

Constraints on Word Learning?

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Recent studies that propose constraints on word learning are reviewed. Theoretical implications of constraints hypotheses are examined in the light of data from other prior and current studies of children's word learning at different developmental points. It is concluded that there is no evidence for strong internal constraints on the acquisition of words by young children of the kind proposed. Alternative conceptions that view lexical development as a social convergence process are suggested as more adequate explanations, based on the full research record.

How do children first learn to say words and learn to use them to express meanings? These are questions that have interested psychologists, linguists, and philosophers at least since the time of Augustine. In the past two decades, as research into all questions of child language has proliferated, interest in these basic questions has intensified as well, reflected in both theoretical and empirical work, and has brought forth competing answers. The solutions that are favored not surprisingly tend to reflect basic theoretical commitments regarding the relation between language and cognition in general.

There have been three general approaches to these questions, which may be termed the cognitive prerequisite position, the social support position, and the linguistic constraint position, respectively. At various times, each of these has had strong proponents and has seemed for a time to be the "right" answer. For example, the cognitive prerequisite position was endorsed not only by Piaget (1962), with whom it is primarily identified, but by Bates (1976), Bowerman

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(1976), Clark (1973), Macnamara (1972), Nelson (1974), and others. The social support position was implicit in Vygotsky's (1962) theory, and has been best articulated in recent years by Bruner (1975; 1983). These two general positions have led to considerable research investigating the process by which children normally acquire their first language. Three edited volumes have been recently published documenting this research (Barrett 1985; Kuczaj & Barrett 1986; Smith & Locke, 1988), and demonstrating that, over the past 20 years, much has been learned about the process of lexical acquisition through the study of children directly engaged in it, as well as through clever experimentation.

Recently, the third position—linguistic constraints—has emerged as a strong contender. We can trace the intellectual roots of this position to Chomsky's (1965, 1976) nativist claims about the basis for language acquisition in general: that there is a genetically built-in universal grammar in the human mind which determines the structure of any possible human language. The linguistic constraint position on word learning extends these claims to the structure of the lexicon and, in particular, to constraints on what a word can refer to. There are now a number of theoretical proposals and a considerable body of empirical research that are in some degree reflective of this position. Some of this research and its interpretations contrast and conflict with the results and conclusions of prior research based on different theoretical assumptions. Such conflicts need to be carefully examined, and this is part of my aim in this paper.

It should be noted at the outset that not all of the researchers whose work I discuss align themselves with the strong nativist claims of Chomsky (1976) and Fodor (1975, 1981). Nor do they all identify the constraints that they invoke with specific *linguistic* constraints. Nonetheless, the claims made are consistent with claims for innate grammatical constraints made in other branches of linguistic and psycholinguistic theory and thus appear to fall within the same general class of theories. To the extent that the authors of the papers in question intend different interpretations, it is incumbent upon them to spell out their theories more completely and to identify how their own assumptions differ from nativist claims.

In this paper, I examine the premises, some of the empirical findings, and the claims of the constraints approach, and contrast them with the premises, findings, and claims of other alternatives. In order to do this, I first summarize some of the major findings of empirical research on lexical development as reflected in contemporary books and journals in the field of child language. Not everyone would agree with the particular framework for this discussion, but the overview presented represents, I believe, a reasonable consensus among active researchers. Following this review, I focus on the theoretical position represented by constraints theory and representative research that derives from it. Finally, I discuss an alternative theoretical approach that, in my view, reflects more accurately the process of lexical development based on the full research record.

THE COURSE OF LEXICAL DEVELOPMENT

Lexical development consists of acquiring word forms and the conventional meanings associated with them as agreed upon by adult users in a language community. It also involves establishing relations among words and meanings of specific kinds, for example, synonyms, antonyms, and superordinate terms within a system of lexical relations. The words that the child must learn are displayed in uses by the language community of which he or she is a part. The conventional meanings must be *inferred* by the child from the way the words are used in context.

At least three distinct developmental periods have been identified by researchers in this area (Barrett, 1986; Nelson & Lucariello, 1985; Kuczaj & Barrett, 1986). Each of the three periods has distinct problems and tasks that are reflected in the word-learning procedures used during the period and in the eventual establishment of lexical relations. These differences indicate that acquiring a lexicon is an essentially *developmental* process, in which the nature of meanings and their relations changes as the subjective lexical system develops.

The first period is one in which the child faces the problem of finding a way into the language system. This period lasts for 6 to 12 months for most children, from the time that the child first becomes sensitive to language forms and begins to respond to some of them consistently (sometimes as early as 9 months) until the production of 30 or more words and the first two-word combinations (which may be as late as 24 months). The problems the child faces are of the following sort: What is a word? What do words do? How are words used to refer? Can a single word refer to more than one category of things or events?

From the 19th century until the present, most observers have reported that, during this initial period, children engage in overextended or complexive uses of words, as well as using them in overly restricted and idiosyncratic ways. For example, a child may restrict the use of the term *car* to the situation of watching cars move on the street outside the window (Bloom, 1973). Barrett (1985, 1986; Barrett, Harris, Jones, & Brookes, 1986) has observed and analyzed a number of context-restricted uses in the early months of word use and claims that such restriction is typical of the early period, a position endorsed by many if not most observers of early child language (e.g., Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; Braunwald, 1978; Dore, Franklin, Miller, & Ramer, 1976; Gopnick & Meltzoff, 1986; McShane, 1980; Nelson & Lucariello, 1985; Rescorla, 1980). Children also use words to refer to complexes of objects or features. Familiar examples include a child who applied the term *clock* to real clocks and watches, to meters, dials, and timers of various sorts, to bracelets, a buzzing radio and telephone, and to a chevron-shaped medallion on his dishwasher, suggesting that clock referred to an associative complex of features, rather than to a particular type or category of object (Rescorla, 1980); and the use of the

word *moon* to refer to a grapefruit half, shiny green leaves, lemon slices, and a hangnail (Bowerman, 1976). Complexive uses have been reported throughout the first phase of word learning (Rescorla, 1980) although most overextensions of words after 16 months are typically to close category members, such as extending *dog* to other four-legged animals or *apple* to oranges and pears. Different researchers have had different interpretations of these early complexive overextensions, suggesting, on the one hand, that they might be comments on similarity between objects rather than real category errors (Nelson, Rescorla, Gruendel, & Benedict, 1978) or that children have formed complexive rule systems (Rescorla, 1980), or that early *word meanings* are formed around prototypes, thus accounting for extension on the basis of one or a few features (Bowerman, 1976; Barrett, 1986; Lucariello, 1987). Greenfield and Smith (1976) suggested that the observed shifting uses of words was related to the context of use, that is, the word's communicative function rather than its referential meaning. One of the recognized problems of interpretation during the single word period is that of inferring the child's word meaning from the child's word use (Nelson, 1985). Despite this problem, children's anomalous uses cannot be simply dismissed nor is it easy on the basis of our present knowledge to give them a single definitive interpretation.

During this early period, most children learn and use many object labels, as well as relational terms, action words, social phrases, and so on. On the average, about 40% of the first 50-word vocabulary consists of generic names of object categories (Nelson, 1973). Individual differences in the type of words learned and used are the rule, however, with some children focusing on object labels and others focusing on other types of words useful in social interactions. In addition, some words are used to refer to both objects and actions so that their target categories are indeterminate, for example, the use of the word *hot* as a name for heaters and ovens as well as for the property of either hot or cold. Dromi (1986) reported that 16% of the words in her daughter's vocabulary in the single-word period were of this type and that, during the first 2 months of acquisition, most of the words acquired were indeterminate.

During these early months, children understand many more words than they use, acquiring a receptive vocabulary of 50 words 6 months prior to the equivalent productive vocabulary (Benedict, 1979). Words are produced infrequently and many that are initially productive drop out of use after a brief period.

Taken together, the characteristics of this long period of beginning language use—comprehension much superior to production, restricted, complexive, and indeterminate uses, and emphasis on one or a few functions—strongly suggest that during this time children are *learning what words do*.

