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Nouns Are Not Always Learned Before Verbs: Evidence From Mandarin Speakers' Early Vocabularies

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This article examines D. Gentner's (1982) claim that nouns are universally predominant in children's early vocabularies. When a conservative method of counting nouns was used, 9 out of 10 22-month-old monolingual Mandarin-speaking children produced more verbs or action words than nouns or object labels in their naturalistic speech. When a more liberal definition of nouns was used, neither a noun nor a verb bias was found. Importantly, there was no difference in the type–token ratios of the children's use of nouns and verbs. Thus, a sampling bias type of explanation cannot explain the prevalence of verbs in these data. Instead, these data suggest the importance of a variety of linguistic and sociocultural input factors in early word learning.

A little more than 10 years ago, Gentner (1982) came up with a set of cognitive and perceptual factors to explain "Why Nouns Are Learned Before Verbs," or at least why they are the predominant category in children's early lexicons. Recently, evidence has begun to accumulate that challenges not only the explanations that Gentner proposed but also the generalization itself—that nouns are learned before verbs. Instead, several authors have presented both individual-difference and cross-linguistic data to show that there are other patterns of lexical acquisition besides the noun-biased pattern that Gentner suggested was a universal in children's early language learning. However, previous attempts to challenge the finding vary in their definitions of "noun" and "verb," thus making comparisons across studies and across languages difficult. Moreover, although several of these studies challenge the finding of a universal noun bias in children's early vocabulary, few studies present clear alternatives to the perceptual and cognitive predispositions that are said to underlie this bias.

It is toward this end that I present a review of the original finding and explanations of the noun bias together with some new vocabulary acquisition data from Mandarin Chinese that contradict the universality of this bias. In addition, to avoid the problems associated with comparisons across various methods for defining and counting instances of nouns and verbs that have occurred throughout this literature, the present article examines various ways of defining these categories for the Mandarin data and the consequences of these definitions. Finally, given that I find no clear evidence of a noun bias for these Mandarin-speaking children, regardless of how the categories *noun* and *verb* are defined, the child-directed speech of these children's caregivers is also examined. Examination of the caregivers' language shows the Mandarin-speaking children's greater use of verbs can be tied to specific features of the adult language. Thus, the present results indicate that both formal features of the language being learned and sociocultural variations in adults' use of that language must be considered in accounts of the "noun bias" and other such biases in children's early word learning.

The Noun Bias

Gentner (1982) is not alone in her claim that children's early vocabularies are predominantly made up of nouns. In fact, supporting evidence for this claim comes from several different endeavours, with English-speaking children and with children speaking a variety of other languages.

In her 1982 paper, Gentner presented data on the early vocabularies of 16 children learning a total of six different languages: English, German, Japanese, Kaluli, Mandarin Chinese, and Turkish. She concluded that

> There is overwhelming agreement among these different languages in the basic pattern that first-word acquisition is concentrated among nominals. The figures range from 50% of the first vocabulary for a Kaluli-speaking child to 85% for an English-speaking child. Moreover, in every case, the proportion of nominals solidly outweighs the proportion of predicate terms. (Gentner, 1982, p. 310)

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Table 1
Data From Gentner (1982)

Language	Age	Total vocabulary	% nominals	% verbals
English	1 yr 4 mo	13	.85	.08
	1 yr 2 mo	**39**	**.69**	**.13**
	1 yr 10 mo	79	.75	.11
	1 yr 7 mo	115	.60	.35
German	1 yr 6 mo	4	.50	.00
	1 yr 8 mo	**33**	**.67**	**.27**
Turkish	1 yr 2 mo	27	.71	.18
	1 yr 4 mo	**42**	**.57**	**.24**
Japanese	2 yr 5 mo	**15**	**.73**	**.13**
	2 yr 0 mo	16	.81	.13
	1 yr 2 mo	19	.68	.26
	1 yr 11 mo	110	.69	.25
Kaluli	1 yr 8 mo	**16**	**.50**	**.31**
	1 yr 11 mo	54	.61	.20
Mandarin	1 yr 5 mo	20	.65	.30
	1 yr 6 mo	**37**	**.59**	**.24**

Note. The children whose data appear in boldface are the subset of children whose vocabularies are examined in detail in Table 2. Adapted from "Why Nouns Are Learned Before Verbs: Linguistic Relativity Versus Natural Partitioning," by D. Gentner, 1982, Table 11.4, p. 311. In S. A. Kuczaj (Ed.), *Language Development: Vol. 2. Language, Thought and Culture.* Copyright 1982 by Lawrence Erlbaum Associates. Adapted with permission.

From these data, which are reproduced in Table 1, Gentner concluded that the noun bias in children's early vocabularies is universal and must therefore be explained by underlying perceptual or cognitive processes that predispose the child to learn nouns. Specifically, Gentner (1982) proposed the *natural partitions* hypothesis and constrasted this with various other hypotheses that relied on nonsemantic features of the input language to explain children's early word learning. Under the natural partitions hypothesis, Gentner placed two assumptions: first, that the distinction between nouns and predicates across languages is based on a preexisting conceptual distinction between "concrete concepts such as persons or things" and "predicative concepts of activity, change-of-state, or causal relations" (p. 301); and second, that "the category corresponding to nouns is, at its core, conceptually simpler and more basic than those corresponding to verbs and other predicates" (pp. 301–302). Gentner further suggested that relational terms are more variable cross-linguistically than object reference terms and that this contributes to the noun advantage in acquisition. An earlier variation on Gentner's natural partitions hypothesis is Nelson's (1974) hypothesis about the preexistence of object concepts. According to Nelson, toddlers already have concepts of objects by the time they begin to learn language, but they do not have similarly well-developed concepts of actions and other relations. Thus, because nouns are easily mapped onto these simpler, preexisting concepts, they are learned first.

Recent research in infant perception and cognition, however, suggests that infants have concepts of movement very early in their development (Mandler, 1992; Spelke, Katz, Purcell, & Ehrlich, 1994) and can even understand the difference between causal and voluntary movement by the time they are 4 months of age (Leslie, 1982). Thus, it is not clear that language-learning toddlers should have any problems with action concepts as opposed to object concepts. Moreover, the fact that infants produce verbs and other relational words among even their earliest words precludes a strong version of this hypothesis.

