZAV) as being either a proper name or a count noun. The cue was the presence or absence of the indefinite article (i.e., *a*) before the word. Macnamara and his colleagues conducted a simple experiment in which children were assigned to one of two conditions: the count noun (CN) condition or the proper name (PN) condition. In the CN condition, children heard the novel word modeled in the sentence "This is a ZAV" and applied to one of two dolls that differed in hair color (and that differed in both hair and dress color in a follow-up experiment). These children were expected to interpret the word as a count noun, designating an entire category (e.g., DOLL). As a result, they were expected to select each doll about half the time when subsequently asked to extend the word ZAV. In the PN condition, children heard the same word applied to the same doll, but it was modeled in the sentence "This is ZAV." These children were expected to interpret the word as a proper name designating the labeled doll. As a result, they were expected to choose only the labeled doll when subsequently asked to extend the word ZAV.

A key result from the studies by Macnamara and his colleagues is that girls as young as 17 months of age chose the labeled doll significantly more often in the PN condition than in the CN condition (Katz et al., 1974). This finding suggests that these children used the presence or absence of the indefinite article to distinguish appropriately between words from the two lexical categories. However, Macnamara failed to obtain this finding with boys, even those who were almost a full year older (i.e., 28 months of age; Macnamara, 1982). The work of Macnamara and his colleagues is important because it was one of the earliest pieces of research to demonstrate that very young children (in this case, girls) can exploit syntactic cues to draw inferences about the meanings of new words. Along with that of Brown (1957), the work has provided a foundation for a large body of research on this topic (e.g., Gelman & Markman, 1985; Gleitman, 1990; Hall & Graham, 1999; Hall, Quantz, & Persoage, 2000; Hall, Waxman, & Hurwitz, 1993; Jaswal & Markman, in press; Landau, Smith, & Jones, 1992; Naigles, 1990; Taylor & Gelman, 1988; Waxman, 1990; Waxman & Markow, 1995; for a review, see Woodward & Markman, 1998). Moreover, the primary results from Macnamara's research have been replicated and extended in several subsequent studies with somewhat older children (with a mean age of 30

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This research was supported by an operating grant from the Natural Sciences and Engineering Research Council of Canada.

A portion of this work was reported in Sharon C. Lee's honors thesis submitted to the Department of Psychology, University of British Columbia, and was presented at the Boston University Conference on Language Development, Boston, MA, November 1999.

We thank Elizabeth Job, Hana Motozono, Jodi Pawluski, Kelley Persoage, and Jennifer Wide for their assistance with all aspects of the work and Susan Graham for helpful comments on a previous version of this article.

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or 31 months) of both genders (e.g., Gelman & Taylor, 1984; see also Hall, 1991).

Liittschwager and Markman (1993) noted an interpretative problem with the work of Macnamara's group and with its follow-ups, a problem that Macnamara himself recognized (Macnamara, 1986). Liittschwager and Markman drew attention to an ambiguity in children's tendency to restrict a novel word to the labeled doll (excluding the other doll) in Macnamara's task. The ambiguity stems from the fact that the labeled doll always had a salient property, such as hair or clothing color, that set it apart from the unlabeled doll. As a result, children's tendency to restrict the novel word to the labeled doll is consistent with their having taken the word to name a salient property of the doll, such as its hair color (e.g., blonde), as if the word were an adjective. The behavior is also consistent with the possibility that children interpreted the word as labeling a restricted category (e.g., blonde dolls), as if the word were a type of count noun. In other words, the behavior does not unambiguously signal that children took the word to name the individual doll, as if the word were a proper name. (See Sorrentino, 1999, for further discussion of alternative interpretations of the findings from this research.)

To address this problem, Liittschwager and Markman (1993) developed a new task. Like the task used by Macnamara and his colleagues (Katz et al., 1974; Macnamara, 1982), theirs involved studying children in one of two conditions (CN or PN). They began by showing 3-year-olds an animate surrogate (e.g., a stuffed bear) that had a salient marker (e.g., a bib) on it. (Their study also involved inanimate objects on other trials.) In the CN condition, they labeled the object with a count noun (e.g., "This is a ZAV"). In the PN condition, they labeled it with a proper name (e.g., "This is ZAV"). They then moved the object in front of the child to a new location marked by a doily and removed the salient marker from the object (e.g., they took the bib off the bear). Finally, they brought out an identical-looking object (e.g., another bear) without any salient marker on it and placed it where the labeled object had been placed originally. At this point, children faced two identical-looking objects. Thus, there was no distinctive property that could serve to differentiate the two objects, and there was no information available for assigning them to distinct restricted categories. The only cue available to children to help keep track of the objects was the doily.

In the CN condition, children were asked, "Where is a ZAV?" and in the PN condition, they were asked, "Where is ZAV?" The predictions were as follows: If children took the word to name an object property or an object category, they should have chosen either object. However, if children took the word to name an individual object, they should have picked only the originally labeled object. The findings were clear. Children chose the labeled animate object significantly more often in the PN condition than in the CN condition. These results provide evidence suggesting that preschoolers do map a novel proper name onto an individual animate object, rather than onto an object property or an object category, and that they do not map a novel count noun in the same way.

Recently, Sorrentino (1999) raised a concern about Liittschwager and Markman's (1993) study. Sorrentino noted that by removing the marker (e.g., the bib) from the originally labeled animate object (e.g., the bear) in their task, Liittschwager and Markman may have changed the object's status as a member of the restricted category that children took to be the meaning of the novel word (e.g., bib-wearing bear). They may also have changed the object's status as a bearer of a property that children viewed as the meaning of the word (e.g., bib wearing). As a result, children's tendency to restrict the novel word to the labeled object in the PN condition in their study may have simply reflected conservatism in the face of a situation in which neither object was seen to be a referent of the word. To address this issue, Sorrentino conducted a replication of the Liittschwager and Markman study with an important change: After the original animate object was labeled with a proper name, she removed the marker and placed it on the identical-looking unlabeled object. Children who thought the word named a restricted category (or a property) involving the marker now should have chosen the unlabeled object to be the word's referent. Using this procedure, Sorrentino (1999) found that 3-year-old children showed a strong tendency to pick the labeled animate object as the referent of a novel proper name. Her result thus established clearly that children mapped the proper name onto an individual object.