The second period of lexical development begins when the child has acquired about 30 productive words or more and seems to have achieved the realization that words name categories of objects and events. This realization is often manifested in a naming explosion when the child asks for and names everything in

sight (Dore, 1978; McShane, 1979; Nelson, 1973). The relation between categorization and the name explosion has recently been affirmed by Gopnick and Meltzoff (1987), who found that the ability to categorize objects into two distinct groups invariably preceded or coincided with the naming explosion. I have suggested that the problem for the child during this period is one of finding the words for conceptual categories that represent the child's world of things, people, actions, and events. The sudden onset of names for everything in sight that is frequently observed can best be explained by the assumption that the child has already formed conceptual categories for things and events in the world and now realizes that words can be used to refer to them. I have argued (Nelson, 1983, 1985) that, during this period, the child tends to assume that words and concepts are in one-to-one correspondence, that is, there is a word for every concept and a concept for every word. The process may work both ways—the child looks for words for established concepts and also tries to form concepts for new words. Overextensions of words are still frequent during this period as children attempt to use their limited vocabulary to make statements about objects and their relations (Clark, 1978; Greenfield & Smith, 1976; Nelson et al., 1978; Rescorla, 1980).

This second period may last several years, as basic knowledge of words and related conceptual distinctions is built up. The process of word learning has been less studied during this period than during the earlier period. A notable characteristic of the period, studied initially by Carey & Bartlett (1978), is the fast mapping of words onto meanings—in their study, the acquisition of a new word for a novel color after a single exposure to its use. Fast mapping has been demonstrated for other word categories and, although it is not yet well understood, its utilization as a strategy has been invoked to explain the evident fact that children acquire words at a very rapid rate—on the order of 10 to 20 new words a day during the preschool period.

The third period is one of revision, reorganization, and consolidation of lexical items within domains of related words. This is a period of growth, beginning in the early preschool years (about 3 to 4 years) that leads into the less turbulent period of the established lexical system by the early school years. The characteristics of this period are less well studied than the earlier periods and less accessible to observation. However, available research strongly suggests some important characteristics that point to the reorganization process. On the one hand, during the second period, there appears to be limitations on the child's use of some words, for example, relational terms (French & Nelson, 1985) and superordinates (Macnamara, 1982; Markman, 1983; Nelson, 1985) that are overcome during the third period as the lexical system is reorganized and new relations are established. Bowerman (1982) has documented evidence for the process of reorganization for terms and establishment of new semantic relations within a number of different domains during this period. Karmiloff-Smith (1979) has described the movement from the child's use of a term in an undifferentiated

way to the restriction of its use to one function and, finally, its use in a multifunctional adult way, reflecting a similar process of reorganization of meaning within the lexical system during this time. All of these findings suggest a system that is at first characterized by independent lexemes, that are related to experientially based concepts but are not related directly to other lexemes, subsequently becoming reorganized in terms of relations between lexical items, a process that in turn leads to new insights into both the linguistic and the conceptual systems.

To conclude, lexical development involves all of the characteristics and problems described in this section, and it is all these that need to be explained by a theory of word learning. The problems of each period are distinct, and, thus, the processes of acquisition of words and their meanings can be expected to differ at different developmental points. I turn, next, to examine the class of theories that address the problems of word learning from a constraints position. For the most part, however, these theories do not address the research findings and issues summarized above, but are directed at a different problem, which requires separate consideration. Nonetheless, to the extent that their claims are at odds with these established findings, the validity of those claims may be questioned.

CONSTRAINTS THEORY

The basic assumption of the general constraints position is that word learning must be *internally constrained* by some mechanism if it is to succeed. Quine's (1960) "problem of radical translation," which sets forth the case for *indeterminacy* in inferring meaning from reference, is frequently invoked in the discussion of word learning from this perspective. This well-known and widely quoted problem poses the following question: How can a linguist in an alien world who observes a native speaker uttering "gavagai" as a rabbit runs by be certain that "gavagai" means rabbit? There are numerous other referential possibilities that Quine and others have pointed out: gavagai might mean rabbit running (or just running), rabbit in grass, the color brown, rabbit ear (or ear in general) or, more exotically, "mere stages or brief temporal segments of rabbits" or "all and sundry undetached parts of rabbits" or "the fusion of all rabbits—that single though discontinuous portion of the spatiotemporal world that consists of rabbits" (pp. 51–52).

Although Quine (1960) himself did not deny that the clever linguist can eventually affirm that gavagai refers to rabbit, many researchers in child language have been impressed by this apparently intractable problem of induction. For example, Markman and Hutchinson (1984) echoed the dilemma:

Young children beginning to acquire their native language continually face this problem of narrowing down the meaning of a term from an indefinite number of possibilities. Someone points in some direction and then utters a word. On what grounds is the child to conclude that a new unfamiliar word, e.g., "dog" refers to

dogs? What is to prevent a child from concluding that “dog” is a proper name for that particular dog? What prevents the child from concluding that “dog” means “four-legged object” or “black object” or any number of other characteristics that dogs share? And finally, what prevents the child from concluding that “dog” . . . also refers to the bone the dog is chewing on or the tree the dog is lying under? (p. 2)

The answer favored by Markman and Hutchinson is in terms of “an abstract constraint children place on possible word meanings” (p. 22). They go on to consider the possibility that “the constraint is innate—from the start, children assume words will refer to categories of similar objects” (p. 24). They doubt that the constraint is induced from early language experience because they found that children as young as 2½ years “believe that count nouns are more likely to refer to objects that belong to the same category than to objects that are thematically related” (p. 24). I return to the evidence for this conclusion shortly. Markman and Hutchinson’s (1984) proposals are designed to provide the necessary and sufficient cognitive and linguistic underpinnings to word learning that would make the Quinean indeterminacy problem disappear by invoking constraints on what can be considered as the referent of a word.¹

The term constraints in these discussions is taken as self-evident and is not defined. In normal usage, the term indicates restriction, limitation, or confining. To the extent that this is the sense of the term when used in reference to word learning, we would expect that there would be limits on what the child could consider as the referent of a word. Contrast this sense with that of bias, preference, or strategy, all terms that have been used in the past to describe young children’s approach to certain cognitive tasks, including that of word learning. For example, children’s performance on the type of forced-choice task used by Markman and Hutchinson (1984) has traditionally been described as a preference for thematic relations over categorical ones. Although Markman and Hutchinson also speak of children’s conceptual preferences for thematic relations, they formulate children’s taxonomic choices in terms of constraints (see following discussion). Rather than suggesting that when pictures are labelled, children’s preferences or biases switch from thematic to taxonomic choices or that children employ different strategies under the two task conditions, they claim that labels *constrain* their choices. The connotation is quite different: Constraints imply

¹ Quine’s major point was the philosophical one that meaning is a function of theory—thus of the language system—and cannot be translated with certainty from one language to another. For him, the indeterminacy of translation problem lies with abstractions such as “neutrinos lack mass,” not with “that’s an apple.” As he noted, indeterminacy of translation is analogous to the problem of intersubjectivity, of the correspondence between individual private worlds, a problem associated with inescapable vagueness of reference, but *not* one that prevents communication using words with conventionally agreed upon meaning. Quine stressed repeatedly that he was concerned with sentence meaning and not with the meaning of individual terms.

restriction—a closing down of choice; whereas preference implies free, but biased, choice.

An important question to consider in regard to purported constraints on word learning is whether they actually constrain or whether proposed constraints represent only preferences, biases, or strategies. A true constraint would be manifested in all or none type responses; bias is manifested in statistically significant trends that fall short of universally consistent response patterns. If the constraint is universal (cognitive or linguistic), all children should follow the pattern: There should be no individual differences. If it is found that alleged constraints do not constrain but merely bias the learner, the term is misleading and suggests an innatist view of human development that may be unintended.

Although there is no single source on which to rely in characterizing constraints theories (but see Keil, 1981 for a clear statement), some central tendencies can be discerned. The usual implications are that constraints are domain specific, in this case *language specific*; that is, constraints are solutions that are somehow triggered by a language-acquisition mechanism designed to make an otherwise impossible task possible. A corollary to this assumption is that the solutions are *species specific*, belonging to human children but not to lower species; and, following from these propositions, constraints are presumed to be *innate*, not acquired, mechanisms. Because they are innate constraints on a particular process which is assumed to be universal and invariant, *no developmental change* in the effects of the constraint is expected. If there is change in the process, it is attributable to maturation of the innate constraint.²

The questions that need to be addressed in regard to the various proposals for constraints on word learning, then, are these: Do they constrain or only bias the learner? Are they specific to the language task or do they represent properties of human cognition and knowledge representation in general? Are they species specific or is there evidence that other species utilize similar principles? Are they innate? If they are innate, they should apply from the beginning of the language learning process in order to be maximally useful, rather than maturing at a later point, after word learning is already underway. In addition, constraints should not conflict with one another, leaving the learner in conflict, and they should not conflict with the structure of the language to be learned, hindering rather than helping the language process. With these questions and cautions in mind, let us consider some of the recently proposed constraints.

