Lucariello, Joan

OBJECTS, CONCEPTS, WORDS: RELATIONS IN EARLY DEVELOPMENT

City University of New York PH.D. 1985

OBJECTS, CONCEPTS, WORDS: RELATIONS IN EARLY DEVELOPMENT

by

JOAN LUCARIELLO

A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

1985

This manuscript has been read and accepted for the Graduate Faculty in Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

April 22, 1985
date

Katherine Nelson
Chairman of Examining Committee

April 22, 1985
date

Herbert D. Saltzstein
Executive Officer

Jerome Bruner

Joseph Glick

Katherine Nelson
Supervisory Committee

The City University of New York

Abstract

Objects, Concepts, Words: Relations in Early Development

by

Joan Lucariello

Adviser: Professor Katherine Nelson

This study addressed the question of developmental change in the lexical acquisition process. In the case of developmental differences, the aim was to specify the nature and cause of those differences.

Two groups of infants: Beginner (pre-vocabulary spurt) and Advanced (post-spurt/multi-word utterance) speakers, participated in a concept/word learning experiment. Learning involved mother-child dyads in the repeated enactment of an event incorporating the use of unfamiliar objects, representing the to-be-learned concepts/words. Receptive learning tests were administered. After learning, generalization tasks, testing word extension to concept exemplars and non-exemplars on the basis of perceptual, functional, and relational information about objects, were administered.

Results indicated that Advanced speakers learned more words than Beginner speakers. Additionally, Advanced speakers engaged in all forms of generalization behavior. Their words signified object concepts, in that conceptual knowledge of objects may be defined, in terms of intension, as specifying perceptual, functional, and

relational knowledge about objects, and, in terms of extension, as specifying concept members. Beginner speakers evidenced extremely limited generalization. Their words basically referred only to the learning session objects. These generalization data indicate a developmental shift in word meaning, from referential, defined as the relation holding between a word and a specific, individual object, to denotational, defined as the relation holding between a word and the class of objects to which that word correctly applies.

The following variables did not account for these developmental differences: child age, object permanence development, maternal speech, and child action on objects. Analysis of another variable, the ability to form object concepts, revealed that both speaker groups formed object concepts, though Advanced speakers formed significantly more. However, important group differences were found in the relation between these concepts and the learning and generalization of words associated with them. Beginner speakers evidenced a lack of coordination between their conceptual and lexical systems, accounting for referential word meaning. Advanced speakers evidenced an interrelation between these systems, which affords denotational word meaning. This coordination in systems is also proposed to be responsible for better word and concept learning in Advanced speakers.

Acknowledgements

On this occasion it is appropriate to acknowledge and thank those who have made a significant contribution to one's graduate career. It is my great good fortune to have many people to thank.

First and foremost, I wish to thank my family, particularly my mother, father, and aunt, whose love, support, and patience made my graduate education possible. Leave it to families to make dreams come true.

Special place goes to Katherine Nelson, whom I hold in high esteem. I grew up as a scholar and professional under her mentorship, due to her commitment to my training in theory and research, and her unstinting support. Her contribution to my understanding of language, conceptual, and semantic development is immeasurable. It also means a great deal to me to have Katherine as a close friend. It was my pleasure to share with her the joys, the trials, and the humdrum over the years.

I also want to thank the other members of the dissertation committee. Joe Glick has had a significant hand in my training, always deepening my understanding of whatever the topic. Additionally, he was a good friend, providing encouragement and counsel whenever needed. Jerry Bruner was not only involved with my dissertation research, but has been well-acquainted with other of my research endeavors as well. He has always graciously offered his insights, which served to deepen and broaden the perspectives of the work, and his enthusiastic support was always readily given.

Additionally, I wish to thank Harry Beilin, who has been a

long-term, conscientious, supporter of my career and a good friend. He always demonstrated keen interest in my work, and his comments were always thought provoking. John Dore has been an extender of good will. He has provided me with some of my "liveliest" discussions, and given generously of his time and expertise to many of my research endeavors, and in these ways increased my knowledge in the area of early language. Harry and John served as outside readers on the dissertation, one more thing for which I am grateful to both.

I'd also like to thank Amy Kyratzis, for extending to me such a warm friendship over the years. She is also a colleague, in the truest sense of the word, giving generously of her time, effort, and keen mind to my work, providing insights, critques, challenges, and unwavering support.

And last, but not least, I express my appreciation to the mothers and children for their gracious participation, which made this research possible.

Table of Contents

List of Tables

Introduction

The problem of what children's first words mean is a topic that has generated considerable theoretical and empirical attention as well as controversy. To provide a flavor of the issues and problems, some phenomena characterizing early word use and their attending debates will be noted. There have been raging debates over the degree and significance of the extension (over-, under-, overlap) of first words (e.g., Anglin, 1977; 1983; Bowerman, 1976; 1977; Clark, 1973; 1983; Nelson, Rescorla, Gruendel, & Benedict, 1978; Rescorla, 1980). A second major issue concerns the importance of form and function in early word meaning (e.g., Anglin, 1977; Bowerman, 1976; 1977; Clark, 1973; Nelson, 1974). Another central theme of the debate over early words is the relation between concepts and words, with some proposing that concepts precede word learning (e.g., Bloom, 1973; Nelson, 1974), others proposing that word learning precedes concepts (e.g., Anglin, 1977; Bowerman, 1977).

In addition, developmental phenomena related to early word use have captured the regard of investigators. Two major developmental differences in early word use have been widely documented. One is the finding that, when first acquired, words are often used in a very limited or restricted way. Early words have been thought to be tied to particular referents (Anglin, 1977; Bowerman, 1977; Nelson & Lucariello, in press), or to specific action schemes (Bates, 1979), or to the enactment of particular events, constrained to a spatial/temporal context (Barrett, 1983b; Bloom, 1973; Nelson et al., 1978). Additionally, word learning has been noted to begin as a slow

process in the first half of the second year of life, with a vocabulary spurt or name explosion occurring at approximately mid-point during the second year (Bloom, 1973; Bloom, Lifter, & Broughton, in press; Dore, 1978; McShane, 1979; Nelson, 1973b; Stern, 1930).

Though these phenomena have been widely noted, very few developmental theories of lexical acquisition have been put forward. The best articulated, of those that have been advanced, rely on an attempt to relate developments within cognition, as seen within a Piagetian framework, with changes in word meaning and use. These attempts have not been generally successful, as will be discussed. Moreover, other cognitive accounts have not provided well-delineated descriptions of the cognition-language relation over development.

To adequately account for all the phenomena or characteristics associated with the meaning and use of early words, it appears that a developmental theory of lexical acquisition is required. Such a theory, which relies on a new, and different account of the cognition-language relation, will be investigated in the present research. Existent developmental and non-developmental theories will be reviewed, however, before the proposal is made for this investigation. Moreover, the present research will attempt to resolve some of the controversies noted above by gaining information on the learning of early words, their meaning, their relation to context, their degree of extension, and the basis of their extension.

As noted, numerous theories of children's word meaning can be classified as non-developmental theories. Such theories share the

assumption that there is a single lexical acquisition process, that is, that the lexical acquisition process occurs in the same way throughout development. Such non-developmental theories fall into two general categories. One category may be termed the "word primacy" category. Theories within this category propose that children derive the intension of their lexical terms from referential instances, that is, from their extension. Word-object associations are formed, and the referent object is analyzed along certain dimensions yielding word meaning. These theories disagree on the type of information the child is said to derive and these differences will be discussed shortly.

Theories within the second category, termed the "cognitive primacy" category, share the premise that the intension of a term is experientially derived from all the child's interactions with relevant objects, and is the product of a conceptualization process that depends only minimally on the pairing of words and objects. The child attaches a term to one of his concepts and extends the term thereafter to new instances that match the concept. Several versions of "cognitive primacy" theories will be briefly discussed.

Before proceeding further it is important to explain and define how the notion of concept will be used in this research. While some theories, such as Piaget's (1962) propose that true concepts are not established until the concrete operational period, and are, therefore, subject to rules of logical class structures, other theorists have readily accepted a concept definition whereby intension consists in componential information about concept members (e.g., Bowerman, 1976; 1977; Nelson, 1974; Rescorla, 1980), and extension consists in

knowledge of concept exemplars or members. This view of a concept will be accepted and employed in the present research.