The findings of Liittschwager and Markman (1993) and Sorrentino (1999) represent important discoveries about the nature of children's early lexical–semantic understanding. However, the results come from groups of children who were about 2 years older, on average, than the group of 17-month-old girls originally studied by Macnamara and his colleagues (Katz et al., 1974; Macnamara, 1982). The average age of the children in Liittschwager and Markman's study was 39 months. Sorrentino's participants were even older, with a mean age of 42 months. In addition, despite the fact that Macnamara and colleagues found gender differences in performance on their task, neither of these subsequent studies focused on gender differences. The findings thus leave open the question of whether children (either girls or boys) younger than 39 or 42 months also understand that proper names, but not count nouns, map onto individual objects. This question bears on the issue of whether there is continuity or discontinuity in children's representations of proper names. Do children represent these expressions as designating individuals when they first learn them (e.g., at 17 months, or perhaps even earlier), or does this understanding emerge (in some as yet unspecified way) only after the age of 3 years?

To address this question, we developed a modified version of Liittschwager and Markman's (1993) task for use with younger children. Our primary modification involved eliminating the salient marker that Liittschwager and Markman added to, and then removed from, the labeled object (e.g., the bib on the bear). We made this modification for two reasons. First, we noted that some children in Liittschwager and Markman's study may have taken the novel word ZAV to name the marker's category (e.g., bib). This possibility arose because the marker was a salient part attached to a familiar object (e.g., a bear), and so it was a plausible candidate for the novel word's meaning, especially in the CN condition (see, e.g., Markman & Wachtel, 1988). As a result, we were concerned that the lack of a marker on either object at the time of questioning might have been confusing to younger children. Second, following Sorrentino (1999), we noted that some children in Liittschwager and Markman's study may have taken the word to denote the restricted category of marker-bearing objects (e.g., bib-wearing bears) or to name a property associated with the marker (e.g., bib wearing). Again, we were concerned that the removal of the marker prior to questioning might have con-

fused younger children. In our modified task, we did not place any extra marker on the labeled object at any time. Making this change had the effect of stripping down the task in a way that we thought might make it easier for young children to follow. At the same time, our change dealt with the interpretative concern raised by Sorrentino about Liittschwager and Markman's procedure, because we never altered the labeled object's markings.

We conducted six experiments to investigate young children's ability to use syntactic cues to distinguish in an appropriate manner between proper names and count nouns. In Experiments 1 through 4 we focused on groups of boys and girls between 20 and 37 months of age, using our modified version of Liittschwager and Markman's (1993) task. Experiments 5 and 6 involved a closer examination of 23- and 20-month-olds, using a further modified task. The findings from these studies enabled us to shed new light on the nature of children's early lexical–semantic understanding.

## Experiment 1

### Method

*Participants.* Thirty-two 20-month-olds participated; their ages ranged from 18 to 22 months. These children were slightly older than the youngest girls who successfully distinguished count nouns from proper names in the original research by Macnamara and his colleagues (Katz et al., 1974). There were 16 boys and 16 girls. Equal numbers of each gender were assigned to the CN condition ($M$ = 20.1 months, $SD$ = 1.8 months) and the PN condition ($M$ = 19.8 months, $SD$ = 1.1 months). An additional 13 children (3 girls and 10 boys) were tested but excluded from the final sample for failing to complete the task. Participants were recruited through advertisements placed in local news media. Parents brought their children to the laboratory in a university psychology department. They received no payment for participation, but we provided reimbursement for parking or travel expenses, and we gave all children a small gift and a certificate of appreciation. The first language of all of the children was English, and most were from middle-class or upper-middle-class homes.

*Stimuli.* There were four pairs of animate surrogate toys: boy dolls, girl dolls, stuffed bears, and stuffed dogs. The toys within each pair looked identical. The boy dolls, girl dolls, bears, and dogs were about 20, 20, 15, and 14 cm tall, respectively.

*Procedure.* Children sat at a table in a booster seat across from the experimenter. Parents sat behind them. The table was 91 cm wide and 61 cm deep. The table was marked with four transparent Xs to indicate the placement of the objects during the task. Two Xs were 23 cm from the edge on the experimenter's side of the table, 38 cm apart. The other two Xs were 14 cm from the edge on the child's side of the table, also 38 cm apart. We used a two-object forced-choice task. The task had four trials, each involving one of the four pairs of toys. The procedure was the same on all trials.

On each trial, we began by familiarizing children with the two identical-looking objects that were to be used. The experimenter offered the child both toys from a pair (e.g., both bears) for a 30-s free-play period. During this time, no labels were used. After approximately 30 s, the experimenter took the toys away and placed them on her lap out of the child's view.

We then taught children a novel word for one of the toys and tested how they interpreted it. The experimenter returned one of the toys (e.g., one of the bears) to the table and placed it on one of the Xs on her side of the table (on either the left or the right, according to a counterbalanced order; see below). In this location, the toy was out of the child's reach. In the CN condition, the experimenter said, "This is a ZAV," and in the PN condition, she said, "This is ZAV." The sentence was repeated five times, preceded by exclamations such as "Look!" "Wow!" or "Yeah!" (See Figure 1, Step 1.) The object was then moved 38 cm across the table to the other X

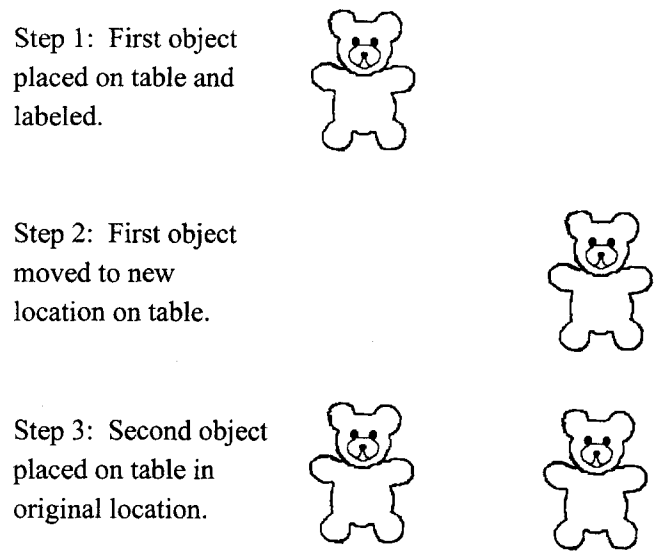


*Figure 1.* Outline of steps in procedure used in Experiments 1–4.