The semantic organization hypothesis is another cognitive principle that has been used, in part, to explain the noun bias. The semantic organization hypothesis, together with the *whole object constraint* (Markman, 1987, 1989), is an explanation at the interface between children's cognitive and perceptual capabilities and the ways in which these perceptions are represented in the languages of the world. In its various instantiations (see Markman, 1989; Rosch & Mervis, 1975), nouns are said to not only represent objects that are easily extractable into representable wholes, but the meanings of nouns are also claimed to have a "correlated, hierarchically organized structure" (Goldfield, 1993, p. 86). Verbs, on the other hand, not only represent many different aspects of the perceptual field, but the relational features of a percept are also integrated and represented in different ways across different languages (Gentner, 1982). Thus, verbs are said to have more matrixlike semantic structures with "multiple organizing principles" (Goldfield, 1993, p. 86; cf. Talmy, 1985) that make them more error-prone and difficult to learn.

Both of these perceptual–cognitive hypotheses take the connection between nouns and objects as their basic assumption. Whether or not researchers who find evidence of a "noun bias" have data that conform to this assumption, however, is a rather sticky issue (see, for example, the arguments raised by Bloom, Tinker, & Margulis, 1993; Nelson, Hampson, & Kessler Shaw, 1993). In the present article, I argue that examinations of children's productions of concrete common nouns are the most appropriate data for examining the hypothesized links between object concepts and the nouns that represent them. Inclusion of abstract nouns, proper names, or kinship terms in the "noun" category occlude this relationship.

Variations in the Noun Bias

Despite the prevalence of a noun bias in children's early productive vocabularies, there are findings that suggest the bias may not be universal, even in English. Moreover, several factors have been found to influence the extent of this bias.

Noun Bias in First Words or During the Vocabulary Spurt?

To begin, there is the issue of when the bias occurs and whether it is a bias in children's first words or a bias at the time their vocabulary goes through a period of rapid growth. In Gentner's (1982) article, she not only claimed that nouns were the most numerous category in children's early vocabularies, but also that nouns are learned earlier than verbs. However, at least one set of evidence suggests that nouns are not necessarily the earliest words to be learned, even by English-speaking children. A longitudinal study done by Gopnik (1981) examined the lexical productions of 9 English-speaking children, 5 of whom had no productive words at the beginning of the study

period. Contrary to Gentner's claims, not only did all children in Gopnik's (1981) study use nonnominal expressions in even their earliest recordings, but these nonnominal expressions were also used more frequently than nominals, and some children acquired nonnominal words before they acquired nominals. Thus, although many English-speaking children may learn nouns as their first words, this is not true of all children.

If nouns are not the earliest words to be learned, then perhaps they are still the building blocks of a basic vocabulary, upon which later syntactic structures can be built once enough items have been added to the vocabulary. Evidence on the vocabulary spurt in English suggests that it may more aptly be called the *naming spurt* because it is almost entirely accounted for by the addition of nouns (Bates et al., 1994; Goldfield & Reznick, 1990). However, recent evidence from Korea suggests that the addition of nouns may not be responsible for vocabulary spurts cross-linguistically. In a study of 9 Korean-speaking children's early lexical development, Choi and Gopnik (in press) found that the majority of Korean-speaking children in their study had a period of rapid vocabulary growth that could be best classified as a *verbing spurt* rather than the naming spurt discussed by Goldfield and Reznick (1990). Moreover, for those children who showed both a verb spurt and a noun spurt, the rapid increase in verbs actually preceded the rapid increase in nouns. Choi and Gopnik's data, therefore, suggest that both verbs and nouns are important categories in Korean-speaking children's early vocabularies.

Individual Differences in Referentiality

Yet another variation in the extent of children's noun bias was initially brought out in Nelson's (1973) monograph on individual differences in children's early language learning strategies. Nelson found that the children in her study fell into two distinct groups of language learners—*referential* and *expressive*—as defined by the kinds of words that appeared in the first 50 words that they learned. Overall, the children in Nelson's study had a mean of 48% common nouns in their first 50 words, but the proportions for individual children varied widely. The children who were characterized as referential had a mean of 60% common noun types, whereas the expressive children had a mean of 33% common nouns. However, even the expressive children had more common nouns in their 50-word vocabularies than any other class of words.

Socioeconomic Status and Birth Order Effects

Another relevant finding is that the proportion of nouns in children's lexicons appears to vary as a function of children's birth order and the socioeconomic status (SES) of their parents (Bates et al., 1994; Hoff-Ginsberg, 1993; Lieven, Pine, & Dresner Barnes, 1992). Specifically, lower SES children in Lieven et al.'s study had a lower percentage of nouns (33%) in their first 50-word vocabularies than did middle SES children (40% nouns) reported by Pine (1990), although it is not clear if these differences were significant. Hoff-Ginsberg (1993) examined children's production of object labels in a sample of 63 children who were relatively equally distributed across firstborns and later-borns in two SES groups. In Hoff-Ginsberg's data, the 21-month-old firstborn children of college-educated mothers had the highest proportion of object labels in their vocabularies (33%), followed by the firstborn children of high-school educated mothers (27%), then later-born children of college-educated (23%) and high-school-educated (21%) mothers. An analysis of variance performed on these data revealed significant main effects both for the children's birth order and for maternal education with no interactions between the variables, although the significance of the differences between the individual means was not reported. Thus, sociocultural factors such as the demographics of the children and families who are recorded appear to have an effect on the noun bias even for English speakers. However, even though the proportions of nouns and verbs have been found to vary with the age, overall vocabulary size, social class, and birth order of the children being studied, a noun bias still appears to be the predominant pattern for learners of English.

Methodological Issues Obscuring the Presence and Extent of a Noun Bias

Definitions of Noun *and* Verb

In addition to variations in the extent of the noun bias across children within a specific sample, there is the more basic question of what gets defined as a *noun* (or *verb*) and whether or not the categories *noun* and *verb* are the most appropriate categories to measure in children's early vocabularies. Reports of a noun bias have been criticized by some researchers (e.g., Bloom et al., 1993; Lieven et al., 1992; Nelson et al., 1993; Tomasello, 1992) because the nominal category itself was defined too broadly, containing not only concrete common nouns, upon which the perceptual–cognitive predispositions arguments were based, but also proper names and sometimes even abstract nouns, which have no clear object reference. Inclusion of these additional types of words makes it much more difficult to justify the argument that nouns map simply and directly onto objects but that verbs have a more complex mapping onto actions. There are many reasons why these various types of nominals should not be grouped together. I will state two of these reasons below but also suggest that even if these other categories are included together in a larger category of nominals, one still finds evidence for a clear noun bias in English but would not find it in Mandarin.