Generally, at least two types of information have been considered to constitute conceptual knowledge of objects, functional and perceptual (e.g., Anglin, 1977; Bowerman, 1977; Clark, 1973; Nelson, 1974; Rescorla, 1980). Such information will be defined as constitutive of conceptual knowledge in the present research. Perceptual knowledge will be defined as knowledge about the appearance of objects, and functional information will be defined as knowledge about the actions that can be applied to individual objects, and the reactions of individual objects. A third type of information will also be considered constitutive of conceptual knowledge in the present research. This information will be termed relational-functional, and it is defined as information about how individual objects relate to other objects or materials in conventional use. While there is great debate as to how the properties or features of concepts are structured, for example, according to a classical view, in terms of necessary and sufficient features, or in a more probabalistic manner, or by exemplar (see Smith & Medin, 1981 for review) no position on this issue is implied or taken here.

While many theories of children's word meaning can be thought of as non-developmental, a few important developmental theories have been advanced. These theories share the assumption that the word acquisition process is affected by developmental changes, that is, that at different points in development word acquisition proceeds differently. Within such theories development has been defined along

cognitive dimensions, and also along language dimensions.

The review of the literature will proceed first to a discussion of the two categories of non-developmental theories. Following this discussion, important developmental theories will be reviewed. After the literature review a brief discussion of the purposes and predictions of the present research will be presented.

Word Primacy Theories

"Word primacy" theories may be classified as positing that from word-object pairings the child derives either concepts, or information about objects, such as features or contrasts which have relevance within a semantic field. As for theories positing a conceptual product, Brown (1956) put forward such an account in "The Original Word Game" proposal, stating that the tutor says "dog" whenever a dog appears, and the player notes the equivalence of these utterances, forms a hypothesis about the non-linguistic category that elicits this kind of utterance, and then tries naming a few dogs himself.

A more recent account based on a prototype or perceptual schema model has been advanced by Anglin (1977). Anglin proposed that the prototype would be based upon the first object which is named in the presence of the child, and would consist in whatever perceptual information the child remembered of that object. The prototype is thought to become a more generalized conception as the child encounters more instances, and is also thought to be multi-modal incorporating perceptual information about what those instances look like, the sounds they make, how they feel, how they move, and the contexts in which they occur.

A similar account has been proposed by Bowerman (1976; 1977). According to this model the child hears a word modeled most frequently, often exclusively, in connection with one referent or a small group of highly similar referents. The first referent of the name serves as a prototype for future referents. The child's first use of the word occurs in connection with one of these referents. After some time, the child begins to extend the word to referents that are similar to the original referent(s) in specifiable and consistent ways. Bowerman takes this as an indication that the child has imposed a featural analysis on the original referent such that he is now capable of recognizing two or more of its attributes independently, that is, in situations in which they do not co-occur blended into a single package, but rather are re-combined with entirely different contextual features. Among the attributes the child comes to recognize as components of a given prototypical referent are perceptual properties or configurations, associated actions, spatial relationships, purpose or end state, and the child's viewing position.

The Anglin and Bowerman accounts differ in that Anglin argues that the prototypes are not analyzed into components or criterial attributes. He bases this claim on child overextension data which he gathered. He found that children will usually include instances rated as central to concepts, whereas they will often not include instances rated as peripheral. In addition, the data indicated that overextensions were predominantly to noninstances which were perceptually similar, particularly in shape, to instances of the concept overgeneralized, suggesting that when children assign objects

to categories they employ their knowledge of the typical form of the instances of a given concept, a prototype.

One major problem with theories positing that conceptual knowledge is derived from referential instances is that they provide no place for the cognitive activity which occurs, and the conceptual knowledge acquired, throughout the infancy period. Research has indicated that concepts of objects, states, and events are formed in infancy (see Clark, 1983 for review), and referential-conceptual theories do not explain what role, if any, such knowledge plays in the word learning process.

"Word primacy" theories positing the establishment of some kind of semantic knowledge from the word-object pairing include Clark's (1973) Semantic Feature Hypothesis (SFH), and the lexical contrast model put forward by Barrett (1978). The Semantic Feature Hypothesis assumed a universal set of semantic primitives and that semantic knowledge is closely related to the human organism's interpretation of perceptual inputs. By this account, the child extracts perceptual features from the examples named, and uses those to identify new referents of the label.

At the level of first words semantic features appear to be identical to perceptual features. The child initially attaches words to only one or two features of the word's referents. So, for example, in the case of dog, the child might initially characterize the word dog as meaning only four-legged. The word then would be extended to other four-legged animals such as horse and cow. At this point the child has only a partial entry for the meaning of the word. The

acquisition of semantic knowledge would consist of the adding of features of meaning to the lexical entry for that word until the child's combination of features in the entry for that word corresponds to the full adult meaning. One major assumption here is that meanings break down into combinations of units, components, or features smaller than than those represented by words.

Initial evidence for the SFH came from the analysis of children's extension of terms after they were first acquired. The majority of overextensions reported in the nineteenth and twentieth century diary studies were based on similar perceptual properties between the objects or events that were included referentially within a single category. The finding that children rely on perceptual features for applying words to new referents has been well-substantiated (Anglin, 1977; Bowerman, 1977, 1976; Rescorla, 1980). There are, however, several problems with the SFH, as noted by Clark (1983) and Nelson (1974; in press). One set of problems relates to the semantic features themselves. The criteria for identifying them were vague, there was confusion between semantic features and perceptual ones, and their status vis-a-vis features postulated in accounts of adult meaning was unclear.

There were other problems with the SFH as well. The addition of features to lexical entries was designated as the only process involved in word learning. Under-extensions and overlaps, however, were found to be characteristic of the child's first use of words (Anglin, 1977; 1983; Bowerman, 1976; 1977, Nelson, 1973b), and both these require the dropping of semantic features as well. Moreover, it

was found that children often do not over-extend in comprehension words they over-extend in production (Fremgen & Fay, 1980; Thomson & Chapman, 1977), and the SFH could not account for the difference in feature structure in comprehension and production. A final blow to the theory comes from the finding that children can learn a concept from a single exemplar (Nelson & Bonvillian, 1978; Ross, Nelson, Wetstone & Tanouye, in press), indicating that learning the meaning of a lexical item through the process of abstracting critical features from groups of related positive examples is not necessary.

Another "word primacy" theory positing the establishment of semantic knowledge from the pairing of words with referential instances has not relied on semantic features but rather on the notion of contrasts. The interrelated nature of the meanings of words which serve to subdivide a single semantic field was noted by de Saussure (1915/1959). Within the same language, all words used to express related ideas were said to limit each other reciprocally. Barrett (1978), relying on this conception of word meaning, put forward a lexical contrast model that differed from Clark's (1973) model in that it did not involve the acquisition of components, but on the differentiation of a semantic field in terms of contrasts.

Barrett (1978) argued that the meaning of a referential term could not be acquired by an abstraction from just the referents of the word, but could be acquired by an abstraction of the contrasts between positive and negative referential instances. The introduction of negative instances entails a characterization of meaning, not in terms of criterial features, but in terms of contrasts which exist between

the extensions of related words. This hypothesis presupposed that the child could identify, prior to the abstraction of contrasts, the semantic field, the set of terms, within which the contrasts were to be drawn.

The process went as follows. The child would first define a semantic field, such as animal, and then pick out dimensions along which members contrast. For example, the possession of body hair and hooves are contrasts by means of which the semantic field of animal terms is subdivided. Thus, bears and dogs are differentiated from sheep and horses. Bears and dogs could then be differentiated from one another by further contrasts, such as differences in bodily configuration. As can be seen here, contrasts are not componential but relational.

The major prediction of this contrastive hypothesis was that words would not be overextended by a child to label an object for which the child had already acquired a more appropriate name. This prediction is a consequence of the interrelated nature of the meanings of words, such that if the appropriate name for an object is known (i.e., the extension of that word is differentiated from the extension of the other words within the same semantic domain), then the use of an inappropriate name for that object should not occur (the extension of the words within a semantic field being mutually exclusive). Barrett (1978) tested this prediction through an analysis of the data available from some early diary studies, and found it strongly supported.

There are, however, several problems with Barrett's account. One

problem noted by Nelson (in press) is that the contrasts are perceptual, and perceptual contrasts may not be adequate to subdivide the semantic field. For example, contrasts such as domestic-wild in the animal domain are not perceptually based, thus, a more abstract system must be posited. Additionally, the finding that children can learn a concept from a single positive exemplar, and will generalize the concept to similar objects (Nelson & Bonvillian, 1978; Ross et al., in press), calls into question the claim that negative referential instances are necessary to acquire the meaning of a referential term. Moreover, comprehension studies have shown that a child may use a general term in production, but understand more specific terms for the same referents receptively (Fremgen & Fay, 1980; Thomson & Chapman, 1977), thereby refuting the main claim of a contrastive theory that a word will not be extended to a referent for which a more appropriate term has been learned.