on the experimenter's side of the table (see Figure 1, Step 2). Next the experimenter brought out the identical-looking second object (e.g., the second bear) and placed it where the original object had been located (see Figure 1, Step 3). At this point, children faced two identical-looking objects. There was no distinctive property that could serve to differentiate them. And there were no cues available for assigning the two objects to distinct restricted categories. Finally, the experimenter pushed both objects 24 cm straight across the table until they covered the two Xs on the child's side of the table, still 38 cm apart. Now both toys were within the child's easy reach. As a test question, children in the CN condition were asked, "Where is a ZAV?" Children in the PN condition were asked, "Where is ZAV?" This question was repeated a minimum of twice. The experimenter then observed and recorded the object (or objects) that children selected.

Children had to complete at least two of the four trials to be included in our final sample (i.e., at least one of our two trial blocks). The novel words were FEP for the dog, ZAV for the bear, RIF for the girl doll, and POK for the boy doll. Within each condition, there were eight orders of the four trials. These orders counterbalanced for trial block (Block 1, girls and bears; Block 2, boys and dogs), for toy pair within each block (girls and bears, or bears and girls; boys and dogs, or dogs and boys), and for left–right presentation of the labeled toy. We videotaped all sessions to enable an independent scorer to code children's responses to the test questions.

### Results and Discussion

There was no difference between the mean numbers of trials (out of four) that children completed in the PN condition ($M$ = 3.38, $SD$ = 0.72) and in the CN condition ($M$ = 3.31, $SD$ = 0.70), $F(1, 30) = 0.06$, $p = .81$. The experimenter coded children's first response to the test question on each trial for whether it involved touching or pointing to (a) the labeled object only, (b) the unlabeled object only, or (c) both objects simultaneously. A second researcher later coded the videotapes of the sessions with no sound (to remain unaware of condition). The agreement between the two coders was 94%.

Our predictions were similar to those of Liittschwager and Markman (1993). If children treated the word as a name for an

object property or an object category,[1] then they should have picked either object. It would also have been acceptable for them to pick both objects. However, if children took the word to name an individual object, then they should have picked the labeled object. We predicted a significantly greater tendency to pick the labeled object in the PN condition than in the CN condition.

Our analyses focused on the mean proportions of trials (out of a maximum of four) on which children touched or pointed to the labeled object only in response to the test questions. These means appear in the top panel of Figure 2. We ran a 2 × 2 analysis of variance (ANOVA) with condition (PN or CN) and gender as between-subjects factors. There was no main effect of condition. Children were no more likely to choose the labeled object in the PN condition ($M$ = .32, $SD$ = .28) than in the CN condition ($M$ = .30, $SD$ = .24), $F(1, 28) = 0.03$, $p = .86$. There was, however, a marginally significant main effect of gender. Overall, girls ($M$ = .40, $SD$ = .23) were somewhat more likely than boys ($M$ = .22, $SD$ = .26) to choose the labeled object, $F(1, 28) = 3.60$, $p = .07$. We found no significant interaction of condition with gender. Finally, we conducted two planned contrasts to investigate the effect of condition within each level of gender separately. Neither test was significant.

We next reanalyzed the preceding data, treating stimulus items rather than subjects as a random factor. Again, there was no significant effect of condition, paired-$t(3) = 0.19$, $p = .86$. We also classified participants as being consistent labeled-object choosers for selecting the labeled object on at least two thirds of completed trials. We again found no significant effect of condition using a chi-square test ($N$ = 3 in the PN condition; $N$ = 1 in the CN condition).

Finally, when children failed to choose the labeled object, we noted that they often selected the unlabeled object (PN condition, $M$ = .30, $SD$ = .26; CN condition, $M$ = .39, $SD$ = .25). However, they also frequently chose both objects simultaneously (PN condition, $M$ = .39, $SD$ = .37; CN condition, $M$ = .31, $SD$ = .36). Selecting both objects simultaneously is a response option that was not noted in previous studies that used similar tasks, but it is an acceptable one for children who think that either object can be picked out by the novel label; and it is striking how often children chose this option.[2] One possible reason for children's choosing this option in the current study is that we used pairs of objects that looked identical, whereas previous studies typically used pairs of objects that differed (at least at some point in the task) in one or more features.

The results of Experiment 1 failed to provide evidence that 20-month-olds differentiate appropriately between words modeled as proper names and those modeled as count nouns. This failure led us to move our attention to children who were, on average, 4 months older than those in Experiment 1 (i.e., children at or near their 2nd birthdays).