On semantic grounds, common nouns and names refer to different types of "things" in the world, and there is plenty of evidence to demonstrate that children can distinguish between people and objects well before their first birthday (Ellsworth, Muir, & Hains, 1993; Frye, Rawling, Moore, & Myers, 1983; Legerstee, 1991). Moreover, children extend these perceptual and affective distinctions to novel *names* and *nouns* and apply these terms differentially to different categories of *things* in controlled laboratory settings (Gelman & Taylor, 1984; Katz, Baker, & Macnamara, 1974). Thus, it is not appropriate to simply group common nouns and names together in the same category on the assumption that children do not distinguish among the two types of labels.

Table 2
A Modified Count of Nouns and Verbs From Gentner (1982)

Language	Total vocabulary	% proper nouns	% common nouns	% main verbs
English	39	.10	.59	.08
German	33	.12	.55	.24
Turkish	42	.17	.40	.24
Japanese	15	.27	.47	.13
Kaluli	16	.44	.06	.25
Mandarin	37	.24	.35	.14

Note. Adapted from "Why Nouns Are Learned Before Verbs: Linguistic Relativity Versus Natural Partitioning," by D. Gentner, 1982, Table 11.5, pp. 312–314. In S. A. Kuczaj (Ed.), *Language Development: Vol. 2. Language, Thought and Culture.* Copyright 1982 by Lawrence Erlbaum Associates. Adapted with permission.

Nouns and names also have different pragmatic roles across various sociolinguistic groups. As discussed by Erbaugh (1992) for Mandarin, and by Schieffelin (1990) for Kaluli, names and kinship terms are very important in the sociolinguistic contexts in which children in some cultures grow up, whereas they appear to be less important in other cultures. Conversely, in middle-class English-speaking families, object labels are accorded great importance. English-speaking parents use various methods to facilitate the acquisition of object labels, including the "Naming Game," which involves long sequences of questions designed to elicit object labels from their children (Hoff-Ginsberg, 1993; Nelson et al., 1993; Ratner & Bruner, 1978). In some cultures, then, parents are focused on eliciting person names not as labels, but as appropriate greeting behavior. In other cultures, parents are focused on eliciting object names as labels for their own sake. Again, there is no reason to assume that the processes would be similar for both types of elicitations.

Thus, to evaluate Gentner's (1982) claims about nouns mapping onto the perceptual category *object,* I reexamined her data for the proportion of concrete common nouns that appeared in children's early vocabularies. Looking at the 6 children for whom Gentner presented detailed data, as shown in Table 2, one finds that common nouns occupy anywhere from 6% to 59% of the children's vocabulary items. This is quite different from Gentner's analyses, in which both common and proper nouns were included, resulting in her finding of 50% to 85% nominals in the children's vocabularies. Nonetheless, common nouns are still the most prevalent category for 5 of the 6 children. However, for the Kaluli-speaking child, proper names are most numerous, followed closely by main verbs, with only one common noun in this child's 16-word vocabulary. Overall, then, it appears that Gentner's data can still be used to support the claim that common nouns are the most numerous category in the early vocabularies of many children learning many different languages, but not the claim that common nouns universally predominate children's early vocabularies.

Methods for Sampling Vocabulary Items

Yet another major point of contention has to do with how the vocabulary data are sampled. In Gentner's (1982) report, a variety of data collection methods were used. Most studies, however, rely primarily on one of two methods for collecting vocabulary data: maternal report or naturalistic observation. An example of the type of problem that exists when one uses only one type of data is the current debate over whether Korean-speaking children are more verb-biased or noun-biased in their early vocabularies. As mentioned earlier, studies by Choi and Gopnik (in press; Gopnik & Choi, 1990, 1995) suggest that Korean-speaking children may have more verbs than nouns in their early vocabularies. However, in a different sample of 4 Korean-speaking children, Au, Dapretto, and Song (1994) reported that Korean-speaking children, like English-speaking children, have more nouns than verbs in their early vocabularies. One of the major differences between the two studies is the way in which the children's vocabulary data were collected. The Au et al. data are based solely on mothers' reports of children's vocabulary use. The instrument used was an adaption of the MacArthur Communicative Development Inventory (CDI), originally developed in English by Bates and her colleagues (see Bates, Bretherton, & Snyder, 1988; Fenson at al., 1994). In contrast, Choi and Gopnik asked mothers to keep diaries of all the words that children added to their vocabularies as well as making regular recordings of the children's speech.

If mothers were accurate observers and recorders of their children's language use, and if children were consistent in the proportions of nouns, verbs, and other categories of words that they used across situations, then both ways of measuring children's vocabularies would be equally valid. However, mothers are not completely unbiased observers (see Pine, 1992; Pine, Lieven, & Rowland, in press), and neither children nor adults demonstrate perfect consistency of language use across situations (see Goldfield, 1993; Tardif, Gelman, & Xu, 1996). Thus, each measure, when used in isolation, is likely to be biased. The important question is whether parental report and naturalistic recordings are biased in different ways. The answer appears to be yes. That is, parental reports appear to be biased toward an overreporting of common nouns (Pine, 1992; Pine et al., in press). However, it also appears that "common nouns may be systematically under-used in children's speech" (Pine, 1992, p. 84). That is, even though they may have many common nouns in their repertoire, children may use only a few of these at any given time, whereas they would be more likely to use the verbs that they know, regardless of the situation in which their language use is examined.

One way of operationalizing this point is to examine the type–token ratio for nouns and verbs in adult and child speech.[1] Comparisons of the type–token ratios for adult speech, whether it is child-directed or not, have consistently found individual verbs to be used with greater frequencies than individual nouns (Johansson & Hofland, 1989; Miller, 1951; Tardif, Shatz, & Naigles, 1996). In one example, Miller (1951, p. 94) reported data from a study of English telephone conversations (French, Carter, & Koenig, 1930) with a type–token ratio of 0.086 for nouns (i.e., each noun was used an average of 11.6 times) and

[1] I thank Philip Dale (personal communication, November 15, 1994) for his comments and references on this issue.

0.036 for verbs (i.e., each verb was used an average of 27.8 times). If similar results are found with children's productions of nouns and verbs, then one could make a strong case for the problem of oversampling verbs in naturalistic speech samples that are not of sufficient length to allow children enough opportunities to use the nouns that they know.

The impact of this issue in the current context, however, is hard to evaluate. First, the argument hinges on the existence of different type–token ratios for nouns and verbs in very young children's word use. Even though it is known that English-speaking adults use verbs with a higher frequency than they use nouns, it is not known whether their language-learning toddlers are similar in this respect. This is an empirical question that is addressed in the present article for Mandarin-speaking caregivers and their children.