² As noted earlier, it may be that these assumptions are not embraced by some of those who invoke constraints. In that case, it is important to be clear about what assumptions are made with regard to the origins of constraints and their applicability across domains and developmental sequences. In neither of the papers cited in this article, nor in others making similar claims, have I found such discussions.

EVIDENCE FOR CATEGORY AND OBJECT CONSTRAINTS

The most basic word-learning constraint proposed is that children obey a "natural constraint on word learning" (Seidenberg & Pettito, 1987) that restricts the meaning of a word to only one ontological category, to only objects *or* events: the natural *category constraint* (Huttenlocher & Smiley, 1987; Keil, 1979; Osherson, 1978; Seidenberg & Pettito, 1987). This is supplemented by the *whole-object constraint*, which claims that children interpret object labels as referring to categories of whole objects and not to parts or attributes of objects, nor to objects and actions together (e.g., ball bouncing) or to objects in events (e.g., cup in breakfast) or objects from one class and from another class (e.g., cup and spoon) (Markman & Hutchinson, 1984; Mervis & Long, 1987; Seidenberg & Pettito, 1987). Markman and Hutchinson (1984) and Waxman and Gelman (1986) refer to this as the *taxonomic constraint*, a constraint that prevents the child from inferring that a count noun refers to a thematic relation between an object and a contextual associate. Because the category constraint almost always refers to object categories in these discussions, the terminology used here, *object-category constraint*, refers to any of these proposals.

At the outset, it can be noted that there is a basic problem with the object-category constraint that is not addressed by any of the discussions that I have seen, although Markman and Hutchinson (1984) allude to it. The Quinean problem applies to all words, not just object words. How is the child to know that a particular word used by an adult belongs to the class of words that refer to objects rather than to actions or whole events? The other half of this question is equally important: How does a child know when a word refers not to an object but to an action, a part of an object, an attribute, or a whole event rather than an object? *The object-category constraint applies only if an object is recognized as a possible extension of a particular word in use in the first place.* That is, the child must have prior knowledge of different word classes for different semantic categories and a way of interpreting which is referred to in a given situation. Note that this is a particular problem for the child's first words.

Markman and Hutchinson (1984) note that "if children have some innate knowledge of the constraint, they may at first overextend it, indiscriminately believing that any word they hear must refer to a taxonomic category" (p. 24). Because they believe that the "huge majority of children's first words are count nouns" they are not concerned about this possibility. However, they are mistaken; although general count nouns form the largest category of words learned by the average child in our culture (see earlier discussion), they constitute only about 40% of the first 50 words and, for many children, much less than that; the eight Expressive children in my sample (Nelson, 1973) averaged only 28% count nouns in their first 50-word vocabularies. Many words that very young children learn refer to actions and states such as "go," "sit," and "eat"; parts such as

“button” and “eye”; relations such as “all gone” and “more;” properties such as “hot” and “broken”; events such as “bath;” particular persons such as “Mama” or “baby” (Bridges, 1986; Gopnick & Meltzoff, 1986; Nelson, 1973). What in the conditions of word learning ensures that any given word will be applied to the correct ontological category? If there is one constraint for one class of words and another constraint for each other class, there would have to be constraints on constraints so that the child would know when to apply the right one. I know of no such proposals and I do not know how such internal constraints would or could work.

It has been proposed by constraints proponents that syntactic morphemes such as articles (the, a) and verb endings (-ed, -ing) can provide clues to the appropriate word class. But, even though sensitivity to some such cues emerges quite early (Macnamara, 1982), it does not emerge until lexical acquisition is already well under way, and constraints on word learning would be needed most at the beginning of the language acquisition process when the child has no other access to information about word reference.

Thus, there are logical problems in applying the whole-object-category constraint. The child must know in advance that the word is an object name in order to apply the constraint. The inductive problem of the referent of an object word is not eliminated by these proposals.

Children's Word Uses

In pursuit of the claim that children's words refer to whole objects and not to combinations of objects or to parts of objects, Markman and Hutchinson (1984) have carried out a series of studies using a forced-choice picture task. They showed that when preschool children are given a target picture (e.g., a dog) and are asked to choose between a taxonomic associate (e.g., a cat) and a thematic associate (e.g., a bone), they tend to choose the taxonomic associate when the target picture is given a nonsense name (e.g., find another dax) and to choose the thematic picture when the picture is not named (e.g., find another one). They claim that this demonstrates that, even though young children prefer to conceptualize the world thematically, they assume that words apply to taxonomies, by which they mean related object categories. Note that they see this as a specifically linguistic, not a general cognitive, constraint.

However, these results are far from all or none; although there are statistically significant differences between thematic and taxonomic choices, these differences do not approach unanimity. In the most stringent test involving novel objects and novel words, taxonomic choices averaged 63% in the novel-word condition compared to 37% in the no-word condition. The findings from these studies thus do not imply that children are constrained rather than simply biased to respond in a certain way. The statistics indicate that there is either considerable within-subject or between-subject variation or both.

On the basis of this work, Markman and Hutchinson (1984) claimed that

“labels constitute a powerful constraint . . . that tremendously simplifies the problem of language learning” (p. 24). Following this line of thinking, Waxman and Gelman (1986) argued that such a taxonomic constraint would be especially useful to children in learning labels for superordinate categories, which pose particular difficulties for young children. They presented preschool children with a sorting task; similar to Markman and Hutchinson, their conditions varied in using familiar labels, novel labels or no labels, and they also found that the labels facilitated sorting according to superordinate classes.

On the basis of their findings, Waxman and Gelman (1986) argue as follows: (a) There are numerous possible ways to classify things in the world (e.g., thematic, ad hoc, idiosyncratic, as well as taxonomic); (b) “if unconstrained this flexibility could greatly complicate the task of word learning”; (c) therefore, “to make word learning possible we may need constraints on that flexibility”; and (d), experimental results “provide evidence of just this sort of constraint . . . a powerful constraint on word learning” (p. 155).

But note that, with the exception of a single experiment (pairing novel words with novel objects), neither Markman and Hutchinson (1984) nor Waxman and Gelman (1986) presented children with a word-learning task. Rather, they used nonsense words, real superordinate terms, or Japanese terms to refer to pictures of familiar objects whose names and superordinate category labels the children already knew. Our understanding of how children learn to apply labels to superordinate categories is not advanced thereby, and the claim for a powerful *word-learning* constraint seems unjustified.

More important, the findings from these studies come from experiments with children who are long past the stage of acquiring their first words and who have had several years of experience with word learning. Thus, they would not bear on the issue of whether there are inherent *initial* constraints on word learning in any event and would not rule out the possibility that any such constraints that may exist are acquired in the course of language acquisition rather than being innate. As noted earlier, most children spend many months during their second year trying out strategies of production and comprehension before they begin rapid and successful vocabulary building. Studies of children in the early period are needed to justify the claim.

Bauer and Mandler (1987) have carried out experiments with children ranging from 20 months to 2½ years, adapting the Markman and Hutchinson (1984) design to one appropriate to children just beginning to talk. Their results are in contrast to Markman and Hutchinson’s in that they found no tendency for children to make thematic choices, whether the pictures were labelled or not. Their subjects all chose taxonomic associates predominantly. These results suggest that the preference for thematic choices is one that emerges with the preschool period, and it is only then that the contrast between labelled and nonlabelled conditions appears. Bauer and Mandler believe that what the novel word does in the Markman & Hutchinson paradigm is to remind the child what game is being

played (Mandler, personal communication, October 1987). Precisely what developments lie behind the differences found at different ages and under different conditions is a question that demands further investigation.