Additionally, recent research on early cognition (Sugarman, 1983) indicates that it is not until 24 months that children can form two class groupings, thereby manifesting the ability to consider two or more categories at once. Such an ability would be necessary to perform the compare and contrast operations on members of a semantic field posited by Barrett as essential to the word meaning acquisition process. Thus, Barrett's account may not be applicable to the early word learning period.

There are several problems, in general, involved in the application of semantic theories to early word learning by children. The proposals of Clark (1973) and Barrett (1978; 1983a) posit that

abstract semantic knowledge is available to the child, and they assume that children's vocabularies are organized from the outset along lines similar to adults', in particular, that they can be defined along the lines of terms within a semantic domain. However, there are critical problems related to the notion of a semantic field. How is a semantic field established by the child? How extensive is it for a child? What is a semantic field for the child? Perhaps, the establishment of semantic domains, and the discovery of dimensions of contrast within these domains are developmental achievements.

An additional problem for such theories, as noted by Nelson (1979b), is that they fall prey to an analytic fallacy, which consists in the tendency to analyze a completed system into its component parts, and then assume that this analysis can be used to explain the development of the system. This process, however, is insufficient to determine how the system was built up.

Before leaving a discussion of "word primacy" theories, it is important to note that such theories have paid virtually no attention to the complexities involved in associating a word with a referential instance. Bruner (1983), however, has described the complexities involved in achieving reference as this is accomplished within a social interactive framework. Bruner employs Putnam's philosophical theory of reference, which presupposes four things: 1. that individuals can signal to each other that they have referential intent, 2. that reference can vary in precision from vagueness to a proper singular, definite referring expression, 3. that reference is a form of social interaction having to do with the management of joint

attention, 4. that there is a goal-structure in referring.

Bruner (1983) provides a rich description of how a single mother-child dyad come to reach agreement about what a thing shall be called within the context of book-reading. The mother provides a "reading format" consisting of four key utterance types: the attentional vocative, the query, the label, and the feedback utterance. The child becomes increasingly able during the second year of life to participate in the format, and due to a "scaffolding" mother the child's contributions become increasingly more sophisticated, moving from incoherent long babbles, to lexeme-length babbles, to words. Bruner states that reference is dependent not only on mastering the relationship between sign and significate, but also upon using social procedures in concert with one another to assure that the sign and the significate that become linked overlap in some negotiable way with the uses of others. In contrast to these considerations, "word primacy" theories simply assume the referential relation.

Cognitive Primacy Theories

As noted above, conceptually-based theories share the premise that the intension of a term is an internal construction, the product of a conceptualization process, that needs little or no direct language input. A couple of such theories will be briefly reviewed.

A conceptual model which received a good deal of theoretical and research attention was the Functional Core Model (FCM) proposed by Nelson (1974). This model assumed that prior to learning words children had formed concepts, and that early words were attached to

these concepts. The concepts the child constructed had a functional basis in the child's own experience, and their functional basis was evident in the kinds of things children chose to name, the vast majority of which were dynamic, not static, objects (Nelson, 1973b).

The child's concepts were formed on the basis of experience with objects in functional situations, and they included information about actions and reactions of objects in relation to people, especially the child himself. Nelson (1979a) later elaborated on the notion of function extending it to include the actions of things, actions on things, reactions of things, and the conventional uses of things. The resulting concept was said to be formed around a functional "core", and less critical information about the object, such as perceptual features used for its identification lay outside the core, and was derived from an analysis of the whole (object) into its parts. Attributes were derived after the concept was formed. In summary, the course of concept formation proceeded from the identification of a single interesting object in a functionally important context; identification of critical features for recognition; attaching a word to the resulting concept. The internal structure of the concept was hypothesized to be hierarchical, with function dominating perceptual information.

There has been some research to support the FCM. Nelson (1973a) found that the function of objects is a primary basis for categorization for infants. Pre-verbal infants (8-12 months) have been found to attend to and remember the reactions of things, their dynamic qualities over and above their static perceptual qualities

(color and form), and to react with greater attention to changes in the dynamic qualities than to changes in the formal qualities (see Nelson, 1979a for review). In addition, a study of concept learning by Ross et al. (in press) demonstrated that objects which provided the most distinctive actional information were learned most effectively. Moreover, Nelson and Bonvillian (1973) found a positive correlation between appropriate concept naming and concept-specific action with 16- and 17-month olds.

Another version of a conceptually based theory is proposed by Rescorla (1980), who studied overextension in the early vocabularies of six children, followed in a language diary study from 1;0-1;8. Rescorla, having found associative complexes (Vygotsky, 1962; Bowerman, 1976; 1977) to be a common form of early extension, put forth a componential model that views word meaning as associative complexes.

She proposed that the child brought to the word learning task considerable information about the referents of words. Four types of information served as the basis for word application in her data: knowledge about the appearance of objects, information about their function and action properties, affective responses to objects and events, and knowledge about how objects and events are organized in time and space. This information has been distilled by the child from his encounters with a particular referent, and become the meaning components, or the concept, of the word he learns to associate with that referent.

Rescorla's (1980) model shares much in common with Nelson's 1974 model. One principle common to both is that the child's encounters with an object serve as the means for deriving conceptual knowledge. In addition, Rescorla proposed, as Nelson before her, that while the child's concepts consist in a collection of discrete elements, the elements have differential salience and some internal structure.

Developmental Theories

Many developmental theories of children's word meaning involve viewing changes in the word acquisition process as contingent on or related to cognitive development. Such theories, however, have differed in their accounts of cognitive development and its impact on word meaning, and thus each theory will be discussed in turn.

Piaget (1962) described the process of transformation of sensorimotor schemas into true concepts and the meaning of words in relation to this process. The first verbal schemas of the sensorimotor period fall short of being concepts for two reasons. First, their meanings constantly change. Second, they are intermediate between the individual symbol and the sign which is properly social.

During the preoperational stage, the functional precursors of true concepts used by the young child are preconcepts. The critical characteristic of the preconcept is that it achieves neither true generality nor true individuality, but is said to fluctuate between the two extremes. The true concept, which is not established until the operational period, is subject to the rules of logical class structures, and has a fixed socially determined definition.

Many theorists of children's first words have conducted their investigations within a Piagetian framework. Bloom (1973) presented an analysis of her daughter's speech from first words at 9-10 months to productive syntax at 22 months. For the first half of this period, until about 17 months, a small group of words, including names for persons and function words such as "more", "gone" and "up", were used more persistently and more frequently than substantive terms. In trying to explain the less extensive and less stable use of substantive forms in the first half of the second year, and their increased and stable usage starting at about 17 months, Bloom relied on Piaget's account of sensorimotor intelligence.

She argued that learning the names for objects depends upon perceiving and discriminating among figurative aspects of things, so that certain things form a class. The mental representation of such a class of things was said to be a summary of perceptual attributes such that new members of the class could be recognized and included. Bloom (1973) concluded that this was more difficult during the first half of the second year than organizing experiences of perceptually different objects according to salient and recurring behaviors which they have in common. She concluded that the summary mental representation of an object class that can be mapped onto a word is a later and more difficult achievement, dependent on the achievement of object constancy in the end of the second year.

Bloom (1973) documented, moreover, chain complexes (Vygotsky, 1962; Werner, 1948) in characterizing the use of substantive terms early in the one-word stage. She interpreted complexive usage as an

index of the lack of the concept of object permanence.

One major problem associated with Bloom's (1973) data is that she had no independent measure of the development of the object concept for her daughter. Additionally, data on the word use of other children have not supported the finding that complexive usage characterizes the first phase of the developmental history of children's words, nor that substantive forms are less frequently and less stably used than function forms at the start of the one-word stage (see Bowerman, 1976; 1977; Corrigan, 1978; Nelson, 1973b; Rescorla, 1980).

Ingram (1978), in attempting to ascertain the degree to which sensorimotor development is related to the word acquisition process analyzed data from Piaget's own children as well as data from diary studies, and found some correspondence between sensorimotor Stage V and the onset of first words, and, additionally, that rapid vocabulary growth did not occur until Stage 6, supporting the claim that such growth is contingent upon the achievement of object permanence. However, Corrigan (1978) found only a rough correspondence between the onset of Stage VI of object permanence and the onset of single-word utterances. In addition, there are reported instances of children using multi-word utterances prior to achieving object permanence (Corrigan, 1978; Ingram, 1978). Moreover, Bates, Benigni, Bretherton, Camaioni, and Volterra (1977) failed to find significant correlations between object permanence development and their language production measures.

The above-cited studies have dealt with the relation between

object permanence development and production measures. However, Miller, Chapman, Branston, and Reichle (1980) studied the relation between object permanence development and language comprehension. They arranged comprehension items in order of increasing difficulty, producing the following scheme: 1. understanding single words for present people or objects, 2. understanding single words for actions, 3. understanding single words for absent people or objects, 4. understanding two words for semantic relations, such as action-object, agent-action, and 5. understanding three words for agent-action-object. They found that Stage VI functioning was clearly not a necessary prerequisite for the comprehension of most of their items, including those involving the comprehension of words for absent people or objects and the comprehension of at least two words in an utterance.