Second, the decision to choose one method over another (if that is the decision to be made) should depend on two factors: the theoretical question to be addressed and the availability of an appropriate form of maternal report. If one is interested in describing children's language use, then naturalistic production data are clearly preferred. If one is interested in a cumulative list of all the different items a child is able to use at a given point in his or her development, then maternal report would be more useful provided that this reporting was demonstrably unbiased.

Although the CDI does have some potential for bias, it is superior to simply asking mothers to recall and list all the items that their child can say (Pine, 1992). One reason that the CDI is so useful is that it has gone through extensive norming, reliability, and validity testing (see Bates et al., 1994; Dale, Bates, Reznick, & Morisset, 1989; Fenson et al., 1994). However, the reliability and norming was done for the English version of the instrument and is still under way for many of the languages in which versions of the CDI now exist. Simple translations and adaptations of the instrument into a new language do not retain the benefits associated with the English version of the CDI. Currently, adequately tested versions of the CDI do not exist for either Mandarin or Korean. Thus, until the appropriate reliability and validity testing have occurred, maternal diaries and naturalistic recordings are more appropriate methods for examining early vocabulary use in Mandarin. In my Mandarin-speaking sample from Beijing, China, the fact that caregiving is shared across a number of adults and older children, not all of whom are literate, means that maternal diaries would also not be very useful for measuring children's early vocabularies. Thus, the present study examined children's vocabulary use in naturalistic recordings of their ongoing speech.

However, regardless of whether maternal report or production data have been collected, the noun bias has been observed for all measurement methods with English-speaking children. Even though the extent to which a child's vocabulary is noun-biased has been shown to vary in English, the existence of a noun bias is robust. There is no reason to expect, a priori, that the same robustness would not be found for Mandarin or Korean.

Existing Data for Mandarin Chinese

There is little research on children's early vocabulary development in Mandarin. Thus far, our knowledge of Mandarin-speaking children's vocabulary development is based on a total of 8 children at varying ages and levels of linguistic ability (in Chen & Xu, 1991; Erbaugh, 1982; Wu & Xu, 1979/1980; Yuan, 1977). Of these, detailed data have been presented for only 4 children (Chen & Xu, 1991; Erbaugh, as cited in Gentner, 1982; Wu & Xu, 1979/1980). Nonetheless, in her review of Mandarin acquisition, Erbaugh (1992, p. 402) claimed that Mandarin-speaking children show "the same early predominance of nouns [as] appears crosslinguistically in English, Turkish, Japanese, and Kaluli." However, an initial analysis of the present dataset (Tardif, 1993) suggested that Mandarin-speaking children may not in fact show such a predominance of nouns in their early vocabularies.

In the present study, a sample of 10 children were recorded in naturalistic interaction with their caregivers. Both the age of the children and the sampling of naturalistic speech were designed to be comparable to a study of English-speaking children for which a noun bias was found (Hoff-Ginsberg, 1990, 1993). Unlike previous studies of Mandarin-speaking children's early language development, the present study also included families from two social class backgrounds: *workers* and *intellectuals* (see Tardif, 1993, for a more detailed discussion of these two groups).

Moreover, given that previous challenges to Gentner's (1982) generalization have involved redefinitions of the categories *noun* and *verb*, with little comparison of the consequences these definitions have for any one set of data, several methods of defining nouns and verbs are applied to the present data. In so doing, I include not only a more restricted definition of nominal, as outlined above, but also the more inclusive definition used by Gentner (1982).

The ways in which nouns and verbs are counted in the present article include common nouns versus main verbs; object labels versus action words; and sentential nominals versus sentential predicates. The first two methods have both conservative and more liberal definitions of the category *noun* and *object label*, which differentially exclude or include proper names. As mentioned earlier, to make a strong case for the "nouns map onto objects" argument, only the conservative counts should be examined. To maintain comparability across studies, however, I also conducted more liberal counts of nouns. The final method, constrasting sentential nominals with sentential predicates, counted a word as a nominal as long as it was the head of a noun phrase in a multiword utterance. Similarly, a word was counted as a predicate if it was the head of a predicative phrase. This latter, more syntactically oriented count, was conducted to exclude the possibility that it is just the relatively free ellipsis of nouns in Mandarin that accounts for the Mandarin-speaking children's high number of verbs in their early vocabularies.

Naturally, changing these category definitions should cause the results to vary, but the primary question is, by how much? In English, regardless of the definitions or the method of sampling, nouns predominate in the vocabularies of most children. In Mandarin, I will show that this is not the case.

Method

Participants

Ten children and their families were selected from immunization records at three local hospitals in Beijing, China. The selection criteria

were as follows: (a) The children were 20 to 22 months of age at the beginning of the study; (b) their parents were native speakers of Mandarin (rather than some other dialect) and, preferably, native to the city of Beijing; and (c) both parents had received formal schooling that was either high school level or below (for the workers group) or college level or above (for the intellectuals group). All of the children were firstborn and only children—a necessary consequence of China's one-child policy.

An effort was also made to equate both the age and the gender distribution of the participants in the two social class groups. Thus, each group had a total of 5 children (4 male and 1 female), and the average age of the two groups differed by only 3 days. Overall, the children's mean age was 21 months 24 days at the time of the speech sample used in the present analyses. Note that this is not the first, nor is it the only, recording of these children's and caregivers' interactions. Rather, the data presented in this article were collected on the second or third visit[2] that I made to the children's homes and is but one visit from a larger set of 12–14-hr-long visits spaced across 5 months that were conducted with each family.

Procedure

I, as a nonnative but fluent speaker of Mandarin, conducted all the visits. On at least the first two visits to each family, a native Beijing research assistant also came along. Each visit was scheduled at the convenience of the child's family, with the only stipulations being that the visits were to be spaced about 2 weeks apart (for the larger study) and that the family was asked to do whatever they normally did at that time of day. The activities that the families participated in varied dramatically but included the range of activities that one would consider "normal" for a 2-year-old child and his or her caregiver(s): indoor toy play, watching television, cleaning up, feeding, talking to and playing with neighbors, and even a trip to a local amusement park. In all cases, the researcher asked the families not to interact with her during the recording time and to try to ignore her presence as she stayed off to the side taking notes on the context of the interactions. In practice, interactions between the researcher and the family frequently occurred.

Visits were audiotaped with a Sony Walkman-type tape recorder that the child's main caregiver (not always the mother) for that particular day wore in a fanny pouch with a tie-clip microphone attached to his or her clothes. In addition, each child wore a wireless microphone and carried a transmitter in a small backpack that was worn throughout the visit.