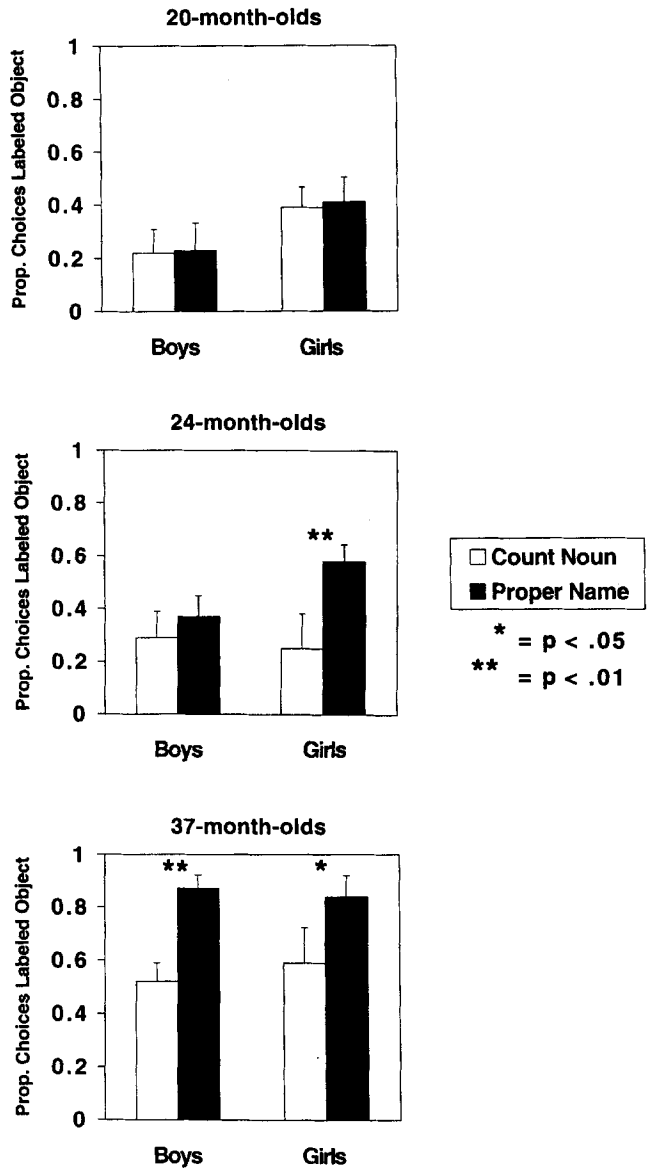


*Figure 2.* Results of Experiments 1, 2, and 3. Error bars represent one standard error. (Prop. = proportion)

## Experiment 2

### *Method*

*Participants.* Thirty-two 24-month-olds participated; their ages ranged from 22 to 27 months. There were 16 boys and 16 girls. Equal numbers of each gender were assigned to the CN condition ($M$ = 24.0 months, $SD$ = 1.6 months) and the PN condition ($M$ = 24.0 months, $SD$ = 1.5 months). An additional 6 children (2 girls and 4 boys) were tested but excluded from the final sample for failing to complete the task. Participants were recruited as in Experiment 1. None had taken part in the previous study.

*Stimuli.* The stimuli were the same as those in Experiment 1.

*Procedure.* The procedure was the same as that in Experiment 1.

[1] If children honor the principle of contrast (Clark, 1987), then they should not treat the novel word as a second label for the familiar object category (e.g., as a synonym for *bear*). Instead, they should treat it as naming a different object category (e.g., a subordinate-level category, such as *grizzly bear*).

[2] The existence of three response options—labeled object only, unlabeled object only, both objects simultaneously—makes it difficult to evaluate the findings with respect to chance performance, because it is not clear that these three should be treated as equally likely by chance alone.

### *Results and Discussion*

There was no difference between the mean numbers of trials (out of four) that children completed in the PN condition ($M$ = 3.75, $SD$ = 0.58) and the CN condition ($M$ = 3.69, $SD$ = 0.60), $F(1, 30) = 0.09$, $p = .77$. Children's answers to the test questions were coded as in Experiment 1. The agreement between the two coders was 95%.

Our analyses again focused on the mean proportions of trials on which children chose the labeled object only (see the middle panel of Figure 2). In an ANOVA with condition (PN or CN) and gender as between-subjects factors, we now found a significant main effect of condition. At a mean age just 4 months older than the mean age in Experiment 1, children were significantly more likely to choose the labeled object in the PN condition ($M$ = .47, $SD$ = .23) than in the CN condition ($M$ = .27, $SD$ = .31), $F(1, 28) = 4.62$, $p = .04$. There was no significant main effect of gender and no interaction of condition with gender. As in Experiment 1, we also conducted two planned contrasts to investigate the effect of condition within each level of the gender factor separately. The contrast was significant for girls, $t(28) = 2.50$, $p < .01$ (one-tailed), but not for boys, $t(28) = 0.54$, $p > .25$ (one-tailed).

We then reanalyzed the preceding data, treating stimulus items rather than subjects as a random factor. We again found a significant effect of condition, paired-$t(3) = 4.40$, $p = .02$. We also classified participants as being consistent labeled-object choosers for selecting the labeled object on at least two thirds of completed trials; however, we found no significant effect of condition using a chi-square test ($N$ = 5 in the PN condition; $N$ = 2 in the CN condition). Thus, although children were significantly more likely to select the labeled object in the PN condition than in the CN condition, few in either condition showed a consistent tendency to do so.

Finally, as in Experiment 1, we noted that children did not always choose the unlabeled object when they failed to choose the labeled object. Children often did select the unlabeled object (PN condition, $M$ = .35, $SD$ = .24; CN condition, $M$ = .31, $SD$ = .27), but they also often chose both objects simultaneously (PN condition, $M$ = .17, $SD$ = .29; CN condition, $M$ = .42, $SD$ = .32).

We were struck by the finding that girls, but not boys, showed the predicted sensitivity to the syntactically cued distinction between count nouns and proper names in the planned contrasts in Experiment 2. These results are consistent with the finding of Macnamara and his colleagues (Katz et al., 1974; Macnamara, 1982) that girls differentiated between the two lexical categories at an earlier age than did boys. However, our observed gender difference raised the question of *when* boys would first distinguish significantly between proper names and count nouns in our task. In an attempt to answer this question, we recalled that Macnamara and his colleagues found some evidence (though it was not significant) that boys drew the predicted distinction at 28 months on their task, almost a full year later than the youngest girls who showed the effect. As a result, we conducted a third experiment in which we tested children who were about 1 year older than the children in Experiment 2. Because so few boys or girls in Experiment 2 showed a consistent tendency to select the labeled object, we included children of both genders in this next experiment in order to determine whether a consistent preference for the labeled object would be evident in either condition in these older children.

## Experiment 3

### *Method*

*Participants.* Thirty-two 37-month-olds took part; their ages ranged from 33 to 43 months. There were 16 boys and 16 girls. Equal numbers of each gender were assigned to the CN condition ($M$ = 36.6 months, $SD$ = 2.7 months) and the PN condition ($M$ = 36.6 months, $SD$ = 2.9 months). No children were excluded from the final sample for failing to complete the task. Participants were recruited differently than in Experiments 1 and 2. We tested most children in the laboratory, as in previous experiments. However, we also tested a few children in each condition (roughly equal numbers) in their local preschools during the school day. None had taken part in any previous study.