Huttenlocher and Smiley (1987) recently reported on a study of early word extensions by children who were still in the early word-learning period. Their data were obtained from longitudinal records and observation of children in their homes. On the basis of their analysis, Huttenlocher and Smiley claim that "from the earliest uses, the extensions of children's object names are like those of adults . . . object names encode categories of particular sorts of objects" (p. 87). Although they do not explicitly invoke constraints, they interpret their results as consistent with the claims of nativist writers such as Fodor (1981), suggesting that "object categories are primitive concepts" in the sense of "biologically available primitives, i.e., unanalyzable gestalts 'triggered' by input" (p. 87). Their conclusions about children's extensions, however, contradict those of many previous reports on early word use, including those summarized earlier. Thus, they demand close scrutiny.

First, unlike Dromi (1986) and others, Huttenlocher and Smiley (1987) report that children do not violate the ontological constraint by using words across the bounds of different word types such as object names, property words, event words, and so on, but rather restrict any given word to one ontological type. This conclusion may, however, result from their classification method. For example, because a child used the word *door* in action contexts 81% of the time, they coded the meaning of that word as an action, rather than a word that crossed the boundary between object and action. As noted earlier, Dromi (1986) reported that most of the words her daughter learned in the early months were indeterminate between categories in just this way.

Second, Huttenlocher and Smiley (1987) reported that children apply object names correctly to whole objects and do not restrict their naming to specific object complexes, such as object in a particular place or object in a specific action. Moreover, in contrast to the studies cited earlier, they did not observe the kinds of overextensions of object names that would lead to the inference that children had complexive concepts rather than well-defined object categories. They claimed, therefore, as noted, that children use object names to refer to well-defined object categories from the beginning, supporting the proposal that there are innate constraints on object naming.

As is evident from the studies summarized in the earlier section of this paper, Huttenlocher and Smiley's (1987) claims conflict with those of other observers of early word uses. There are several possible explanations for these discrepancies. First, much of the prior data relies on parental diaries whereas the Huttenlocher and Smiley data were gathered by observers using standard probes and tests with a standard set of small objects, and taking handwritten notes (rather than audio or video tapes).³ Reliable, trained observers are clearly important in psychological research, but they are not necessarily superior to trained parents

recording every use of a word by a child according to standard criteria or to records kept by linguist or psychologist parents of word uses by their own children (e.g., Bowerman, 1976). Observers trained to note only conditions of the physical setting—presence, absence, similarity of the referent of the word—may miss the relevance of the utterance to the ongoing interaction and, therefore, the child's communicative intention in using the word. (See Bloom, 1970 on rich vs. objective interpretation.) Parent diarists are more likely to focus on the entire interactional setting for the word's use and to take into account the pragmatic history of the child's use of the word (see Braunwald, 1978).⁴

As many people have noted, parental reports have the advantage in reporting on the appearance of early words, which are used sparingly and infrequently by children first beginning to talk. The sample obtained by Huttenlocher and Smiley (1987), even though based on 5 hours of recording per month, could cover no more than 2% of word uses in the single-word period⁵ and probably recorded considerably less than that. The implication here is that, because of their restricted data base, Huttenlocher and Smiley seriously underestimated in their sample the kinds of complexive uses of words documented by other researchers.

It also seems plausible that Huttenlocher and Smiley (1987) did not observe the earliest word uses and particularly the earliest object term uses by their subjects. Although Huttenlocher & Smiley did not report the criteria they used to attribute a word to a child, they reported that only 1 of the 10 children in their sample began using any words before 13 months, and that only 3 of them used object words among their first words. The average age reported for the first object word in this sample was 15.8 months with a range of 12 to 24 months. These milestone ages for their sample are several months later than most of the other reports in the literature, which typically report first words between 9 and 13 months, including object words. Thus, their report is based almost entirely on word uses by children aged roughly 16 to 25 months, whereas the previous reports were based on children aged as much as 7 to 10 months younger than this. Because most observers of complexive or context-restricted word use have documented these in the earlier phases of single-word use (see Bloom, 1973; Barrett, 1985; Nelson, et al., 1978), it seems likely that Huttenlocher and Smiley missed the period of observation when these uses were most probable. This seems

³ Note, however, that Nelson (1973) and Rescorla (1980) combined parental diaries with audio tapes and home observations, and Barrett et al.'s (1986) work is based on a combination of parental diaries and video-taped observation.

⁴ Parental diaries differ in quality and rigor of, course (see Braunwald, 1978). The implication here is not that any diary record is superior to any observation record, but rather that good diaries may provide a better record for the purposes under examination here.

⁵ This estimate is based on my calculations derived from their description of mean word use per hour during the first 2 months of observation, as well as total word uses observed over the total reported observation period.

particularly likely in that, unlike other observers (Barrett, 1985; Bloom, 1973; Rescorla, 1980), they found no changes in word use, for example, in overextensions, during the single-word period.

Still a third possibility is that individual differences in these types of uses exist, and that these need to be accounted for. As I have suggested previously (Nelson, 1981), individual differences can help in understanding the general processes of language development, identifying what is variable and what is universal in development. It might be that, by chance, Huttenlocher and Smiley's sample of 10 children did not include any who engaged in overly restricted or complexive uses.

In summary, the Huttenlocher and Smiley (1987) report on constraints on early word uses by children first learning to use words is at odds with much other data in the literature, and their conclusions cannot, therefore, be accepted unequivocally at this time. More generally, the research purported to support the category constraint has neither demonstrated universality nor an initial linguistic constraint on word learning.

Word Learning by Chimpanzees

The constraints-on-word-learning claim has been extended to a critique of symbol learning by chimpanzees by Seidenberg and Pettito (1987) who base their argument on the claim that "basic *knowledge* [italics added] of what *names* [italics added] are is innate and specific to humans" (p. 286). In response to Savage-Rumbaugh, McDonald, Sercik, Hopkins, and Rupert's (1986) report that the pygmy chimpanzee Kanzi has learned the meaning of numerous lexigrams, in a manner analogous to the way young children learn the meaning of words, Seidenberg and Pettito (1987) argue that Kanzi and other chimps are using signs in some restricted—because nonhuman—way. They claim that the apes respond to the demands of an experimental situation in a problem-solving manner, using symbols only because this behavior has been shown to bring rewards (see also Terrace, 1985 for a similar argument). Note that this is a claim about *names*, that is, language forms, and not necessarily one about the nature of human versus ape *concepts*. Concepts might be the same or different but, according to this claim, only children would know that names refer to a specific type of concept.

Seidenberg and Pettito (1987) believe that Kanzi's lexigram uses in natural contexts indicate his deficiencies in that his "lexigrams are not simply produced in reference to well-defined categories. For example, Kanzi used juice in several ways: (a) to refer to a particular kind of drink . . . (b) to refer to the fixed location where juice was located . . . and (c) to refer to the act of going to the juice location" (p. 280). But Kanzi appears to use lexigrams in much the same way as children use words. Child language literature is rife with examples of children's uses of words for both objects and locations, actions, or attributes during the early period when the child is capable of using only one word at a time (see references above). For example, in the study just discussed, Huttenlocher

and Smiley (1987), who emphasized that children use words primarily in reference to well-defined object categories, also observed children's use of words in the absence of objects to comment on where an object had been found or to request the object, just as Kanzi did.

But Seidenberg and Pettito (1987) argue that "the comparison between child and chimpanzee turns on whether the *same processes and types of knowledge* [italics added] underlie their respective utterances . . . Our claim is that the bases of these utterances are in fact very different" (p. 282). They claim that "the biological constraints on this developmental process [i.e., children's developing hypotheses concerning the meanings of utterances] are such that only certain types of hypotheses are entertained" (p. 282). What they propose, then, is that the same behavior in the two species be given different interpretations. But, plainly, there is no reason to construe a word use one way for children and another way for apes, except the conviction that humans are different.⁶

Note that it would not be an argument against innate constraints if Kanzi (and other chimps) could be shown to use principles similar to those used by children in applying symbols to referents. It would only push the alleged constraint farther back into the evolutionary process. All parties would agree, I believe, that there is no reason to believe that the chimpanzee has an innate specifically linguistic capacity. Therefore the similarity between chimpanzees and children would mean that the constraint was a conceptual and not a specifically linguistic one. This is a different message from that argued by Seidenberg and Pettito (1987), or by any of the other constraints theorists we have considered.⁷ If children and Kanzi are similar in their naming behavior, and the evidence shows that they are, at least for the early stages of word acquisition,⁸ the various innate constraints on word meaning positions seem to have little explanatory power. Whatever constraints exist must then be considered neither domain (i.e., language) nor species specific but must derive from some combination of circumstances surrounding the acquisition of symbols—words or lexigrams—by highly intelligent organisms in an interactive environment. Analysis of these circumstances, then, is called for.