Transcribing

The tapes from each visit were first transcribed into the pinyin system of romanized Chinese spelling by trained undergraduate and graduate students from one of three Beijing universities. The transcribers were asked to write down the words and to pay close attention to the speaker and intended listener for an utterance as well as utterance boundaries, changes in loudness, and any errors, mispronunciations, or dialect words that occurred. After initial transcription, the researcher listened to the tapes and entered the data into the computer for analysis. Disagreements between the researcher and the student transcribers were resolved by playing the segment to at least one other native Chinese speaker and entering the form that was agreed on by at least two of the listeners. If no agreement could be reached, the segment was deemed uninterpretable.

Coding

Because Mandarin has such a high number of single-syllable words, it also has a high proportion of homonyms. Thus, rather than simply being able to count words as they appeared in the transcripts, it was necessary to code every single word as it appeared in an utterance. To do this, I created a computer program, LEX4000 (Tardif & Tan, 1993), that could be used interactively to code words according to their parts of speech. Once coded, the number of vocabulary types (individual words) and tokens (the number of times each word appeared) were counted for the various ways of defining nouns and verbs, as described below. Any utterances or parts of utterances that were not wholly productive were not counted. Thus, words that were partial or complete repetitions or that appeared in a segment of quoted speech such as a song or poem do not appear in the following analyses.

Nouns and verbs. Two methods of counting nouns and verbs were used in the analyses. The first considered only common nouns and main verbs, as defined by Chao (1968) and further described in Tardif (1993). As I argued earlier, this strict definition of the formal categories *noun* and *verb* is the most meaningful for descriptions of children's early noun and verb vocabularies. However, to compare these data to Gentner's (1982) data, I also used a second method. In the second method of counting, *nouns* included not just common nouns (regardless of whether they were concrete or abstract) but also proper names. For *verbs*, in addition to the category *main verbs*, qualitative verbs (e.g., *xi3huan1*, "to like"), classificatory verbs (e.g., *xing4*, "to be surnamed"), the copula *shi4*, and the "to have" verb *you3* were also included. These verb types have most of the properties of main verbs and are generally classified as verbs in child language research in other languages, even though they are not included in Chao's (1968) strict classification of main verbs in Chinese. Note that the latter definition of verbs does not go beyond the verb class and thus excludes adjectives, adverbs, and other predicative terms.

Object labels and action words. In keeping with previous arguments about the mapping of objects onto nouns and actions onto verbs, I used a second set of categories in which only nominals that labeled concrete, single objects and verbs that referred to readily observable actions were tabulated. This counting method did not include nouns that labeled actions or overlapped with action words (e.g., a dance), nor did it include verbs that overlapped with nouns or were not readily observable and identifiable by a single set of actions (e.g., to help, to think). As with nouns and verbs above, both a conservative and a more liberal method of defining object labels were used. For the conservative method, proper names were not counted because of the semantic and sociolinguistic differences outlined earlier. The more liberal method, however, included proper names that referred to persons or other individuated referents (cf. Gentner, 1995). Thus, the more liberal definition of *object* included words like *ma1ma* ("mommy") but not words like *Bei3jing1* ("Beijing"). *Bei3jing1* was not included because it referred to the entire city and was too large to be considered an individuated object in the child's immediate environment.

Counting nominals and predicates. Finally, a third counting method was used in which only sentential nominals and predicates were considered. This final method was used to determine whether it was just the "pro-drop" feature of Mandarin syntax (Huang, 1989) that was responsible for the increased use of verbs found in Tardif (1993). Specifically, Mandarin-speaking children may produce more verbs than

[2] The first visit was an informal interview during which the researcher and a native Beijing research assistant reminded the family of the purposes of the study, demonstrated the recording equipment, and generally became acquainted. This was done to ensure that the families would not be greatly disturbed by the researcher's presence, as this type of study is rare in China. Recording and transcribing of visits did not start until the researcher was confident that the families were sufficiently comfortable with her presence and the situation to approximate a "natural" interaction.

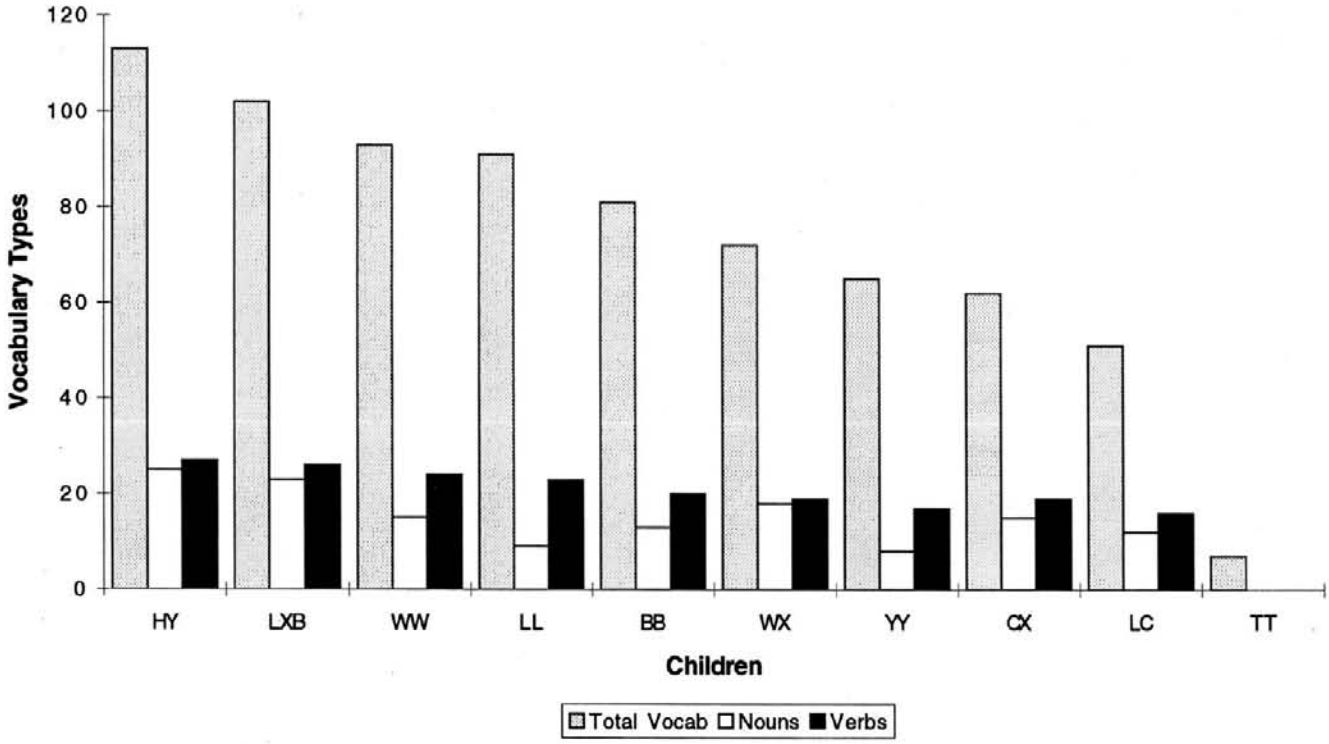

Figure 1. Individual children's vocabulary types, by category, in decreasing order of vocabulary size (listed by the children's initials).