*Stimuli.* The stimuli were the same as those in Experiment 1.

*Procedure.* The procedure was the same as that in Experiment 1 except that we did not videotape the sessions because of the children's advanced age and because of the high reliability of coding in the first two experiments. In addition, these older children sat in chairs rather than booster seats.

### *Results and Discussion*

There was no difference between the mean numbers of trials (out of four) that children completed in the PN condition ($M$ = 3.94, $SD$ = 0.25) and the CN condition ($M$ = 3.75, $SD$ = 0.58), $F(1, 30) = 1.42$, $p = .24$. Children's answers to the test questions were coded by the experimenter.

Our analyses again focused on the mean proportions of trials on which children chose the labeled object only (see the bottom panel of Figure 2). In an ANOVA with condition (PN or CN) and gender as between-subjects factors, there was a significant main effect of condition. Children were more likely to choose the labeled object in the PN condition ($M$ = .85, $SD$ = .19) than in the CN condition ($M$ = .56, $SD$ = .29), $F(1, 28) = 11.06$, $p = .003$. There was no significant main effect of gender and no interaction of condition with gender. As in previous experiments, we conducted two planned contrasts to investigate the effect of condition within each level of the gender factor separately. The contrast was significant both for girls, $t(28) = 1.98$, $p < .05$ (one-tailed) and for boys, $t(28) = 2.72$, $p < .01$ (one-tailed).

We also found a significant effect of condition when we reanalyzed the preceding data, treating items rather than subjects as a random factor, paired-$t(3) = 5.73$, $p = .011$. We also classified participants as being consistent labeled-object choosers for selecting the labeled object on at least two thirds of completed trials. We then found a significant difference between conditions. There were 14 consistent labeled-object choosers in the PN condition but only 6 in the CN condition, $\chi^2(1, N = 32) = 8.53$, $p = .004$. Thus, children in Experiment 3 were not only significantly more likely to select the labeled object in the PN than in the CN condition, but they were also significantly more likely to be consistent in their tendency to do so in the PN condition than in the CN condition.

In addition, we noted that when the 37-month-olds failed to choose the labeled object, they often selected the unlabeled object (PN condition, $M$ = .15, $SD$ = .19; CN condition, $M$ = .27, $SD$ = .25). They also sometimes chose both objects simultaneously, although they did so less often than the 20- or 24-month-olds did (PN condition, $M$ = .00, $SD$ = .00; CN condition, $M$ = .17, $SD$ = .34).

Finally, to examine whether 37-month-olds were more likely than 24- or 20-month-olds to choose the labeled object only, we

combined the data from Experiments 1, 2, and 3. We then conducted an ANOVA with condition (PN or CN), gender, and age (20, 24, or 37 months) as between-subjects factors. The results showed a significant effect of condition, $F(1, 84) = 10.60$, $p < .005$, with more choices of the labeled object in the PN condition than in the CN condition. In addition, there was a significant effect of age, $F(2, 84) = 21.67$, $p < .0001$. A linear trend contrast established that with increasing age, children were significantly more likely to choose the labeled object, $t(84) = 6.12$, $p < .0001$. No other effects were significant, although there was a marginally significant main effect of gender, $F(1, 84) = 3.27$, $p < .10$, with girls being more likely than boys to select the labeled object. There was also a marginally significant interaction of condition with age, $F(1, 84) = 2.45$, $p < .10$, indicating that the effect of condition was stronger among older than among younger children.

The results of Experiment 3 showed that both girls and boys who were about 1 year (13 months) older than our 24-month-olds in Experiment 2 had a significantly greater tendency to map a novel proper name than a novel count noun onto an individual object. Recall that at 24 months, only girls had shown the effect. Taken together, the findings from Experiments 2 and 3 suggest that boys lag up to 1 year behind girls in appropriately differentiating between these two lexical categories. The results are consistent with those of Macnamara (1982), who observed that boys were at least 11 months behind girls in differentiating between the two word classes on his task. (Even 11 months later, boys still failed to distinguish significantly between the categories.)

Having found that boys successfully distinguished proper names from count nouns on our task at 37 months, we wondered whether they lagged a full year behind girls in acquiring this ability. To answer this question, we decided to test a group of boys whose ages were halfway between those of the 24-month-olds of Experiment 2 and the 37-month-olds of Experiment 3—namely, 31-month-olds.

## Experiment 4

### Method

*Participants.* Sixteen 31-month-old boys took part; their ages ranged from 29 to 33 months. Equal numbers were assigned to the CN condition ($M = 31.4$ months, $SD = 1.1$ months) and the PN condition ($M = 30.8$ months, $SD = 1.0$ months). An additional 5 boys were tested but excluded from the final sample for failing to complete the task. Participants were recruited as in Experiment 1. None had taken part in any previous study.

*Stimuli.* The stimuli were the same as those in Experiment 1.

*Procedure.* The procedure was the same as that in Experiment 1. However, children sat in chairs rather than booster seats.

### Results and Discussion

There was no difference between the mean numbers of trials (out of four) that boys completed in the PN condition ($M = 3.75$, $SD = 0.46$) and the CN condition ($M = 3.50$, $SD = 0.76$), $F(1, 14) = 0.64$, $p = .44$. Boys' answers to the test questions were coded as in Experiment 1. The agreement between the two coders was 95%.

Our analyses again focused on the mean proportions of trials on which children chose the labeled object only (see Figure 3). A one-way ANOVA with condition (PN or CN) yielded no significant effect. Boys were no more likely to choose the labeled object in the PN condition ($M = .47$, $SD = .30$) than in the CN condition ($M = .44$, $SD = .20$), $F(1, 14) = 0.06$, $p = .81$.