It appears then that most of the data do not support the position that the cognitive bases of language reside in the child's developing knowledge about objects in general. In fact, it has been proposed, and there is some evidence to indicate, that the child's knowledge of a class of objects may be a more important source of knowledge underlying early words (Freeman, Lloyd, & Sinha, 1980).

A new approach to the study of these issues comes from Bloom et al. (in press). These investigators, still concerned with the relation between cognitive development, within a Piagetian framework, and word learning, studied three children's sensorimotor development as it was evidenced in naturally occurring play situations, attempting to make developmental comparisons with naturally occurring language

behaviors, such as the onset of first words and the vocabulary spurt. Two aspects of the object behavior in the children's spontaneous play were examined: 1. displacing objects in relation to one another for evidence of reversible activity in sensorimotor action schemes, and 2. finding or locating objects to use in displacement activities, for evidence of object permanence.

Results indicated that developments in children's object knowledge were only generally consistent with their performance on the Uzgiris and Hunt (1975) scale of object permanence development. These investigators proposed that objective scales may have to do with solving a particular problem or performing a particular task, and may not reflect the progressive organization of underlying thought in development. Moreover, they proposed that mental representation is not an achievement at the end of the sensorimotor period; rather it constitutes the development that occurs within that period.

These investigators did find a relationship between developments in object knowledge, as evidenced in play behavior, and language. The emergence of first words was preceded by the emergence of constructions in play, that is, by a reorganization of schemes from subject-object to object-object. Additionally, the vocabulary spurt occurred subsequent to developments of reversibility, and subsequent or coexistent with increasing evidence of the ability to represent relations between objects. Thus, further developments in mental representation beyond what was required for first words were required for the vocabulary spurt. However, the most mature level in the development of object permanence was not required for the vocabulary

spurt.

In response to these findings, Bloom et al. (in press) proposed a model of the relation between cognition and language which differs from the model proposed by Bloom (1973). Bloom's earlier model advanced a unidirectional, serial, or parallel relation between cognition and language, such that developments in cognition support developments in language. The model put forward by Bloom et al. (in press), however, proposes an overlapping and synergistic relation between cognition and language. While relations between early words and early aspects of object knowledge may be serial relations to begin with, the language that the child knows, as it is itself developing, is said to inform, as much as it is informed by, the child's developing understanding of reality. For example, Bloom et al. (in press) suggest that the vocabulary spurt itself may guide children's continuing development of knowledge about objects, and serve as an indication of the mutual and overlapping developmental relation between the two domains.

A note of caution is in order, however, in interpreting the findings and conclusions of Bloom et al. (in press). The data are based on a very small sample size, consisting in three subjects. In addition, some inconsistencies among the children were found regarding the relation between object knowledge and the emergence of first words. In two of the children, first words emerged in late Stage 5 and near the transition to Stage 6, while in the third child, first words did not emerge until late Stage 6.

Another theory dealing with cognitive development and its

relation to the word acquisition process has been advanced by Nelson (in press) and Nelson and Lucariello (in press). This theory rested on an account of cognitive development put forward by Nelson (1982; 1983; in press). This account proposed that the child's initial mental representations are in the form of schemas for familiar events involving social interaction. An event schema is a structured whole representing a sequential activity, organized in terms of temporal and causal relations between component acts. It specifies the roles that people play and the objects that complement the actions in the course of the activity. It is a generalized representation of an activity that has occurred more than once. There is evidence that by one year of age the child has a number of schemas that guide action and interaction in familiar routines (Ashmead & Perlmutter, 1980; Bruner, 1978; Nelson, 1978; Ratner & Bruner, 1978; Schank & Abelson, 1977).

According to Nelson, an object concept may be seen as an achievement by way of an abstraction of the consistent appearance in an event schema of a particular object or set of objects in a system of recurrent relationships. The creation of an object concept involves the establishment of a decontextualized unit apart from its situationally contextualized particulars. During the first half of the second year the event schema is thought to remain wholistic, that is, unanalyzed. Toward the middle of the second year (15 - 20 months), the event schema is thought to be subjected to cognitive analysis yielding concepts of its component parts (e.g., actions, objects). The basis for this proposed timing was an attempt by Nelson to account for developmental changes in word use in the second year of

life, consisting in a vocabulary spurt occurring on the average at 19 months. Object concepts, which prior to this were represented only in terms of a system of relationships, now were thought to achieve representation independent of the event representation.

In considering what bearing this view of conceptual development has on word meaning, Nelson (in press) and Nelson and Lucariello (in press) proposed that object words acquired and used prior to the partitioning of the event schema do not signify independent object concepts. Rather they are thought to either signify a concept of the event activity as a whole, or to mean non-conceptually, by serving to refer only to specific, individual objects in their original event contexts. Words acquired and used after a system of discrete object concepts has been established through the cognitive analytic process can signify object concepts. The vocabulary spurt often noted to occur at approximately 19 months (Bloom, 1973; Dore, 1978; McShane, 1979; Nelson, 1973b; Stern, 1930), and the onset of multi-word utterances are said to be indices of the attachment of words to these newly formed concepts.

Thus, according to this theory, word meaning is said to undergo a shift from referential meaning, defined by Lyons (1977) as the relationship which holds between terms and specific individuals, to denotational meaning, defined by Lyons (1977) as the relationship which holds between a lexeme and the class of objects to which that lexeme correctly applies. Developments in the conceptual system are thought to underlie the shift.

These proposals have not been investigated directly, but some

support for such a shift comes from a study by Oviatt (1982). Oviatt trained three groups of infants: 12-, 15-, and 18-month-olds, on the name of a novel animal. Infants in all age groups demonstrated comprehension of the name of the unfamiliar animal, thereby evidencing referential word meaning in receptive language. However, in an additional task to discover when the infants would use the newly learned name to designate novel representations (instances), Oviatt found no difference in performance between the 12- and 15-month-olds, with both these groups unable to correctly designate the novel target referent. Performance improved substantially, however, between 15 and 18 months. This task requires denotational word meaning because it requires conceptual knowledge in terms of extension, that is, the specification of instances that count as members, and the application of a name to a novel instance.

Barrett (1983a; 1983b) re-formulated his original model along the lines proposed by Nelson (in press) and Nelson and Lucariello (in press) to better account for his own recent data, as well as the data of others, indicating that early object terms are initially used in highly specific behavioral contexts (Bates, 1979; Bloom, 1973; Nelson et al., 1978). Relying on Nelson's (1982; 1983; in press) account of early cognition, Barrett proposed that at the outset of lexical acquisition, the child's conceptual system consists, to some extent, in event schemas. Words are said to go through various event-bound uses before the mental representation of a particular object becomes disembedded from the schema, and forms a prototypical referent for a word.

Barrett (1983a) describes the process from here, relying on some of the key concepts of his earlier (1978) model. The child identifies some of the principal perceptual and functional features that characterize the prototypical referents, and then groups these prototypical referents into semantic fields. The child then identifies those features which serve to differentiate the prototypes which are grouped in any particular semantic field from one another. This semantic aspect of Barrett's recent proposal is subject to the same critique leveled at his earlier (1978) model.

Barrett (1983b) notes three general points in relation to this word acquisition process that prevent its classification as a developmental theory, and that highlight the differences between his account and the account offered by Nelson (in press) and Nelson and Lucariello (in press). He proposes that not every word acquired in the second year is initially used in an event-bound manner, not every word undergoes de-contextualization, that is, some words remain event-bound, and de-contextualization occurs at different times for different words.

Since this recent account of Barrett's views words as attaching to concepts once de-contextualization is achieved, this theory may be classified as a "cognitive primacy" theory. It cannot be classified as a developmental theory, however, because presumably this same process of lexical acquisition occurs throughout development. In addition, the changes in use and meaning which the word undergoes throughout this process are not linked to broad developmental changes in the cognitive or language systems.

One additional cognitive developmental theory, thought to bear on word learning, will be reviewed here. This theory has been proposed by Rosch, Mervis, Gray, Johnson, and Boyes-Braem (1976). In studying the categorization of natural objects they found one level of abstraction, the basic level, to be more fundamental than the other levels (superordinate, subordinate). This level is the most general at which category members have similar overall shapes, and the most general one at which a person uses similar motor actions for interacting with category members. While categories at all levels are considered to be based on correlated attribute clusters, the correlations are said to be most apparent for the basic level categories.