⁶ This brings us back to the Quinean problem of indeterminacy; but the difficulty of inferring the same meaning for different species does not imply the necessity of claiming different meanings; it only implies indeterminacy.

⁷ Recall Markman and Hutchinson's (1984) emphasis on the difference between the use of words and nonwords in terms of children's taxonomic and thematic responses, respectively, and their claim that the taxonomic constraint applies to words and not to conceptualization.

⁸ It would clearly be foolish to claim that there is no difference between chimp and child in lexical (or any other) development. But if you take a developmental, rather than a nativist, view you can grant the chimp his due without feeling that the human is in any way threatened in his or her uniqueness.

Adult Word Meanings

Do the alleged constraints on children's word meanings apply to adult word meanings as well? First, as is well known, word classes such as noun and verb do not map directly onto semantic categories such as object and action. This fact has been the focus of much discussion in the child-language literature in considerations of the child's acquisition of syntactic categories. Only a subset of nouns refer to categories of countable objects. Many common English nouns, in fact, refer to a complex of objects and actions, for example, the words "breakfast," "lunch," "bath," and children seem to learn these words as readily as they learn words for discrete small objects (Nelson, 1973). Moreover, the same English words may be used as both nouns and verbs (e.g., "hammer," "toast," "walk", "drink"). The fact that they belong to different word classes when used for different grammatical functions is of no relevance for children in the single-word period, whose words, in any event, cannot be classified in terms of nouns and verbs.

That dual category terms exist in the adult language, that children learn and use them, that both adult and child users extend names for objects to the actions of objects and vice versa, suggests that, to the extent that there is an ontological category constraint (e.g., Keil, 1979) it is not a constraint on the possible extension of words. For category constraints on word learning, this is a problem. But for the language-learning child, it clearly is not; the young child readily uses the term "potty," for example, for both the object and the action, and is not deterred from using "door" both to refer to the object and as a request to go outside. Children's early word uses are nothing if not flexible and so, be it noted, are adults'. The point, here, is that if children were actually constrained in their word learning as the object-category constraint suggests, they would be at a disadvantage in learning and using many words. Evidence shows that they are not.

CONTRAST CONSTRAINTS

A different set of proposed constraints on word learning has been set forth by Clark (1983, 1987) in terms of the principle of *contrast*, which holds that, when a child hears a new word, he or she assumes that it contrasts with other words already in his or her lexicon. Thus, if a child knows the word *dog* and hears the word *cat* used to refer to a small furry animal, the child will assume that the words *cat* and *dog* contrast and will, therefore, look for contrasting features in their referents. Thus, vocabulary acquisition grows naturally as the child is exposed to more and more words and picks out the contrasts in their referents. Clark (1987) notes: "The Principle of Contrast offers a powerful tool to children acquiring language. It constrains the inferences they can make about possible meanings for new forms by distinguishing them from already familiar forms" (p. 28).

Clark (1987) points out that the principle of contrast shows up in a number of other acquisition theories, implicitly or explicitly, in particular in Markman's (1984) principle of *mutual exclusivity*. The principle of mutual exclusivity is more restrictive than the principle of contrast. It states that the child assumes that each object has one and only one name; thus, two words cannot refer to the same thing. This principle is, of course, violated in the adult language; its use would rule out not only synonyms but superordinates, subordinates, and metaphors. As Clark points out, once the child understands that words apply at different levels in a taxonomy, he or she must give up mutual exclusivity. This constraint, then, can apply for only a short period during acquisition and is put forth as a kind of primitive strategy for word learning. It seems relevant to note that the mutual exclusivity constraint undermines the findings from Markman and Hutchinson's (1984) and Waxman and Gelman's (1986) studies of taxonomic choices named by nonsense words such as *dax*, as discussed earlier. In the face of a novel word, the child should reject the choice of an item for which he or she already knows a word (e.g., *dog*). If nothing else, children in this experimental situation should be confused, if the mutual exclusivity, or even the contrast principle holds.

Contrast is clearly an important property of the language system. It leads both linguists and children to look for the site of contrast when a new term or form is encountered, and it has attracted a number of theorists (e.g., Barrett, 1978; Markman & Hutchinson, 1984). Two questions must be addressed, however: Is it a true constraint, that is, a principle that is seldom violated? And, to the extent that it holds, is it innate or is it acquired during the language learning period?⁹

How restrictive and reliable is the principle of contrast or the mutual exclusivity constraint? Several tests of these principles have been carried out recently with young children. In general, they have indicated that children do not adhere systematically to the principles (see Gathercole, 1987b for a thorough review of the issues and the relevant literature). When provided with novel names for familiar objects for which a label is known and unfamiliar objects, children do not systematically apply the novel word to the novel object, as the principle of contrast indicates they should, until the age of 3 years (Merriman, 1986, 1987). Moreover, evidence shows that very young children may respond to a word receptively (e.g., *horse*) for an object to which they apply a different label (e.g., *dog*) productively (e.g., Fremgen & Fay, 1980; Rescorla, 1980). Additionally, Mervis (1984) has demonstrated that 1-year-old children who first learn a term such as *kitty* and apply it to what she calls a "child-basic category"—one including tigers and leopards as well as cats—may subsequently use

⁹ It is interesting to note that the principle of contrast conflicts with an earlier proposal about the course of lexical acquisition: Clark's (1973) semantic feature hypothesis. This hypothesis claimed that features were learned one at a time and that, at an early point in development before the acquisition of the full set of features, both words in many semantically related pairs (e.g., *before* and *after*, *big* and *tall*) had the same meanings. The contrast principle rules out this implication of the old hypothesis, which had in any event, found little support in the research literature (Carey, 1982).

both the child basic term (kitty) and the adult term (e.g., tiger) to apply to the same object (the toy tiger), before, eventually, the child basic term drops out. Merriman and Bowman (1987) reported that an examination of Leopold's (1939) and Rescorla's (1976) data provided no support for the contrastive hypothesis. Rather, as Mervis's study found, children tended to use incorrect (overextended) terms simultaneously with correct terms for the same referents, contrary to what the principle of contrast or the mutual exclusivity constraint would predict.

Gathercole (1987a, 1987b) examined five propositions derived from the contrast principle:

- (1) that children's overextensions of words cease when competing lexical items enter their speech; (2) that children's extensions of related words will be non-overlapping; (3) that words entering the child's lexicon will be assumed to apply at the same level; (4) that children set up semantic fields for words early in their acquisition of those words, and (5) that innovative forms will be used only to fill lexical gaps. (1987a)

She reported, counter to Clark's (1987) claims, that the available data either fail to support or provide counterevidence for each of these propositions.

Merriman's (1986, 1987) studies support the claim (Nelson, 1985) that the principle of contrast emerges with development. Because the experimental evidence put forth by Clark and Markman for these principles is based on work with older preschool children (rather than those acquiring their first vocabularies), it seems reasonable to assume that, to the extent that they are relied upon by young children, the principles are acquired in the course of language acquisition rather than constraints that are in place at the outset of language learning. In a similar vein, Dockrell and Campbell (1986) refer to a "preemption strategy" used by preschool children to interpret novel words. As their studies show, this strategy is only partially successful in leading children to the correct denotation of a new word, thus supporting its designation as a strategy rather than as a constraint. Note that it is only the weaker principle of contrast that should emerge at all, because the stronger principle of mutual exclusivity would lead the child acquiring a complex lexical system seriously astray, given the existence of overlap in terms at different hierarchical levels. By the age of 3 or 4 years, a system of hierarchical lexical relations is beginning to be established.