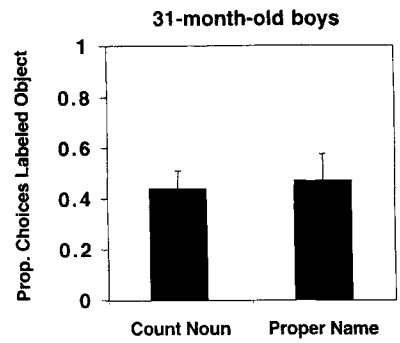


*Figure 3.* Results of Experiment 4. Error bars represent one standard error. (Prop. = proportion)

When we reanalyzed the preceding data, treating items rather than subjects as a random factor, we also found no significant effect of condition, paired-$t(3) = 0.09$, $p = .93$. In addition, we classified participants as being consistent labeled-object choosers for selecting the labeled object on at least two thirds of completed trials. We found no significant difference between conditions using a Fisher's exact test ($N = 2$ in the PN condition; $N = 2$ in the CN condition).

Finally, we noted that the 31-month-old boys who failed to choose the labeled object often selected the unlabeled object (PN condition, $M = .41$, $SD = .34$; CN condition, $M = .43$, $SD = .25$) but also sometimes chose both objects simultaneously (PN condition, $M = .13$, $SD = .19$; CN condition, $M = .14$, $SD = .27$).

Our failure to find a significant effect of condition among 31-month-old boys in Experiment 4 left us with the result that girls showed an appropriate differentiation of proper names from count nouns about 1 year earlier than boys. This difference between genders can be seen clearly in Figure 4, which groups together the results of Experiments 1, 2, 3, and 4. The gender gap we observed is similar to the one observed by Macnamara (1982). We still wondered, however, whether this difference reflected the fact that the younger boys lacked the ability to use syntactic cues to distinguish suitably between the two word categories or whether the ability was present but harder to demonstrate in boys than in girls. Perhaps, as Macnamara (1982) hypothesized, boys were less attentive than girls during the task. Inattention during the task would have hurt performance, especially in the PN condition, because the task required children to track an object under a novel word and to keep it distinct from another identical-looking object. Some support for this inattention hypothesis comes from the numbers of boys and girls who were excluded from the first two experiments. Exclusion usually meant that a child fussed too much to complete at least two trials of the task, often presumably a sign of inattention. Fourteen boys, but only 5 girls, were excluded from Experiments 1 and 2, almost a 3:1 ratio. In Experiment 5, we examined the inattention hypothesis by modifying the procedure from Experiments 1–4 in order to provide a more elaborate and interactive context for learning a novel word. We expected that these modifications would help maintain attention to the task. We tested two new groups of boys who were at or near their 2nd birthdays.

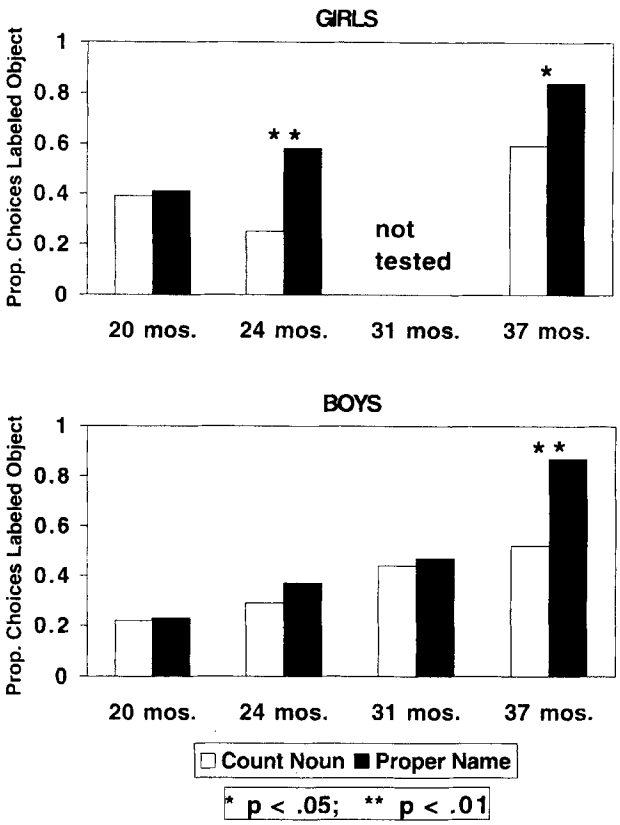


*Figure 4.* Results of Experiments 1, 2, 3, and 4. (Prop. = proportion)

## Experiment 5

### *Method*

*Participants.* Sixteen 23-month-old boys took part; their ages ranged from 22 to 26 months. Equal numbers of boys were assigned to the CN condition ($M$ = 23.3 months, $SD$ = 1.4 months) and the PN condition ($M$ = 23.0 months, $SD$ = 1.6 months). An additional 4 boys were tested but excluded from the final sample for failing to complete the task (see below). Participants were recruited as in Experiment 3. None had taken part in any previous experiment.

*Stimuli.* We used only one pair of stuffed animals as stimuli: two identical-looking monkeys, about 12 cm high. We also used two puppets (a frog and a giraffe).

*Procedure.* The procedure was similar to that of Experiment 1 but with the following differences, introduced in an attempt to maintain boys' attention better during the task:

1. We administered only one trial instead of four. This reduction in the number of trials enabled us to devote more time to teaching the novel label.

2. We used two puppets (the frog and the giraffe) to help in asking children the test questions. We introduced the puppets for approximately 30 s before introducing the two identical-looking objects (monkeys). After 30 s, we had the puppets say that they were sleepy and needed to go for a short nap but that they would return later to play. The experimenter then put them away under the table and brought them back to ask children questions later in the procedure.

3. We made the teaching of the novel word more elaborate and interactive in order to enhance the salience of the labeled object and thereby heighten its perceived individuality. First, when we taught the novel word, we embedded it in several distinct sentence frames to make its lexical category easier to detect. Second, we asked children to repeat the label while we were teaching it. Third, we invited children to interact with the labeled object as the word was taught.