Rosch et al. (1976) proposed that children would be able to categorize at the basic level before being able to categorize at other levels of abstraction, and that names at the basic level should be the first concrete nouns acquired in the language development of the child. The order of acquisition of category levels and terms has become the subject of considerable research activity in recent years, and such work has supported the primacy of the basic level (see Anglin, 1977; Brown, 1958; Daehler, Lonardo, & Bukatko, 1979; Horton & Markman, 1980; Mervis & Crisafi, 1982; Rosch et al., 1976).

One major problem with the Roschian proposal, however, is that what underlies the child's increasing ability to categorize (and name) at other levels of the hierarchy is not well specified. One can presume that some developments in cognition support this move, since the correlated attribute clusters of the real world are unchanging.

Yet, the nature of these cognitive changes is unclear.

A developmental theory viewing development along the language dimension has recently been put forward by Clark (1983). She proposed a theory, Lexical Contrast theory, which has many features in common with Barrett's (1978) proposal. Clark states that in acquiring meanings, children work off two basic principles of language and lexical organization - contrast and conventionality. The Principle of Contrast, as noted by de Saussure (1915/1959), states that the conventional meaning of every pair of words contrasts. The Principle of Conventionality states that for meanings there is a conventional word that should be used in the language community.

According to Clark the goal of the word-learner is to fill lexical gaps, and this goal encompasses two major assumptions. One is that children will look for new words as they become aware of a gap, that is, aware of wanting to talk about a particular category and finding no word readily available for it. Second, when children hear new words, they assume that those words contrast with ones they already know, and that they must therefore map onto hitherto unlabeled conceptual categories. To support her theoretical formulation Clark (1983) documents three phenomena associated with children's early word use that can be taken to indicate that children are attempting to fill lexical gaps: overextensions, general purpose words such as demonstratives, and coinages, whereby children construct new word forms to carry new meanings.

Clark proposes that in the earliest stages words map onto concepts, in that children look for words to label categories that are

salient to them. However, as soon as children acquire some language (the level is left unspecified), Clark states that not only can contrasting categories trigger a search for contrasting words, but exposure to new words can trigger a search for the relevant conceptual contrasts. Thus, with development in language, the lexical acquisition process undergoes a change.

There are a couple of problems with Clark's latest formulation, however. She is insistent upon maintaining the distinction between conceptual categories and word meaning, seeing lexical meaning as an entity separate from the concept. Clark, however, provides no specification of what lexical meaning is, and how it is distinct from conceptual categories. In fact, she conflates the two by arguing that the word-learner is using words to flag and talk about conceptual categories. In addition, as is the case with semantic theories, she posits that early word learning proceeds within the structure provided by semantic domains. As already noted, however, the attribution of semantic knowledge to the child overlooks the problem of how the child acquires such knowledge, and what this knowledge consists in for the child.

Summary

Non-developmental theories cannot account for any developmental phenomena associated with early word use and meaning. Of such theories, "word primacy" theories do not consider pre-linguistic cognitive processing and conceptual knowledge as it relates to the word learning process. Semantic theories, whether they are non-developmental, "word primacy" theories, or whether they are

integrated into developmental accounts, involve the application of adult models of word learning and lexical meaning to the child. Cognitive developmental theories which have relied on a Piagetian framework in explaining phenomena associated with early word use and meaning have not received much empirical support. It appears necessary to look in the direction of a developmental model, which relies on a different framework of early cognitive development, in attempting to explain early word use and meaning.

Purposes and Predictions of Present Research

The purpose of the present research is to study developmental changes in word acquisition and use during the second year, in relation to cognitive development. The particular developmental phenomena under consideration are the move from context-bound to contextually flexible usage of words, and the vocabulary spurt noted to occur midway during the second year of life.

It was hypothesized that conceptual development, as outlined by Nelson (1982; 1983; in press), that is, developmental differences in the ability to form object concepts, in contrast to general knowledge about objects, underlies developmental differences in word use. This account of conceptual development proposes that conceptual representation in the first half of the second year of life consists in the representation of event schemas, with independent object concepts established in the second half of the second year of life, after these schemas are subjected to analysis. The hypothesized effect on word meaning, as proposed by Nelson (in press) and Nelson and Lucariello (in press), includes a developmental shift in word meaning from referential, whereby words refer to particular objects within specific situational, activity contexts, during the first half of the second year of life, to denotational, whereby words refer to a class of objects, in the second half of the second year of life.

To examine these proposals, the learning of concepts and words for unfamiliar objects was studied in two groups of children. One group was comprised of infants approximately 15-19 months who were in the one-word phase, prior to the vocabulary spurt. The second group

consisted of infants approximately 18-23 months, who had already undergone a vocabulary spurt and were producing multi-word utterances. The to-be-learned objects were incorporated into an activity repeatedly enacted by the infants. This ensured that the objects would take on functional and relational meaning for the child.

Object concept formation was studied by examining child behavior with new exemplars and non-exemplars of the original learning session objects, once learning had taken place. It was predicted that the beginner/younger speakers would not establish independent concepts of the to-be-learned objects, whereas the advanced/older speakers would. General knowledge about objects was studied by ascertaining child level of object permanence development.

Word learning was studied through the administration of a comprehension test. Since this test involved the identification of learning session objects in response to words, outside of the activity and situational context in which they were learned, and apart from acting on them, this task could serve to index the level of the context relatedness of early words.

Word use was studied as well. To ascertain the degree of extension of early words, and the basis of their extension (e.g., functional, perceptual), several types of generalization tasks were administered. It was hypothesized that the words of beginner/younger speakers would be greatly limited in extension, whereas the words of advanced/older speakers would be broadly extended, reflecting their conceptual meaning. The formation of object concepts and general knowledge about objects were studied in relation to these predictions

about word learning and use.

In addition, other possible influences on concept and/or word learning were examined. These included variables, such as maternal speech and child action on objects, gleaned from the literature as potentially important to these processes.

Method

Subjects

Ten infants served as subjects in what was designated as the Beginner speaker group. There were 6 males and 4 females, ranging in age from 15.0 to 19.0 months at the start of the study (Mean age = 16.9 months). These infants had productive vocabularies ranging from ten to forty words at the start of the study (Mean number of words = 25.3). By study's end their vocabularies did not exceed fifty words, and none produced multi-word utterances. Ten additional infants served as subjects in what was designated as the Advanced speaker group. There were 4 males and 6 females, ranging in age from 17.9 to 23.5 months at the start of the study (Mean age = 20.0 months). Each of these infants had productive vocabularies of fifty words or more, and each was producing multi-word utterances at the start of the study. Information about the child's linguistic history and status, which served as the basis for assignment to speaker group, was gathered from an interview with each mother. A copy of the maternal interview form appears in the Appendix.

All infants were children of white, middle-class parents. All were full-term babies, none had been subjected to trauma at birth, and none had any major medical problems during infancy. Information on the child's medical history was gathered through the maternal interview. These infants were recruited through notices sent to organizations, such as the YMCA and parenting groups, which sponsor programs for mothers and/or toddlers in the New York metropolitan

area.

Three additional infants were dropped from the study. One was lost due to the mother's resigning the study after completing only two learning sessions. The data from two other dyads were not included in the analyses, though these dyads had completed the study, because, in one case, the infant had initially been assigned to the Beginner speaker group, but began producing multi-word utterances in the midst of the study, and in the other case, at the start of the study the child was 24 months of age, and it was later decided that this was too advanced an age for inclusion in the study.

Design and Procedure

Each mother-infant dyad made five visits to the laboratory. These visits occurred within a 2.7-5.4 week span (Mean number of days Beginner speaker group = 30.2; Mean number of days Advanced speaker group = 28.6). The following events occurred during these laboratory visits.

Maternal Interview. On the first laboratory visit a maternal interview was conducted. The purpose of this interview was to gain information on the medical history of the mother and child, the language history of the child, and to ascertain that the child was unfamiliar with the to-be-learned objects.

Object Permanence Scale. On the first laboratory visit a scale of object permanence development constructed by Miller et al. (1980) was administered. A copy of this scale appears in the Appendix. This scale is comprised of items taken from existing sensorimotor assessment instruments: Uzgiris and Hunt Ordinal Scales of

Psychological Development (Uzgiris & Hunt, 1975), Albert Einstein Scale of Sensorimotor Development (Corman & Escalona, 1969; unpublished), an observational system of assessment of sensorimotor behaviors (Chatelanat & Schoggen, 1975), and the scale arranged by Mehrabian and Williams (1971). Additionally, one item on the scale was designed from Piaget's original work (1952; 1954; 1962). The origin of each item on the scale is noted on the scale. Due to state problems, the scale could not be administered to two infants in the Beginner group on the first visit, and thus the scale was administered to these infants on the next visit.