SUMMARY OF EVIDENCE ON CONSTRAINTS ON WORD LEARNING

We can, at this point, address the propositions set forth earlier. Are there innate, species-specific, task-specific constraints on word learning? The constraints considered here have not been shown to apply universally to first words as well as to later words, as innate principles should if they are to be maximally useful; or to be distinguishable from strategies used by language-learning chimps, for exam-

ple; or to be demonstrably specific to language. Moreover, what we have found is that the constraints proposed may actually interfere with acquisition of different types of words, if they operate as constraints and not as biases or strategies.

A major problem for the innate-constraints argument is that children may learn a great deal about what words are likely to refer to as they begin to learn words. In other words, the principles that are observed for children even as young as 2 years may be acquired as language is learned, rather than existing as initial constraints on how it is learned. To the extent that strong preferences for assigning particular meanings to words exist, they seem on present evidence to be strategies that emerge during the preschool period, a period when language structures are being reorganized and consolidated (Bowerman, 1982; Nelson, 1985; Nelson & Nelson, 1978). During a period of consolidation, children's rule systems tend to be most rigid (Nelson & Nelson, 1978) and, therefore, what look like constraints may emerge. However, neither children nor the language system itself is ever as constrained as some theorists have implied.

If the alleged constraints do not meet the criteria of task-specific, species-specific universals, do they contribute in any other way to understanding lexical development? Once stripped of these strong entailments, the claims appear empty. Labelling certain behaviors under certain task conditions "constrained" adds nothing to the description of those behaviors themselves. Whether the behaviors are held to be the result of biases, preferences, strategies, or constraints, the burden is on the investigator to probe beneath the descriptive label and show what in the transaction conditions between child and task lies behind the behavioral regularity. The term constraint only appears to be explanatory because it appears to invoke an innate mechanism. If it does not do so, then it has no explanatory force.

The discussion of formal constraints by Fischer and Bullock (1981) is highly relevant to the issues raised here. They define formal constraints as special patterns of data: "Of the many formally possible developmental outcomes, only a small set are ever actualized." They go on to note:

one might be tempted to treat them [formal constraints] as restrictions on the operation of the human cognitive system. We believe that, in this regard, the word *constraint* may be misleading. It suggests restricting the natural inclination of something, as when ill-designed clothing constrains movement. In many instances when the data are formally constrained, however, there is no sense in which some part of the cognitive system acts to restrict the natural inclination of another part. The constraint in such instances exists primarily in the eyes of beholders who have learned the skill of symbolically generating all formally possible combinations. For these cases, the theorist's task is not to explain how the system eliminates possibilities but how it *actualizes* (only some) possibilities. There is a difference (pp. 6-7).¹⁰

¹⁰ I thank Alison Adams for drawing my attention to this discussion.

DOES WORD LEARNING NEED CONSTRAINTS?

How, then, do children learn words? How can they be sure that the word *dog* refers to dogs and not some other aspect of the observed world? How do we avoid Quine's dilemma of indeterminacy? In brief, the answer seems to be that both child and parent assume intersubjective agreement on meaning, ignoring the true indeterminacy that exists between them, or negotiating toward a better understanding, just as adults do when they converse in words. Children, like adults, do not seek certainty of reference but only communicability. But, doesn't the child need some sort of built-in mechanism to know what words can do and what they can refer to? To answer this question, we need to consider the actual process of word learning, including its social conditions and its developmental course.

Repeatedly, in the studies cited above and in others not discussed here, the need for constraints has been invoked in response to Quine's problem of induction, formulated in terms of what has been assumed to be the prototypical word-learning situation: Adult points and utters a word, child guesses at the intended reference. This prototypical scene has been evoked by writers as diverse in their viewpoints as Augustine (397/1950), Brown (1958), Clark (1973), Macnamara (1982), and Ninio and Bruner (1978). How typical of actual word learning is this scene? The many studies referred to earlier in this paper suggest that the answer is not very. Although parents do frequently attempt to teach their young children words through pointing (to pictures or objects) and naming in the early period, it is notable how infrequently they are successful, as the long, slow process of vocabulary building during this period implies and as direct observation attests (Nelson, 1973). After the child catches on to the word-learning game and enters the second period, the game changes. Then it is the child who points and demands to know the name of the thing pointed to. From then on, new words are learned at the child's requests or in the course of natural interactions, when unfamiliar words are used by adults in otherwise familiar contexts. Such learning was exemplified in the Carey and Bartlett (1978) experiment in which a teacher requested that the child fetch a chromium tray—"not the red one, the chromium one." This kind of learning is somewhat hit and miss: some children attached a color meaning to the term, others didn't, and the particular meaning varied widely across children. Other direct studies of interactive learning in the earliest period (Lucariello, 1987; Ross, Nelson, Wetstone, & Tanouye, 1986) have shown that children learn words for objects that afford interesting interactions and will generalize them to other objects that seem to have the same possibilities. Words for objects that adults simply name but that have no functional importance or interest for the child are not learned.

The point of these observations is that the typical way children acquire words in their first language is almost completely the reverse of the Quinean paradigm. Children do not try to guess what it is that the adult intends to refer to; rather,

they have certain conceptions of those aspects of the world that they find interesting and, in successful cases of word acquisition, it is the adult who guesses what the child is focused on and then supplies an appropriate word.¹¹ Of course, parents are not infallible guessers, either; their mismatches frequently lead the child into error. For example, the child may come to believe that the word *door* means to go out, because that is his or her focus when standing in front of it.

The process of lexical acquisition, then, generally involves (a) a child interacting with the world of people and things and attempting to make sense of it, forming representations of events and concepts of objects; (b) parents, siblings, and other adults interacting with the child linguistically and nonlinguistically in a variety of contexts, including play and caretaking, focused on the child or on other people and activities; and (c) within these varied contexts, words being used that have conventional meanings in the parent language, children being introduced to them in situations where their use is appropriate and their reference often thereby transparent.¹² Is there a problem of induction here? As Wittgenstein (1953) pointed out, at the beginning of the language game, words are used in functional contexts, and their reference is inferred from the context. The entire situation—the child's immediate focus and available conceptualizations, the ongoing activity, the adult's ability to interpret the child's focus—constrains what the child will learn about a new word. But such constraints guarantee nothing; words may be misinterpreted in many ways and frequently are.

The conditions of lexical acquisition just sketched not only differ from the prototypical scene assumed by constraints theorists, but contrast markedly with the choice tasks and sorting tasks typically employed in this research. In these experiments, there is no real-world interactive context, no adult collaborator, to support inferences and provide feedback. The child is forced to rely on his or her own strategies of interpretation. What the child interprets are the experimenter's implicit demands as reflected in the task and instructions and, as has been demonstrated, different conditions lead to different interpretations. This is not to imply that the findings from these experiments are not interesting; they assuredly are. They have identified some of the strategies (looking for contrasts and for categorical relations) that preschool children may use to interpret reference when no other contextual clues are available. But their relevance to word learning under natural conditions and constraints on word learning is seriously in doubt.

The point to be emphasized in this discussion is that the child does not embark on the journey through linguistic space alone or solve its problems without help.

¹¹ This description, too, must be qualified in that it is typical of Western middle-class children and parents, but the interactional context in other cultures is often quite different from either the Quinean paradigm or the observations described here (e.g., Ochs & Schiefflin, 1984).

¹² These conditions may be considered to hold generally across cultures and languages. However, some of the more detailed claims about the way in which children in middle-class Western homes are introduced to new words may not apply to other classes and cultures.

Lexical development is well described as a social convergence process (Adams & Bullock, 1986; Nelson, 1985). The continuing problem for the child is to acquire word forms and match them to the contexts of word uses of the adult. Even when the child uses a form in the same contexts that the adult does, however, it may be that the two do not have the same meanings, as Vygotsky (1962) stressed. The child is guided toward the conventional uses by the adult, both directly and indirectly. But the child must also rely on his or her own cognitive processes to construct meanings from the language in use. Thus, there are two necessary contributions to the establishment of a working lexicon: (a) cognitive processes, including especially the establishment of conceptual representations and the formation of relations among concepts of varying kinds; and (b) the guidance, direct and indirect, of the adult partner toward convergence on conventional meanings, including both denotation and sense (Dockrell & Campbell, 1986; Lyons, 1977; Nelson, 1985). I have, in several places, laid out a proposal for how the child develops conceptual representations derived from his or her own experience and maps language forms onto these representations (Nelson 1982, 1983, 1985). Here, I want to emphasize the other part of the equation: the contribution of social guidance to the development of a conventional lexical system.