In both conditions, the experimenter first presented the labeled object (one of the monkeys) at a point midway between the two Xs on the child's side of the table. In the PN condition, the experimenter introduced the object in this way: "He's DAXY." In the CN condition, the experimenter said, "He's a DAXY." The experimenter then continued as follows, omitting the words in parentheses in the PN condition but including them in the CN condition: "He's called (a) DAXY. Look! (The) DAXY wants to jump!" The experimenter made the monkey jump and then said, "I like (this) DAXY very much." The experimenter cuddled the monkey and then said, "(This) DAXY loves to sleep." The experimenter then laid the monkey down on the table and tried to elicit the novel word from the child, saying, "What did I call him?" If the child did not answer, the experimenter answered for the child. The experimenter then asked, "Here, do you want to touch (the) DAXY? (The) DAXY is soft. Do you want to hold (the) DAXY?" The experimenter then handed the object to the child. After several seconds, she retrieved it, saying, "Okay, let me take (the) DAXY and put him here." The experimenter at this point moved the labeled object to its second mark, on one of the two Xs on the child's side of the table, to the left or the right according to a counterbalanced order. The identical-looking second object was then placed on the other X on the child's side of the table, 38 cm away (as in previous experiments).

4. During the labeling of the object, the unlabeled object always remained in view in a corner of the table. As a result, the child had a continuous spatiotemporal reminder of the distinctiveness of the two objects.

5. We asked the test question on a total of three occasions instead of just one. To keep the pragmatics of the questioning as natural as possible, we had a different individual ask the question on each occasion. The experimenter asked first. After the child answered, the monkeys were carefully repositioned while the child was watching, and the first puppet (the frog) was brought back from his nap to ask the same question. After the child answered again, the objects were carefully repositioned again with the child watching, and the second puppet (the giraffe) was brought back from his nap to ask the question a third time. Thus, although we used only one stimulus set, we obtained up to three responses from each child.

Children had to answer at least two of the three questions in order to be included in the final sample. The novel word used was DAXY.

### *Results and Discussion*

There was no difference between the mean numbers of questions (out of three) that boys answered in the PN condition ($M$ = 2.63, $SD$ = 0.52) and the CN condition ($M$ = 2.63, $SD$ = 0.52). Boys' answers to the test questions were coded as in Experiment 1. The agreement between the two coders was 100%.

Our analyses again focused on the mean proportions of trials on which children chose the labeled object only (see the upper panel of Figure 5). A one-way ANOVA involving condition (PN or CN) yielded a significant effect. Boys were significantly more likely to choose the labeled object in the PN condition ($M$ = .62, $SD$ = .32) than in the CN condition ($M$ = .15, $SD$ = .21), $F(1, 14) = 12.70$, $p = .003$.

Because there was only one stimulus set, we performed no analyses that treated stimulus items as a random factor. However, as in previous experiments, we classified participants as being consistent labeled-object choosers for selecting the labeled object in response to at least two thirds of all questions they answered. We found no significant difference between these numbers in the two conditions using a Fisher's exact test ($N$ = 3 in the PN condition; $N$ = 0 in the CN condition). Thus, although boys were

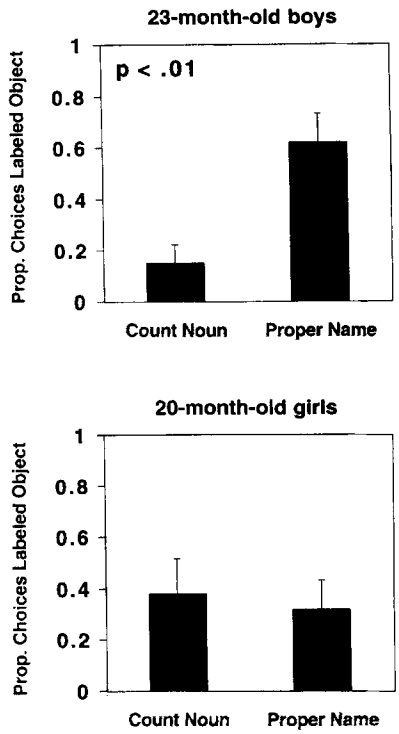


*Figure 5.* Results of Experiments 5 and 6. Error bars represent one standard error. (Prop. = proportion)

significantly more likely to select the labeled object in the PN condition than in the CN condition, relatively few in either condition showed a consistent tendency to do so. This overall pattern of results is similar to the pattern shown by 24-month-old girls in Experiment 2.

Finally, we noted that the 23-month-old boys who failed to choose the labeled object often selected the unlabeled object (PN condition, $M = .21$, $SD = .31$; CN condition, $M = .50$, $SD = .30$) but also often chose both objects simultaneously (PN condition, $M = .17$, $SD = .24$; CN condition, $M = .36$, $SD = .40$).

In sum, 23-month-old boys successfully differentiated proper names from count nouns when we modified our procedure in several ways to provide a richer and more elaborate linguistic and nonlinguistic learning context. We suspect that these modifications may have helped boys maintain their attention to the task. Although it is not clear which of the changes enabled boys to succeed, our results are noteworthy for showing that there are conditions under which, before their 2nd birthdays, boys can reveal a capacity to use syntactic cues to distinguish appropriately between proper names and count nouns.

Having provided evidence that both girls (Experiment 2) and boys (Experiment 5) by their 2nd birthdays are more likely to map proper names than count nouns onto individual objects, we asked a final question. If boys could succeed on our modified task before 24 months, could even younger children succeed as well? In other words, did our original task underestimate even girls' ability to show an understanding of proper names and count nouns? To address this issue, we conducted a final experiment in which we tested 20-month-old girls with the modified task from Experiment 5.

## Experiment 6

### Method

*Participants.* Sixteen 20-month-old girls took part; their ages ranged from 18 to 22 months. Equal numbers were assigned to the CN condition ($M = 19.6$ months, $SD = 2.1$ months) and the PN condition ($M = 19.6$ months, $SD = 1.5$ months). An additional 4 girls were tested but excluded from the final sample for failing to complete the task. Participants were recruited as in Experiment 5. None had taken part in any previous study.

*Stimuli.* The stimuli were the same as those in Experiment 5.

*Procedure.* The procedure was the same as that in Experiment 5.

### Results and Discussion

There was no difference between the mean numbers of questions (out of three) that girls answered in the PN condition ($M = 2.88$, $SD = 0.35$) and the CN condition ($M = 2.50$, $SD = 0.54$), $F(1, 14) = 2.74$, $p = .12$. Girls' answers to the test questions were coded as in Experiment 1. The agreement between the two coders was 100%.