nouns for the simple reason that they are already tuning into the fact that Mandarin, like Korean, allows relatively free ellipsis of nominal elements. If this were the case, then one would expect the largest difference between nouns and verbs to occur in this method of counting.

For this final method of counting, a word had to occur in the context of a multiword utterance with an identifiable predicate or nominal in order to be codable. Included in *nominals* were common nouns, proper names, pronouns, and "this" and "that" when used pronominally rather than as specifiers for a noun. Included in the *predicate* category were all of the verb categories listed above plus stative verbs (e.g., *bing4 le,* "to be sick") and adjectives (e.g., *hong2 le,* "to be/turn red") that were used as full predicates. Auxiliary verbs, negatives, adverbs, aspect markers, and resultative verb complements were not included in this count.

Results

Excluding interjections and nonreferential onomatopoeia, the children in this sample produced a mean of 73.7 (*SD* = 30.28) wholly productive vocabulary types and 338.0 (*SD* = 251.77) vocabulary tokens in the 1-hr speech sample for which the following data were analyzed. A mean of 259.3 (*SD* = 175.1) utterances (range = 64 to 699 utterances) were produced by each child. Individual children varied quite a bit both in their overall vocabulary size and in their syntactic development. Moreover, children of intellectuals produced more words than children of workers, as reported in Tardif (1993). Nonetheless, the pattern of findings were consistent across the entire range of language abilities found within this sample, with no evidence for systematic biases as a function of social class, overall vocabulary size, or the mean length of utterances.

Nouns and Verbs: Vocabulary Types and Tokens

Regardless of whether one uses a conservative or a more liberal definition of the formal categories *noun* and *verb,* the Mandarin-speaking children in this sample use more verbs, not nouns, in their early productive vocabularies. Moreover, this greater use of verbs is neither tied to repetitive uses of a small number of verbs (as the following type–token ratios show), nor is it tied to a particular level of vocabulary development. This is demonstrated in Figure 1, which presents noun and verb types together with the total vocabulary types produced by each of the 10 children.

Not surprisingly, how one defines noun and verb does have implications for the extent of this difference, as can be seen from the summary of results across the various analysis methods presented in Table 3.

For the conservative definition of noun and verb, including only common nouns and main verbs, all of the children who produced any common nouns or main verbs in their productive vocabularies produced more main verb types than common noun types. As can be seen from Table 3, both the type and token means show significantly more verbs than common nouns in these children's early vocabularies.

For the more liberal definition of noun and verb, in which

Table 3
Summary of Analyses and Results With Means and Number of Children Who Demonstrate a Bias for Each Category

	Types			Tokens		
Counting method	*M*	*SD*	*n* biased	*M*	*SD*	*n* biased
Nouns and verbs						
Common nouns	13.8	7.3	0	67.1	72.5	1
Main verbs	19.1**	7.7	9††	88.2**	80.4	8†
Common nouns + names	19.0	8.4	2	98.3	69.8	6
All verbs	20.6	8.2	8†	95.3	86.5	4
Objects and actions						
Object labels	13.0	7.1	0	63.6	72.3	1
Action words	17.4*	7.1	9††	81.6**	77.6	8†
Object + people labels	18.2	8.3	4	94.9	69.5	7
Action words	17.4	7.1	3	81.6	77.6	3
Nominals and predicates						
Nominals	18.8	9.0	5	90.9	75.9	7
Predicates	19.7	10.4	5	67.4	51.9	3

* $p < .01$, paired $t(9)$, two-tailed. ** $p < .005$, paired $t(9)$, two-tailed. † $p < .10$, two-tailed sign test for matched pairs. †† $p < .05$, two-tailed sign test for matched pairs.

proper names were included in the noun category and all verb types were included in the verb category, these children still showed a trend toward producing more verb types than noun types, but the differences were no longer statistically significant. The token data for this more liberal definition of noun and verb appear to reveal that there is no bias in either direction. Roughly half of the children produced more verb than noun tokens, whereas the other half produced more noun than verb tokens.

What is interesting about this is that one might have expected the opposite. That is, if it is true that children's production data are biased against nouns because children use a small number of verbs highly frequently (i.e., low type–token ratios), then one would have expected the difference between verbs and nouns to appear more strongly in the token data than in the type data. This, as just demonstrated, was not the case. Thus, it was not just the "overuse" of a small number of verbs and missed sampling of infrequent nouns that was responsible for the greater use of verbs by these Mandarin-speaking children.

In fact, if one examines the type–token ratios for main verbs and common nouns in the children's productive utterances, one will find that they were roughly equal. The mean type–token ratio for verbs was .327 (SD = .062). For nouns it was .282 (SD = .085), with no significant differences between these ratios. Only 3 of the 10 children followed the expected pattern of having higher type–token ratios for nouns than for verbs. The other 6 children who produced nouns and verbs had slightly higher type–token ratios for verbs. Neither the type–token ratios nor the children's overall vocabulary size varied systematically as a function of the number of utterances that were sampled. Thus, one could not argue that the children used more verbs simply because of unequal type–token ratios that favored the sampling of verbs in these 1-hr samples of productive speech.

Instead, the type–token ratios varied as a function of the children's overall linguistic development. The 3 children for whom the type–token ratio for nouns slightly exceeded that for verbs were the 3 children with the largest productive vocabularies. Moreover, the mean length of utterance of the 2 children for whom the difference was relatively large were among the top 3 in the sample at this 22-month visit. Thus, it was the linguistically more advanced children to whom an oversampling argument could apply and not the children who were at an earlier (and, according to Gentner, 1982, and others, even more noun-biased) phase of language learning.