Several recent studies have provided evidence that constructing a semantic system is a collaborative project, to use Adams and Bullock's (1986) felicitous phrase. Unfortunately, space does not permit the detailed discussion of these studies here, but several can be mentioned. A number of studies have traced the effects of maternal naming practices on children's lexical development. Ninio and Bruner (1978) examined the evolution of mothers' picture-book reading practices as children's competence at naming increased over the course of several months. Mervis's (1984) work showed that mothers adapt their use of object labels for their 1-year-old children to what they believe the child's category to be, but also provide distinctive information as the child grows older to enable the child to find the conceptual basis for the conventional adult label for an object. Barrett et al. (1986) recently reported that, during the very earliest period, when children frequently tend to restrict their word uses to a single object or situation, their mothers were found to be restricting their own uses in a similar way, suggesting that the child's uses were constrained by the adult model. Lucariello and Nelson (1986) found that maternal naming practices varied by context and provided clues within those contexts that the child could use for constructing hierarchical categories from event knowledge. Watson (1987) found that mothers' uses of superordinate terms for 2½-year-old children were significantly correlated with children's understanding of such terms 1 year later. A particularly interesting study by Adams and Bullock (1986) of adult picture-naming practices demonstrated both differences in how pictures were labeled for children of different ages (corresponding to the three periods outlined in the introductory section), differences depending upon the context of the object to be labeled, and the emergence of explanations of labels for older children. Not surprisingly,

children's labels followed their mothers' practices. Together, these accumulating reports provide important support for the proposal that word learning and lexical development in general are functions not only of a child's developing capacities and dispositions but of the contextually and developmentally dependent guidance provided by parents and others.

What, then, supports lexical development? To recapitulate, first, the child's own developing capacity for, and interest in, categorizing objects and events in the world supports it. Second, learning is supported by adults who label those objects and events in different contexts and at different developmental points and the kind of information they supply to the child about them. Finally, the semantic-conceptual system itself determines the course of development. At first, the child does not even know how words can be used, thus acquisition of words is restricted to certain contexts. Later, when words are mapped to the conceptual system, they are limited to reference aspects derived from the child's experience. Finally, the lexicon may expand indefinitely as words are related to other words and knowledge is gained through language as well as through direct experience.

REFERENCES

- Adams, A. K., & Bullock, D. (1986). Apprenticeship in word use: Social convergence processes in learning categorically related nouns. In S. A. Kuczaj II & M. D. Barret (Eds.), *The development of word meaning: Progress in cognitive development research* (pp. 155-198). New York: Springer-Verlag.
- Augustine, St. (1950). *The confessions of St. Augustine* (E. B. Pusey, Trans.). New York: E. P. Dutton & Co. (Original work published 397.)
- Barrett, H. D. (1978). Lexical development and overextension in child language. *Journal of Child Language*, 5, 205-219.
- Barrett, M. D. (1986). Early semantic representations and early word-usage. In S. A. Kuczaj II & M. D. Barret (Eds.), *The development of word meaning: Progress in cognitive development research* (pp. 39-68). New York: Springer-Verlag.
- Barrett, M. D., Harris, M., Jones, D., & Brookes, S. (1986, September). *The first words of the infant: Their characteristics and their relationship to maternal speech*. Paper presented at the British Psychological Society developmental section annual conference, Exeter, England.
- Bates, E. (1976). *Language and content: The acquisition of pragmatics*. New York: Academic.
- Bates, E., Benigni, L., Bretherton, I., Camaioni, L., & Volterra, V. (1979). *The emergence of symbols: Cognition and communication in infancy*. New York: Academic.
- Bauer, P. J., & Mandler, J. M. (1987, April). *What's in a name? Novel labels and taxonomic classification by 16- and 20-month olds*. Paper presented at the biennial meeting of the Society for Research in Child Development, Baltimore, MD.
- Benedict, H. (1979). Early lexical development: Comprehension and production. *Journal of Child Language*, 6, 183-200.
- Bloom, L. (1970). *Language development: Form and function in emerging grammars*. Cambridge, MA: MIT Press.
- Bloom, L. (1973). *One word at a time: The use of single word utterances before syntax*. The Hague: Mouton.
- Bowerman, M. (1976). Semantic factors in the acquisition of rules for word use and sentence construction. In D. M. Morehead & A. E. Morehead (Eds.), *Normal and deficient child language*. Baltimore, MD: University Park Press.

- Bowerman, M. (1982). Reorganization processes in lexical and syntactic development. In E. Wanner & L. R. Gleitman (Eds.), *Language acquisition: The state of the art*. London and New York: Cambridge University Press.
- Braunwald, S. R. (1978). Context, word and meaning: Towards a communicational analysis of lexical acquisition. In A. Lock (Ed.), *Action, gesture and symbol: The emergence of language* (pp. 485–528). London: Academic.
- Bridges, A. (1986). Actions and things: What adults talk about to 1-year olds. In S. A. Kuczaj II & M. D. Barret (Eds.), *The development of word meaning: Progress in cognitive development research* (pp. 225–258). New York: Springer-Verlag.
- Brown, R. (1958). How shall a thing be called? *Psychological Review*, 65, 14–21.
- Bruner, J. S. (1975). The ontogenesis of speech acts. *Journal of Child Language*, 2, 1–19.
- Bruner, J. S. (1983). *Child's talk: Learning to use language*. New York: W. W. Norton.
- Carey, S. (1982). Semantic development: The state of the art. In E. Wanner & L. R. Gleitman (Eds.), *Language acquisition: The state of the art*. London and New York: Cambridge University Press.
- Carey, S., & Bartlett, E. (1978). Acquiring a single new word. *Papers and reports on child language development* (No. 15, pp. 17–29). Stanford, CA: Stanford University, Department of Linguistics.
- Chomsky, N. (1965). *Aspects of a theory of syntax*. Cambridge: MIT. Press.
- Chomsky, N. (1976). *Reflections on language*. Glasgow, Scotland: Fontana.
- Clark, E. V. (1973). What's in a word? On the child's acquisition of semantics in his first language. In T. E. Moore (Ed.), *Cognitive development and the acquisition of language*. New York: Academic.
- Clark, E. V. (1978). Strategies for communicating. *Child Development*, 49, 953–959.
- Clark, E. V. (1983). Meanings and concepts. In J. H. Flavell & E. Markman (Eds.), *Cognitive development: Vol. 3. Manual of child psychology* (4th ed.). New York: Wiley.
- Clark, E. (1987). The principle of contrast: A constraint on language acquisition. In B. MacWhinney (Ed.) *Mechanisms of language acquisition* (pp. 1–34). Hillsdale, NJ: Erlbaum.
- Dockrell, J., & Campbell, R. (1986). Lexical acquisition strategies in the preschool child. In S. A. Kuczaj II & M. D. Barrett (Eds.) *The development of word meaning: Progress in cognitive development research* (pp. 121–154). New York: Springer-Verlag.
- Dore, J. (1978). Conditions for the acquisition of speech acts. In I. Markova (Ed.), *The social context of language*. New York: Wiley.
- Dore, J., Franklin, M. B., Miller, R. T., & Ramer, A. L. H. (1976). Transitional phenomena in early language acquisition. *Journal of Child Language*, 3, 13–28.
- Dromi, Esther (1986). The one-word period as a stage in language development: Quantitative and qualitative accounts. In I. Levin (Ed.), *Stage and structure*. Norwood, NJ: Ablex.
- Fischer, K. W., & Bullock, D. (1981). Patterns of data: Sequence, synchrony, and constraint in cognitive development. In K. W. Fischer (Ed.), *Cognitive development* (pp. 1–19). San Francisco: Jossey-Bass.
- Fodor, J. A. (1975). *The language of thought*. New York: Crowell.
- Fodor, J. A. (1981). *Representations*. Cambridge, MA: MIT Press.
- Fremgen, A., & Fay, D. (1980). Overextensions in production and comprehension: A methodological clarification. *Journal of Child Language*, 7, 205–212.
- French, L., & Nelson, K. (1985). *Young children's knowledge of relational terms: Some ifs, ors and buts*. New York: Springer-Verlag.
- Gathercole, V. C. (1987a, April). *The contrastive hypothesis for the acquisition of word meaning: A reconsideration of the evidence*. Paper presented at the biennial meeting of the Society for Research in Child Development, Baltimore, MD.
- Gathercole, V. C. (1987b). The contrastive hypothesis for the acquisition of word meaning: A reconsideration of the theory. *Journal of Child Language*, 14, 493–532.