Learning Sessions. On the first visit the first learning session was conducted. There were a total of 4 learning sessions, and the remaining three were conducted on each of three subsequent visits, in an identical manner to the first. The learning sessions consisted in an event enactment by each mother-child dyad. The event was termed "making pizza", and it incorporated the use of five real-world objects, unfamiliar to the child. These objects represented the to-be-learned concepts/words. They were: sifter, board, rolling pin, chopper, and baster. It was assured at the start of the study that each mother knew the names of these objects. Only one exemplar of each object was used throughout the learning sessions.

The actions constituting the event enactment were as follows:

1. spoon flour into sifter
2. sift flour onto the board
3. put ball of dough on board
4. roll dough flat with rolling pin

5. put cheese in chopper
6. chop cheese in chopper
7. remove cheese from chopper
8. sprinkle cheese on dough
9. fill baster with water
10. squeeze water on dough

A chart listing these actions was hung in the room where the learning sessions were conducted. All the necessary materials were present in the room, and always arranged in the same manner. Each mother was familiarized with these actions, told to perform them in sequence, to take as much time as needed to complete the event, and to allow her child to participate in the activity as much as she deemed appropriate. In terms of object labelling, mothers were told to name the objects as they normally would name objects for their children.

Most event enactments were of approximately 5-10 minutes. These enactments were audio- and video-recorded, while the experimenter observed from another room. The mother was told that the experimenter would return upon completion of the event. Mothers were instructed not to mention the learning sessions and the objects to their children between laboratory visits.

Comprehension Task. Upon completion of each learning session, the experimenter administered a multiple-choice receptive learning test to each child. For these test sessions, all pizza-making props (e.g., cheese, dough, flour, water) were removed from sight.

The tests were constructed in the following manner. Four tests were constructed, each to be administered to every child after a

different learning session. Thus, there were comprehension tests 1, 2, 3 and 4. Each of these tests consisted in two 5-trial-sets. Each of the five objects was requested once in the first 5-trial-set, and once in the second 5-trial-set. The order in which the five objects were requested per trial set was always distinct, both within and across tests. Within tests, the object requested at the end of the first 5-trial-set was always different from the object requested at the start of the second 5-trial-set.

Each trial array consisted of 3 objects, the requested item and two non-requested items. The objects comprising the arrays were exact replicas of the learning session objects. As noted, within each test, each object was requested twice. Across both requests for a specific object, the requested object always appeared with every other object. So, for example, if upon the first request for the board, the board appeared with the chopper and baster, upon the second request it appeared with the rolling pin and sifter. Additionally, across requests for the same object within a test, location was controlled for, such that the object requested did not appear in the same place in the array both times. Moreover, within each 5-trial-set, the requested items were never placed in the same location within the arrays more than twice.

The mother kept the child distracted as each array was set-up. Once the array was established the child was presented with one or more of the following prompts consisting in a request for the object: "where's the," "give mommy the," "give E the," "point to the," "touch the," "get the," all followed by the name of the requested object.

When object requests without props failed to elicit a response, the following requests incorporating the use of props were used: put the (object name) on the table, put the (object name) in the box, put the Smurf near the (object name), put the keys near the (object name), put the (object name) on the E's or M's head. In cases where all above-noted prompts failed to elicit a response, a Fozzie the bear hand puppet was utilized by mother and/or experimenter. Object requests, as listed above, were either made by the puppet and/or the child was asked to give or show the puppet the object, or to get the object for the puppet, or give the object to the puppet, or to put the puppet's nose or hat on the object. Prompting was discontinued when the child either made a response, correct or incorrect, or when the above series of prompts failed to elicit a response.

The child's first response on each trial was scored as correct, incorrect (with the incorrect choice noted), or none. Since not every child completed both trial sets on each comprehension test, due to state difficulties, such as crying or lack of attention, a correct identification of an object in one 5-trial-set was accepted as evidence of learning that object word. When children who completed both 5-trial-sets within a session identified a specific object correctly both times, the additional correct choice did not affect the learning score. In cases where the child identified the object correctly on one 5-trial-set, and incorrectly on the other 5-trial-set, the child was nonetheless given credit for his correct choice. In cases where an object was not correctly identified in either one 5-trial-set, when only one 5-trial-set was administered, or

in both 5-trial-sets, when both were administered, the child was not given credit for a correct choice (learning).

Only one child, a Beginner speaker, missed a comprehension test. This was due to state problems. In this case, the child was given credit for a correct choice for one item, the chopper. This was the only item which she ever showed evidence of learning, that is, which she had identified correctly on the previous and subsequent tests.

Generalization Tasks. Upon completion of the learning phase of this experiment, that is, the four learning sessions and their accompanying comprehension tasks, three types of generalization tasks were administered. The order of administration of these tasks was counter-balanced across subjects. The first generalization task was administered on the fourth laboratory visit, after the completion of the fourth learning session and its associated comprehension task. The remaining two generalization tasks were administered on the fifth laboratory visit. For one Advanced speaker, all three generalization tasks were administered on the fifth visit due to state problems on the fourth visit. Next follows a description of these tasks.

1. Perceptual/Photographic Extension Task. The purpose of this task was to test word extension to concept exemplars on the basis of perceptual information or features only. The same test was administered to every child. The format of this task was identical to the comprehension task, in terms of the construction of the test, the manner in which the child was queried, and the manner in which child responses were coded as correct or incorrect. A correct choice here was indicative of generalization.

In this task, however, the items constituting the trials were color photographic representations (5 in. X 7 in.) of those objects serving as concept exemplars in the Extension/Overextension task (see below). The order in which the five objects were requested on each of the 5-trial-sets was distinct from any order utilized in the comprehension tasks and in the other generalization tasks. Each mother was asked if her child had any prior experience with two-dimensional repesentations of people or objects (e.g., drawings, illustrations, photographs). Every child was found to have such experience.

2. Relational Overextension Task. The purpose of this task was to test word extension to non-concept exemplars on the basis of relational information only. This task consisted in a re-enactment of the learning session event of "making pizza". For this reason this task was never administered on the fourth laboratory visit, when the final learning session occurred. All counter-balancing of generalization tasks was done within the constraint that this task could not occur first. In this event enactment, three of the learning session objects were replaced by objects unfamiliar to the child, but objects which operated in the same system of relations as the learning session objects they replaced. The sifter was replaced by a strainer, the chopper, by a grater, the baster, by a ladle. As can be seen, the new objects were not concept exemplars of the objects they replaced. Mothers were instructed before the event enactment not to name the new objects, nor to reference the old or replaced objects, but simply to incorporate these new objects into the event activity.

Upon completion of the event enactment, which was video-taped, the experimenter returned to query the child. All the pizza-making props were present during this testing. The questions consisted in requests for the objects: sifter, chopper, baster. These requests were formulated in the same manner as in the comprehension test (e.g., "where's the sifter," or "give mommy the chopper"). The requests were made in random order. The child's first response to a request was counted. Credit for a relational overextension was given each time the child indicated the strainer in response to a request for the sifter, the grater, in response to a request for the chopper, and the ladle, in response to a request for the baster. Thus, for each child, a maximum of three such overextensions was possible.

3. Extension/Overextension Task. The purpose of this task was to test word extension to concept exemplars and to non-exemplars, which were functionally and/or perceptually similar to the learning session objects. This task consisted in two parts, an interactive period and a test period. The interactive period was conducted first. This period consisted in the mother and child playing with ten objects for approximately 8 minutes, though the time was shortened if the child became fussy. No session was ended, however, unless the child had at least looked at every object.

The ten objects consisted in one instance and one non-instance of each of the learning session object/concepts. Thus, the extension items consisted in a new sifter, board, rolling pin, chopper and baster. The extension sifter was larger in size than the original sifter. The extension board was different in shape (circle) than the

original board (rectangular). The extension chopper was different in shape, size, material and color from the original chopper. The extension rolling pin was shorter in length than the original rolling pin, and had grooved shapes all along its cylinder, in contrast to the smooth cylinder of the original rolling pin. The extension baster was shorter in length, and different in material and color from the original baster.

The overextension items bore some similarity to their counterpart learning session objects. An oil can served as an overextension item to the sifter. It was perceptually similar to the original sifter in approximate size, shape, and in the presence of a handle, and functionally similar in that a stem of the handle could be manipulated, though not in the same direction. It differed from the original sifter in that it had no opening and was a different color. An auto filter served as the overextension item for the rolling pin. It was perceptually similar to the rolling pin in that it had the same features (2 handles and a cylinder) in the same arrangement as a rolling pin. It bore functional similarity in that it could be rolled. It differed from the original rolling pin in size, being considerably shorter, and in material.