This result is particularly interesting when the adult-to-child type–token ratios for these children's caregivers are taken into account. The Mandarin-speaking caregivers of all these children show much higher type–token ratios for nouns (M = 0.265, SD = 0.071) than for verbs (M = 0.148, SD = 0.020), paired $t(9) = 9.16$, $p < .001$. Thus, the children's greater use of verbs cannot be dismissed by a difference in the probability of occurrence of verbs relative to nouns, even though such an argument could be applied to their caregivers.

Object Labels and Action Words

As with nouns and verbs, two methods were used for calculating the number of object labels and action words in children's early vocabularies. For the first method, only concrete common objects and main verbs that referred unambiguously to actions visible in the immediate context were considered. Again, with a narrow definition of *objects* and *actions*, all of the children who produced any object or action words produced more action words than object labels. Again, the means for both action word types and tokens were significantly higher than those for object labels. Notice, though, that these means are only slightly below the common noun and main verb means, suggesting that, in fact, almost all of the common nouns and main verbs in these

children's early vocabularies did refer to concrete objects and readily observable actions.

When one looks at the more liberal way of defining *objects* and extends this category to include not only concrete common nouns but also proper names that refer to people and other readily identifiable individuals in the child's immediate environment, a different story begins to emerge. Instead of showing a clear preference for action words, the children in this sample appeared to be relatively equally distributed with respect to whether they used action words or object labels more frequently. The differences between the means were not significant for either types or tokens in this extended count of object labels, thus providing no evidence for either a noun or a verb bias. The fact that such a high number of person words were used by these children is not surprising given the contexts in which they were reared (with multiple caregivers and interactants present during most of their waking hours) and the sociocultural emphasis on addressing each person in their immediate environment with appropriate kinship terms. What is surprising is that even by including person words, these Mandarin-speaking children still did not show evidence of a noun bias.

Nominal Place Holders and Predicates

For the final method of counting, no clear preference for either nominals or predicates was shown. Specifically, in utterances that were two or more morphemes in length and showed a clear nominal and/or predicate term, neither the type nor token means differed significantly. If it were true that Mandarin's allowance of dropped nominals was solely responsible for these children's production of more verbs than nouns, then one would expect there to be an even larger difference in the number of nominal and predicate terms. However, even with an extended definition of nominals that included not only common and proper nouns, but also personal and deictic pronouns, this was not found. Thus, it does not appear that these children produced more verbs simply because the grammar of Mandarin allowed them to delete nominals (which it does), but rather because verbs were somehow more salient in the input and thus more likely to be included in their early productive vocabularies.

Discussion

These data provide clear evidence that whether one considers the category *nominal* and *predicate, noun* and *verb,* or *object label* and *action word* to be the most relevant distinction, children's early vocabularies are not always disproportionately filled with common nouns. Instead, verbs made up the largest class for the majority of the Mandarin-speaking children in this sample. Even by extending the categories of noun and object label to include proper names, there was still no evidence for a noun bias in these children's early vocabularies.

Thus, we can conclude that nouns are not the universally predominant category in children's early vocabularies. Common nouns are, in fact, the most numerous category for most children learning English, but verbs are the most numerous category for most early Mandarin speakers. One might argue, given the evidence for developmental and stylistic differences in the extent to which children are noun-biased (cf. Bates et al., 1994), that I may have sampled these children at the wrong time for a noun bias to occur (i.e., when their vocabularies were between 100 and 400 words) but that Mandarin-speaking children are still noun-biased in general. While I would not dismiss the possibility of variability in the proportions of the children's vocabularies that are taken up by nouns and verbs as a function of vocabulary size, the basic finding remains that regardless of the definition of noun and verb, many of these Mandarin-speaking children produced more verbs than nouns at some point in their vocabulary development. When only main verbs and common nouns were examined, all of the children who had any productive common nouns and main verbs used more main verbs than common nouns at 22 months of age. There is no time at which English-speaking children use more verbs than nouns. English-speaking children may not always be noun-biased, as Nelson (1973) and others (e.g., Bloom et al., 1993; Lieven et al., 1992) have pointed out, but if they vary from a noun-biased pattern, it is not by producing more verbs.

Moreover, these Mandarin-speaking children produced more verb types and not just more verb tokens. Thus, the failure to find a noun bias in this sample cannot be explained by a simple difference in the frequency of noun and verb tokens, as demonstrated by the lack of a difference for the type–token ratios in these children's speech samples. Nor could it be explained from the syntax of Mandarin alone, although it is certainly possible that the syntax may contribute to such a bias.

The general conclusion that these data allow, then, is that the presence of nouns (or verbs!) in children's early vocabularies cannot be explained solely in terms of universal cognitive predispositions toward learning a particular vocabulary type. Thus, although Gentner (1982) rejected the role of input in favor of perceptual–cognitive biases, the present data suggest it is necessary to reexamine the role of input and other types of cognitive processes that act in more general ways to account for word learning (see, for example, the discussion of relevance in Bloom et al., 1993).

Characteristics of the Input Language

If input is responsible for these Mandarin-speaking children's greater use of more verbs as opposed to nouns, what might the relevant factors be? Instead of providing an exhaustive list of possible features, I would like to reconsider four characteristics that have been addressed by Gentner (1982) and others. These are frequency, perceptual salience, morphological simplicity, and interactional qualities of the language learning game (cf. Wittgenstein, 1958).

Frequency. Frequency of a lexical item or class of items in the input language and the likelihood of its appearance in the child's vocabulary must be one of the most straightforward and obvious input effects to examine. Or is it? Gentner (1982) examined and then discarded the possibility of a frequency account for the preponderance of nouns in children's early vocabularies. However, in an examination of the frequency of lexical items in parents' speech to children, Huttenlocher and colleagues (Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991)

Table 4
Comparative Data on Nouns and Verbs in Caregiver Speech

Study	Language	Verbs		Nouns	
		Types	Tokens	Types	Tokens
		Frequency per 100 utterances			
Furrow, Nelson, and Benedict (1979)[a]					
18 months	English	N/A	86.9	N/A	72.9
27 months		N/A	83.6	N/A	52.3
Choi and Gopnick (1993)[b]					
18 months	English	23.9	52.6	24.7	47.5
18 months	Korean	19.3	62.5	11.4	32.7
Tardif (1993)[c]					
22 months	Mandarin	12.8	87.6	8.8	32.6
26 months		13.9	85.8	11.1	37.3
		Frequency per minute			
Goldfield (1993)[d]					
12 months					
Toy play	English	2.17	6.53	2.34	7.01
Nontoy play		2.90	7.05	1.82	4.50
Tardif (1993)[e]					
22 months	Mandarin	1.50	10.40	1.23	6.65
26 months		1.73	10.83	1.60	6.62