- Gopnick, A., & Meltzoff, A. N. (1986). Words, plans, things, and locations: Interactions between semantic and cognitive development in the one-word stage. In S. A. Kuczaj II & M. D. Barrett (Eds.), *The development of word meaning: Progress in cognitive development research* (pp. 199–224). New York: Springer-Verlag.
- Gopnick, A., & Meltzoff, A. N. (1987, April). Relationships between categorization, object permanence and means–ends development and the naming explosion. Paper presented at the biennial meeting of the Society for Research in Child Development, Baltimore, MD.
- Greenfield, P. M., & Smith, J. H. (1976). *The structure of communication in early language development*. New York: Academic.
- Huttenlocher, J., & Smiley, P. (1987). Early word meanings: The case of object names. *Cognitive Psychology*, 19, 63–89.
- Karmiloff-Smith, A. (1979). *A functional approach to child language*. Cambridge: Cambridge University Press.
- Keil, F. C. (1979). *Semantic and conceptual development: An ontological perspective*. Cambridge, MA: Harvard University Press.
- Keil, F. C. (1981). Constraints on knowledge and cognitive development. *Psychological Review*, 88, (3), 197–227.
- Kuczaj, S. A., II, & Barrett, M. D. (Eds.). (1986). *The development of word meaning: Progress in cognitive development research*. New York: Springer-Verlag.
- Leopold, W. F. (1939). *Speech development of a bilingual child: A linguist's record: Vol. 1. Vocabulary growth in the first two years*. Evanston, IL: Northwestern University Press.
- Lucariello, J. (1987). Concept formation and its relation to word learning and use in the second year. *Journal of Child Language*, 14, 309–332.
- Lucariello, J., & Nelson, K. (1986). Context effects on lexical specificity in maternal and child discourse. *Journal of Child Language*, 13, 507–522.
- Lyons, J. (1977). *Semantics* (Vol. 1). Cambridge, MA: Cambridge University Press.
- Macnamara, J. (1972). The cognitive basis of language learning in children. *Psychological Review*, 77, 1–13.
- Macnamara, J. (1982). *Names for things*. Cambridge, MA: MIT Press.
- Markman, E. M. (1983). Two different kinds of hierarchical organization. In E. K. Scholnick (Ed.), *New Trends in conceptual representation: Challenges to Piaget's theory?* Hillsdale, NJ: Erlbaum.
- Markman, E. M. (1984). The acquisition and hierarchical organization of categories by children. In C. Sophian (Ed.), *Origins of cognitive skills: The 18th annual Carnegie Symposium on Cognition* (pp. 376–406). Hillsdale, NJ: Erlbaum.
- Markman, E. M., & Hutchinson, J. (1984). Children's sensitivity to constraints on word meaning: Taxonomic vs. thematic relations. *Cognitive Psychology* 16, 1–27.
- McShane, J. (1979). The development of naming. *Linguistics*, 17, 879–905.
- McShane, J. (1980). *Learning to Talk*. Cambridge, MA: Cambridge University Press.
- Merriman, W. E. (1986). Some reasons for the occurrence and eventual correction of children's naming errors. *Child Development*, 57, 942–952.
- Merriman, W. E. (1987, April). *Lexical contrast in toddlers: A reanalysis of the diary evidence*. Paper presented at the biennial meeting of the Society for Research in Child Development, Baltimore, MD.
- Merriman, W. E., & Bowman, L. L. (1987, April) *Developmental studies of lexical contrast*. Paper presented at the biennial meeting of the Society for Research in Child Development, Baltimore, MD.
- Mervis, C. B. (1984). Early lexical development: The contributions of mother and child. In C. Sophian (Ed.), *Origins of cognitive skills: The 18th Annual Carnegie Symposium on Cognition* (pp. 339–370). Hillsdale, NJ: Erlbaum.
- Mervis, C. B., & Long, L. M. (1987, April). *Words refer to whole objects: Young children's*

- interpretation of the referent of a novel word.* Paper presented at the biennial meeting of the Society for Research in Child Development, Baltimore, MD.
- Nelson, K. (1973). Structure and strategy in learning to talk. *Monographs of the Society for Research in Child Development*, 38, (1-2, Serial No. 149).
- Nelson, K. (1974). Concept, word, and sentence: Interrelations in acquisition and development. *Psychological Review*, 81, 267-285.
- Nelson, K. (1981). Individual differences in language development: Implications for development and language. *Developmental Psychology*, 17, 170-187.
- Nelson, K. (1982). The syntagmatics and paradigmatics of conceptual representation. In S. A. Kuczaj II (Ed.), *Language development: Vol. 2. Language, thought and culture*. Hillsdale, NJ: Erlbaum.
- Nelson, K. (1983). The derivation of concepts and categories from event representations. In E. Scholnick (Ed.), *New trends in conceptual representation*. Hillsdale, NJ: Erlbaum.
- Nelson, K. (1985). What's in a name? *Journal of Experimental Psychology: General*, 116, 293-296.
- Nelson, K., & Lucariello, J. (1985). The development of meaning in first words. In M. Barrett (Ed.), *Children's single word speech*. Chichester, England: Wiley.
- Nelson, K. E., & Nelson, K. (1978). Cognitive pendulums and their linguistic realizations. In K. E. Nelson (Ed.), *Children's language*. New York: Gardner Press.
- Nelson, K., Rescorla, L., Gruendel, J., & Benedict, H. (1978). Early lexicons: What do they mean? *Child Development*, 49, 960-968.
- Ninio, A., & Bruner, J. S. (1978). The achievements and antecedents of labelling. *Journal of Child Language*, 5, 1-16.
- Ochs, E., & Schieffelin, B. B. (1984). Language acquisition and socialization: Three developmental stories and their implications. In R. A. Shweder & R. A. Levine (Eds.), *Culture theory: Essays on mind, self, and emotion*. New York: Cambridge University Press.
- Osherson, D. N. (1978). Three conditions on conceptual naturalness. *Cognition*, 6, 263-289.
- Piaget, J. (1962). *Play, dreams and imitations in childhood*. New York: Norton.
- Quine, W. V. O. (1960). *Word and object*. Cambridge, MA: MIT Press.
- Rescorla, L. A. (1976). *Concept formation in word learning*. Unpublished doctoral dissertation, Yale University, New Haven, CT.
- Rescorla, L. A. (1980). Overextension in early language development. *Journal of Child Language*, 7, 321-335.
- Ross, G., Nelson, K., Wetstone, H., & Tanouye, E. (1986). Acquisition and generalization of novel object concepts by young language learners. *Journal of Child Language*, 13, 67-84.
- Savage-Rumbaugh, S., McDonald, K., Sercik, R., Hopkins, W., & Rupert, E. E. (1986). Spontaneous acquisition and communicative use by pygmy chimpanzees (*Pan paniscus*). *Journal of Experimental Psychology: General*, 115, 111-135.
- Seidenberg, M. S., & Pettito, L. A. (1987). Communication, symbolic communication, and language: Comment on Savage-Rumbaugh, McDonald, Sercik, and Rupert (1986). *Journal of Experimental Psychology: General*, 116, 280-287.
- Smith, M., & Locke, J. (Eds.) (1988). *The emergent lexicon*. New York: Academic.
- Terrace, H. (1985). *Thought and language*. Cambridge, MA: MIT Press.
- Watson, R. (1987, April). *Features of discourse and the development of categorical organization*. Paper presented at the biennial meeting of the Society for Research in Child Development, Baltimore, MD.
- Waxman, S. R., & Gelman, R. (1986). Pre-schoolers' use of superordinate relations in classification and language. *Cognitive Development*, 1, 139-156.
- Wittgenstein, L. (1953). *Philosophical investigations*. New York: Macmillan.