Our analyses again focused on the mean proportions of trials on which children chose the labeled object only (see the lower panel of Figure 5). A one-way ANOVA involving condition (PN or CN) yielded no significant effect. Girls were no more likely to choose the labeled object in the PN condition ($M = .31$, $SD = .34$) than in the CN condition ($M = .35$, $SD = .44$), $F(1, 14) = 0.05$, $p = .83$.

As in Experiment 5, we could perform no analyses that treated stimulus items as a random factor. However, as in previous experiments, we could classify participants as being consistent labeled-object choosers for selecting the labeled object in response to at least two thirds of the questions they answered. We found no significant difference between the resulting numbers in the two conditions using a Fisher's exact test ($N = 1$ in the PN condition; $N = 2$ in the CN condition). Few girls in either condition showed a consistent tendency to select the labeled object.

Finally, we noted that the 20-month-old girls who failed to choose the labeled object often selected the unlabeled object (PN condition, $M = .36$, $SD = .32$; CN condition, $M = .31$, $SD = .38$) but also often chose both objects simultaneously (PN condition, $M = .33$, $SD = .40$; CN condition, $M = .33$, $SD = .44$).

Girls' failure to differentiate between proper names and count nouns on our modified task at 20 months of age gave us confidence that the procedure used in Experiment 1 did not underestimate their ability to succeed on this type of word extension task. Coupled with the failure of both boys and girls in Experiment 1, this failure provided converging evidence of a change between 20 and 24 months of age in young children's understanding of proper names and count nouns.

## General Discussion

The results of these six experiments provide the first clear evidence that 24-month-old girls and 23-month-old boys can use syntactic cues to distinguish appropriately between proper names and count nouns. These children are 15–19 months younger than the youngest children previously reported in the literature to possess this ability (Liittschwager & Markman, 1993; Sorrentino, 1999). The boys are even younger than those shown to distinguish between the two categories by Macnamara and his colleagues in

their original research (Macnamara, 1982). In addition, we found that just 3 or 4 months earlier, at 20 months of age, neither girls nor boys differentiated between proper names and count nouns. These findings thus suggest that children's ability to distinguish in an appropriate manner between proper names and count nouns emerges during the second half of the 2nd year.

Our results also provide evidence of a further development between 2 and 3 years in children's interpretations of proper names and count nouns. By 24 months, children did distinguish significantly between the two lexical categories, but their tendency to select the labeled object as the referent of a novel proper name was only modest (47% in Experiment 2). However, at 37 months, children not only differentiated between the two categories but also showed a much stronger tendency to select the labeled object as a referent of the proper name (85% in Experiment 3). There was also a similar increase between 2 and 3 years in children's tendency to select the labeled object as the referent of a novel count noun (27% in Experiment 2; 56% in Experiment 3). These changes suggest that between 2 and 3 years, children become increasingly likely to select an object that they know to be a referent for a novel label when asked to extend that label, regardless of the label's lexical category. Such a change may reflect an increase in the efficiency of children's word learning during the 3rd year.

In the original version of our task, used in Experiments 1–4, we found that girls were about 1 year ahead of boys in drawing an appropriate distinction between proper names and count nouns. This 1-year gap is consistent with Macnamara's (1982) findings, in which girls were at least 11 months ahead of boys in differentiating between the two word categories on a similar task. The lag in both studies may reflect the fact (as hypothesized by Macnamara, 1982) that boys simply paid less attention than girls during the task, making them less successful than girls in keeping track of the two objects that looked either similar (in Macnamara's research) or identical (in our research). Our ability to eliminate the gender difference by providing a more elaborate linguistic and nonlinguistic context for learning words (Experiment 5) supports this possibility, because the elaborated context plausibly served to hold attention better than did the context provided in the earlier experiments.

Although we were able to eliminate the gender difference in performance on our task through the use of a modified procedure, we still found a lower limit on the age at which children showed an appropriate differentiation between proper names and count nouns: 23 or 24 months. It is noteworthy that the youngest children who succeeded on our task were about half a year older than the youngest children who did so on Macnamara's (1982) task (i.e., 17-month-olds). What can account for the difference between the studies? One possibility is that this half-year gap represents a difference in the way that 17-month-olds and 23- or 24-month-olds understand proper names and count nouns. Maybe children under 23 or 24 months represent proper names differently than they represent count nouns, but they do not represent them as designating individual objects. Perhaps, for example, they do represent them as designating properties or restricted categories (see Sorrentino, 1999, for discussion of other alternative interpretations). If this possibility is correct, then there would be a discontinuity in lexical–semantic development. Children's first proper names would be represented differently than those of adults or even those of 2-year-olds. These representations then would have to undergo some sort of restructuring (through an as yet unspecified process) prior to yielding the representations of 2-year-olds.

Another possibility, however, is that the difference reflects the fact that our task (even in its modified version) placed undue processing limitations on our youngest boys and girls. Perhaps 17-month-olds do represent proper names as being semantically distinct from count nouns in a way that is continuous with older children's and adults' way of representing them—namely, as marking individual objects. And perhaps our task simply obscured our youngest children's ability to show this understanding because of its complexity—it required them to learn a novel label for an object, to track the object through displacement, and then to point to or retrieve the object, distinguishing it from another identical-looking object. If this possibility is correct, then there would be no discontinuity in lexical–semantic development: Children would represent proper names as designating individuals from their earliest appearance in the lexicon (i.e., at 17 months, or perhaps even younger).

One way to test which of these two possibilities is correct is to turn to other methods for measuring word learning. Recent findings from a study that used a methodology developed for use with infants (i.e., manual habituation) suggest that an appreciation of a semantic difference between novel words modeled syntactically as adjectives or as count nouns may exist soon after the 1st birthday (Waxman, 1999). Perhaps an earlier sensitivity to the appropriate distinction between proper names and count nouns also could be detected through the use of this or another methodology (e.g., preferential looking). We are currently exploring this issue, focusing on children younger than 24 months of age. We expect that this work will shed further light on the nature of children's initial representations of proper names and count nouns and on the emergence of children's grasp of the fundamental conceptual distinction between individuals and categories.

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Received June 5, 2000
Revision received November 27, 2000
Accepted December 15, 2000 ■

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