[a] Frequencies are measured in tokens per 100 utterances of child-directed speech in a naturalistic setting, averaged over 7 caregiver–child dyads when the children were 18 and 27 months old. [b] Types and tokens per 100 utterances of child-directed speech in a naturalistic house-play setting with 20 English-speaking and 15 Korean-speaking caregivers talking to their 18-month-old children. [c] Frequencies per hour are converted to types and tokens per 100 utterances, averaged over 10 Mandarin-speaking families when the children were 22- and 26-months-old. [d] Frequencies are measured in types and tokens per minute for 11 mothers of 12-month-olds talking to their children in a 12-min toy play and a 5-min nontoy play interaction in their own homes. Note also that the verb token frequencies do not include the copula, which was also not included in my analyses for Mandarin. Note also that Goldfield's *noun* category contains both common nouns and proper names. [e] Frequencies per hour converted to type and token frequencies per minute. In addition, I have added proper names to my *noun* category for comparison with Goldfield's (1993) data.

found that children's time of acquiring any particular word bore a direct relation to the frequency of that word in their mothers' speech. Thus, for individual words, frequency does make a difference.

What about for classes of words? Gentner (1982), drawing from the Kucera and Francis (1967) norms, initially ruled out the possibility that children could be learning more nouns from their parents' overall frequency of nouns. However, the present data suggest that the frequency with which a word class appears in parents' speech may in fact be partly responsible for differences in the prevalence of that category in cross-linguistic examinations of early word learning. In particular, it may be that Mandarin-speaking children's early vocabularies include a high proportion of verbs because the number of verbs is clearly disproportionate to the number of nouns that they hear.

As reported by Tardif (1993), adult-to-child speech in this Mandarin sample contained even more verbs than the children's speech. As we can see from Table 4, English-speaking caregivers show an inconsistent pattern of more noun types than verb types but more verb tokens than noun tokens with variations across contexts (Goldfield, 1993). In contrast, Korean- and Mandarin-speaking caregivers consistently produce more verb types and verb tokens, with roughly twice as many verb tokens as noun tokens (Choi & Gopnik, 1993; Tardif, 1993). Thus, the higher frequency of verbs in the Mandarin input may serve to counteract whatever conceptual biases the children may have brought to the task of learning new words. Nonetheless, if frequency alone was responsible, one would expect English-speaking children to be less noun-biased than they are.

Sentence position. As mentioned earlier, the beginnings and ends of utterances are presumably salient for the child (cf. Newport, Gleitman, & Gleitman, 1977; Slobin, 1973, 1985). Thus, if a word (or a class of words) appears frequently in these "salient" utterance positions, it should be acquired earlier and with greater ease than a word that appears more frequently in nonsalient (intermediate) utterance positions.

Goldfield (1993), examining English-speaking mothers' input to their 12-month-old infants, found that nouns appear in the utterance-final position of mothers' utterances with very high frequency, whereas verbs appear at the ends of utterances with much lower frequencies. Au et al. (1994), however, found that although utterance-final nouns may appear to account for the noun bias in English, Korean-speaking mothers use a large number of verbs at the ends of their utterances. The Korean-speaking children in their study still acquired more nouns than

verbs in their early lexicons, at least when measured by their adaptation of the MacArthur CDI into Korean. Thus, Au et al. concluded that the utterance-final hypothesis does not accord with the data. However, Au et al. also acknowledged that Korean-speaking mothers use many more nouns at the beginnings of their utterances than they do verbs, thus not ruling out sentence position effects entirely.

In Tardif (1993), Mandarin-speaking mothers were found to place verbs at the beginnings and ends of utterances with much higher frequencies than they place nouns. In fact, verbs were the most likely part of speech to begin an utterance, with an average of 28% (SD = 4%) of all utterances beginning with a verb. Counting both the beginnings and ends of utterances, verbs were found to occur in salient positions in 39% of all utterances, whereas nouns began or ended only 11% of all Mandarin adult-to-child utterances. Thus, both the grammar and input of Mandarin appears to highlight verbs, whereas English highlights nouns.

Morphological simplicity. Morphological simplicity is yet another possibility that Gentner (1982) raised as a possible account for children's early noun biases. The simpler the morphological markings on a word, or the lesser the variety of these markings, the easier it should be for a child to acquire the word. Unlike English, Mandarin nouns and verbs are minimally inflected, and the inflections themselves are highly regular and do not significantly alter the phonology of either nouns or verbs. Thus, the morphology of Mandarin nouns and verbs is equally simple and consistent across contexts of use, whereas the morphology of English nouns is relatively simple compared with that of English verbs. The differences in morphological complexity for English nouns and verbs reinforce whatever biases the child may have toward nouns, whereas such biases would not be reinforced by the morphology of Mandarin nouns and verbs.

Interactional features of the language learning game. The final set of hypotheses involves the interactive nature of language learning itself.

It may not be just the frequency of a word or the cognitive limitations of the child that determine which words are acquired. How the word is presented in the context of adult–infant interaction may also make a difference. Thus, in the language socialization approach of Ochs and Schieffelin (Ochs, 1985, 1988; Schieffelin, 1985, 1990; Schieffelin & Ochs, 1986), and also in the cultural learning approach of Tomasello (1992), language is inseparable from culture and is learned in the process of becoming a member of the culture.

In the United States, middle-class English-speaking parents find talk about objects to be interesting for infants (this is interesting in itself when one considers the range of toys that adults in this culture provide for their infants). This leads them to center their conversations with infants around objects (Bridges, 1986; but see also Bloom et al., 1993). Thus, English-speaking parents often elicit names for objects in order to establish and maintain the language learning game of their culture (Tomasello, 1992). In contrast, Japanese-speaking mothers have been found to emphasize social routines, even when playing with the same set of toys that elicited object labeling from a comparable group of English-speaking mothers (Fernald & Morikawa, 1993).

Conclusion

These Mandarin-speaking children's data demonstrate that the noun bias is not a universal in children's early productive vocabularies. Because it is not a universal, there is no reason to restrict explanations for the bias, when it does occur, to universal perceptual or cognitive mechanisms. The present data do not rule out the possibility of such mechanisms; rather, they suggest that these universal processes cannot be solely responsible for the effect. Instead, such processes must operate in tandem with various factors in the linguistic input and sociocultural environment that serve to support or counteract whatever processing biases the child may bring to the task.

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