A picture frame with a brown plastic rim and a cardboard insert, with no glass, served as the overextension item for the board. It was similar to the board in shape (rectangular), though a bit larger in size, and different in material. The overextension item for the baster was a bulb syringe. It was perceptually similar to the learning session baster in that it had a bulb and a tip, though its

stem was considerably shorter, and it was made of a different material. It was functionally similar to the baster in that a squeezing motion could be applied to it. The overextension item for the chopper was a garden sprayer. This item bore perceptual similarity to the chopper in that it had a handle, attached to a can-like piece, and functional similarity, in that the handle could be moved in and out, though the orientation of this movement differed from that of the chopper's.

The mothers were instructed not to name any of the objects, not to demonstrate any actions with the objects, not to name any actions in relation to the objects, prior to the child's doing so. This session was video-taped as the experimenter observed from another room. Upon completion of the interactive period, the experimenter returned to conduct the test period.

This test was identical across children, and consisted in two 5-trial-sets. The first five trials were termed extension trials, in that all items in the arrays, the requested item and the two non-requested items, consisted in extension items. The order in which the five objects were requested was distinct from any other trial-set in the experiment. The control of the location of the requested items within a 5-trial-set, the manner in which the child was queried, and the manner in which child responses were coded were identical to the comprehension tests. Correct responses were indicative of generalization.

The second 5-trial-set consisted in the overextension trials. Here again the order in which the objects were requested was unique.

The location of test items within a 5-trial-set was controlled for, as in the comprehension tests, and the manner of querying the child was the same.

The array which tested for a specific object (e.g., the baster) consisted in its extension item (e.g., the extension baster), and its overextension counterpart (e.g., the bulb syringe), and a third unrelated item (e.g., the auto filter). Correct responses consisted in the choice of either the extension or overextension items, and were indicative of generalization behavior.

If the child's first response consisted in either the extension or overextension item, that item was removed from the array, and the object request was repeated. If the child then selected the remaining correct item, either the extension or overextension item, depending on the first choice, this was noted. Thus, if the child failed to select a correct extension item in the extension trials, he had another opportunity to do so here. However, two correct choices of an extension item did not affect any measure of generalization. There was only one opportunity to select each overextension item. All correct choices, extension and overextension, or both were noted. Whenever the child chose the unrelated item the trial was ended, and the choice was considered incorrect.

Results

The results will be presented in four sections. The first section includes the discussion of learning behavior. In the second section, performance on the various kinds of generalization tasks are discussed. In the third section analyses of variables that may potentially affect learning and generalization are discussed. The fourth section involves a discussion of concept formation in relation to word learning and use.

Learning

Five aspects of learning behavior by speaker group were analyzed: overall learning, learning by object, number of different words learned per child, learning over time, and stability of learning. These will be discussed in turn.

Overall Learning. Overall learning was analyzed by computing for each child a learning score consisting in the total number of correct object identifications made summed across the four comprehension tasks. Since for each comprehension task the highest score a child could achieve for the correct identification of any object was one, and thus correct identification of all objects per task would yield a score of five, the highest possible total score that could be achieved by a child on the overall learning measure was 20. Results indicated that every child evidenced some learning. The group means on overall learning are presented in Table 1, and these means are significantly different, $t(18) = 3.18$, $p < .005$, for a one-tailed test, with Advanced speakers showing twice the level of learning of Beginner speakers.

TABLE 1

Mean Learning Scores Overall And

Per Object by Speaker Group

Learning Score	Beginner M	Beginner (SD)	Advanced M	Advanced (SD)
Rolling Pin	1.2	(1.1)	3.0	(.9)**
Baster	1.2	(1.1)	2.9	(1.2)**
Board	.5	(1.0)	2.0	(1.6)*
Chopper	1.7	(.7)	1.6	(1.0)
Sifter	.9	(1.0)	1.9	(1.3)
Overall	5.6	(3.7)	11.2	(4.2)**

*$p < .01$
**$p < .005$

Learning Per Object. Learning per object was assessed by tallying the total number of times each child identified each object summed across the four comprehension tasks. The maximum possible score per object is 4. Mean learning scores per object are presented in Table 1. Advanced speakers showed significantly better learning of the rolling pin, $t(18) = 3.83$, $p < .005$, the baster, $t(18) = 3.26$, $p < .005$, and the board, $t(18) = 2.59$, $p < .01$. All values are based on one-tailed t-tests. There were no significant differences in learning between groups on the chopper and the sifter.

Words Learned Per Child. The number of different words learned per child was assessed in two ways. First, the number of different objects correctly identified in response to a word at least once across the four comprehension tasks was noted for each child. The means per group are as follows: Beginner = 3.0, Advanced = 4.7. These means are significantly different, $t(18) = 3.15$, $p < .005$, for a one-tailed test. Advanced speakers scored very well on this index, with 7 of 10 children learning the words for all five objects, and the remaining 3 learning words for four of the five objects.

A stricter criterion was also employed for this analysis. It was noted for each child how many different objects were correctly identified by a child in response to a word at least twice across (not within) the four comprehension tasks. This criterion led to the elimination of approximately the same amount of "learned" words for both speaker groups, that is, 43.3% or 13 words for Beginner speakers, and 34% or 16 words for Advanced speakers. The resulting means, 1.7 for Beginner speakers and 3.1 for Advanced speakers, were

significantly different, $t(18) = 2.19$, $p < .025$, for a one-tailed test. Thus, under both criteria, Advanced speakers learned more words than Beginner speakers.

Learning Over Time. To measure learning over time, the data from both speaker groups on all four comprehension tasks (see Table 2) were entered into a 2 (speaker group) X 4 (comprehension task) mixed-model ANOVA, with speaker group as a between-subjects factor, and comprehension task as a within-subjects factor. This analysis revealed only significant main effects for speaker group, $F(1, 18) = 10.7$, $p < .01$, and comprehension task, $F(3, 54) = 9.86$, $p < .01$. Significant differences between means were evaluated by planned comparisons.

Within the Beginner speaker group, comparisons between comprehension tasks 1 and 4, 2 and 4, 3 and 4, revealed no significant differences. The same set of comparisons for Advanced speakers yielded a significant difference, $F(3, 54) = 10.65$, $p < .01$. Further comparisons indicated that Advanced speakers evidenced an increase in learning from comprehension task 1, on comprehension task 2 $F(1, 18) = 13.51$, $p < .01$, and on comprehension task 4, $F(1, 18) = 58.06$, $p < .01$. There was no difference in learning between comprehension tasks 2 and 3, and 3 and 4 for Advanced speakers. In summary, while both groups showed an increase in learning over time (see Table 2), this increase is significant only for Advanced speakers.

Additionally, comparisons were made between speaker groups on learning for two comprehension tasks, 1 and 4. These analyses revealed a significant difference between groups at comprehension task

TABLE 2

Mean Comprehension Scores Per Session

By Speaker Group

Speaker Group	Comprehension Test 1	2	3	4
Beginner	.9	1.3	1.8	1.5
Advanced	1.5	3.2	3.2	3.5

4 $F(1, 18) = 15.65$, $p < .01$, but not at comprehension task 1 (see Table 2). These data indicate that while the groups started out more or less equivalently, by the end of the learning phase of the experiment, consisting in four learning sessions, Advanced speakers evidenced significantly greater learning.

Learning Stability. The stability of learning was measured by dividing the four comprehension tasks into two groups: early trials comprised of comprehension tasks 1 and 2, and later trials comprised of comprehension tasks 3 and 4, and computing what percentage of words learned by each child as revealed in comprehension tasks 1 and/or 2 were still evidenced as being learned in comprehension tasks 3 and/or 4. Two-thirds of Beginner speakers' words and 81.3% of Advanced speakers' words appeared in both early and later trials. These data speak to a fairly high consistency in words learned for both groups of speakers.

Summary. The data on learning behavior indicate that Advanced speakers surpass Beginner speakers on every index of learning. Advanced speakers, in comparison to Beginner speakers, had significantly higher overall learning scores, learned words for three of the five objects significantly better, learned significantly more words per child, and showed significant improvement in learning over time.

Generalization

Four types of word generalization behavior were examined: extension to concept exemplars, overextension to functionally and perceptually similar non-concept exemplars, relational overextension

to functionally similar but perceptually dissimilar non-concept exemplars, and perceptual extension to photographic representations of the extension items. Though extension and overextension were studied within the same experimental task, the Extension/Overextension task, they are, and will be analyzed here as, discrete forms of generalization behavior.

Generalization performance was analyzed in two ways. Generalization was analyzed only for words that were learned for each child. These analyses were based on the looser criterion of learning, that is, single comprehension task identifications. First, the total number of children from each speaker group engaging in each type of generalization behavior was calculated. These data are presented in Table 3. Separate χ^2 analyses were performed on each kind of generalization behavior. The second analysis involved the calculation for each child of the percentage of learned labels that were generalized. This analysis was conducted for every form of generalization behavior except functional overextension because, in this case, a total of only three, in contrast to five, labels could be potentially generalized. The mean percentage of generalized labels of Advanced and Beginner speakers is presented in Table 4. T-tests were calculated on these means. Results of each of these analyses for each form of generalization behavior will be discussed separately.

Extension. The purpose of the extension task was to test word application to exemplars of the learning session objects. There was no significant difference between speaker groups in the number of children who engaged in extension behavior. However, Advanced

TABLE 3

Total Number of Children Per Speaker Group

Engaging in Generalization Behavior

	Generalization Tasks				
Speaker Group	Extension	Overextension	Perceptual Photographic Extension	Relational Overextension	All Tasks
Beginner	7	3	3	1	0
Advanced	10	9*	9*	7*	6*

*differs from Beginner Group, $p < .05$

TABLE 4

Mean Percentage of Labels Generalized
Per Task By Speaker Group
(Mean Number of Labels in Parentheses)

	Generalization Tasks		
Speaker Group	Extension	Perceptual Photo Extension	Overextension
Beginner	M 44.0 (1.4)	22.0 (.4)	10.7 (.8)
	SD 39.5	38.2	21.4
Advanced	M 74.0 (3.5)*	64.5 (2.5)**	54.0 (3.0)***
	SD 24.6	31.5	30.2

*differs from Beginner Group, $p < .05$
**differs from Beginner Group, $p < .01$
***differs from Beginner Group, $p < .005$

speakers did have a significantly higher percentage of labels which were generalized to the extension items, $t(18) = 2.04$, $p < .05$, for a one-tailed test. Thus, even in this, the most basic, and easiest form of generalization behavior, due to the fact that the extension objects represent the closest possible matches, functionally and perceptually, to the learning session objects, Beginner speakers fail to achieve the same level of extension as Advanced speakers. The fact that less than half of Beginner speaker labels (44%) were extended to the extension items indicates that the meaning of their words, for the most part, does not include perceptual, functional, and relational featural information about objects.

Perceptual/Photographic Extension. The purpose of this task was to test word application to exemplars of the learning session objects on the basis of perceptual information only. Significantly more Advanced, than Beginner, speakers engaged in this form of generalization behavior, $\chi^2(1) = 5.21$, $p < .05$. Additionally, Advanced speakers applied significantly more labels than Beginner speakers to the photographic representations of the extension objects, $t(18) = 2.71$, $p < .01$. Considering that only 30% of Beginner speakers engaged in this kind of generalization behavior, and that only 22% of their learned labels were applied to the photographic repesentations, it can be concluded that word meaning for Beginner speakers did not in general include perceptual information about objects.

Overextension. The purpose of the overextension task was to ascertain the extent to which words would be applied to non-exemplars of the learning session objects, that is, to exemplars whose features

are not identical to the learning session objects. Three times as many Advanced as Beginner speakers engaged in word overextension, and this difference is significant, $\chi^2(1) = 5.21$, $p < .05$. Moreover, Advanced speakers extended significantly more labels to non-exemplars, $t(18) = 3.70$, $p < .005$, than did Beginner speakers. Just 10% of Beginner speakers' labels were overextended. Considering that over half of Advanced speakers' labels were applied to non-exemplars, it appears that such speakers extend their words to objects on the basis of partial matching of features, even in the presence of non-matching features. This indicates considerable breadth and flexibility in their application of words.

Relational Overextension. The purpose of this task was to examine word extension to non-exemplars of the learning session objects on the basis of relational information only, and in the face of discrepant perceptual information. Significantly more Advanced than Beginner speakers engaged in functional overextension, $\chi^2(1) = 5.21$, $p < .05$. Since only one Beginner speaker engaged in functional overextension it may be concluded that functional and relational information about objects does not serve to constitute word meaning for Beginner speakers. Here again, Advanced speakers show considerable breadth in word application.

Generalization Analyses By Stricter Learning Criterion. Both types of analyses, number of speakers engaging in generalization behavior by group, and the mean percentage of labels generalized per child by group, were conducted also on "learned" labels, using the stricter criterion of learning. It will be recalled that this

criterion consisted in a minimum of two correct object identifications in response to a word across the four comprehension tasks. The results of these analyses followed the same general pattern of results yielded by the looser criterion.

In terms of the number of children engaging in generalization behavior across the four generalization tasks, significantly more Advanced, than Beginner, speakers engaged in perceptual/photographic extension, $\chi^2(1) = 5.5$, $p < .02$. These data are presented in Table 5. The difference in the number of speakers per group engaging in generalization behavior across two other tasks, the overextension and the functional overextension tasks, was not significantly different by this analysis, though the number of Advanced speakers was always higher (see Table 5). These tasks had yielded significant differences between groups when the looser learning criterion was employed. This discrepancy is due to the finding that no Beginner speakers were eliminated in these generalization categories, while two Advanced speakers were eliminated from each due to the stricter criterion.

The second analysis, the mean percentage of labels generalized per child, yielded significant group differences across the three generalization tasks to which it was applied. These data are presented in Table 6. Advanced speakers generalized significantly more words than Beginner speakers to the extension items, $t(18) = 2.05$, $p < .05$, to the photographic representations of the extension items, $t(18) = 2.38$, $p < .025$, and to the overextension items, $t(18) = 2.61$, $p < .01$. All values are based on one-tail tests.

Thus, even with a stricter criterion of learning, the pattern of

TABLE 5

Total Number of Children Per Speaker Group
Engaging in Generalization Behavior
By Stricter Learning Criterion

	Generalization Tasks				
Speaker Group	Extension	Overextension	Perceptual Photographic Extension	Relational Overextension	All Tasks
Beginner	5	3	3	1	0
Advanced	9	7	9*	5	6**

*differs from Beginner Group, $p < .02$
**differs from Beginner Group, $p < .01$

TABLE 6

Mean Percentage of Labels Generalized
Per Task By Speaker Group
Using Stricter Learning Criterion
(Mean Number of Labels in Parentheses)

		Generalization Tasks	
Speaker Group	Extension	Perceptual Photo Extension	Overextension
Beginner	M 50.0 (1.1)	31.3 (.8)	13.5 (.4)
	SD 46.3	45.8	19.9
Advanced	M 85.5 (2.7)*	73.7 (2.3)**	53.7 (1.8)***
	SD 31.5	34.4	42.3

*differs from Beginner Group, $p < .05$
**differs from Beginner Group, $p < .025$
***differs from Beginner Group, $p < .01$

findings between Beginner and Advanced speakers remains the same. There are two major reasons, however, why it is more appropriate to adopt the looser criterion for learning. First, the majority of one-time correct object identifications occurred in the later comprehension tasks, that is, comprehension tasks 3 and 4 (Beginner speakers = 69.2%; Advanced speakers = 62.5%). This means that these words were learned late in the experiment, and, thus, the likelihood of their being identified more than once is sharply decreased.

Second, in cases of single comprehension task identifications, generalization was more likely to occur than non-generalization. For Beginner speakers who engaged in generalization behavior, 54.5% of their words comprehended only once were generalized. For Advanced speakers, 81.3% of their words comprehended only once were generalized. Since generalization on the basis of one-time identifications in the comprehension tasks was a common occurrence in general, and something readily accomplished by Advanced speakers, such identifications should not be omitted from forming part of the bases for the present analyses.

Summary. These findings strongly indicate that Advanced speakers are significantly more likely than Beginner speakers to engage in generalization behavior. This finding is highlighted by the additional finding that significantly more Advanced, than Beginner, speakers, engaged in all forms of generalization behavior, based on the looser learning criterion, $\chi^2(1) = 5.09$, $p < .05$ (see Table 3), and on the stricter criterion, $\chi^2(1) = 7.2$, $p < .01$ (see Table 5). The high percentage of labels generalized by Advanced speakers in these tasks

indicates the substantial extent to which their labels were transferred from the learning session objects to other exemplars. Their word meaning included relational, functional, and perceptual knowledge about objects. These words may be thought to signify concepts, since conceptual knowledge has been defined in these terms.

The findings that very few Beginner speakers engaged in generalization behavior, and that they had a very low percentage of generalized labels, indicate that their word meaning does not include functional, relational, and perceptual information about objects. Rather their words, for the most part, refer only to the original learning session objects, or to very close replicas of them, as evidenced by their behavior in the comprehension and extension tasks respectively.

Variables Potentially Affecting Learning and Generalization

The above-reported results clearly point to striking differences in word learning and generalization between Beginner and Advanced speakers. In order to explore possible factors accounting for these differences, variables suggested by other investigators as important to the word learning and generalization processes were examined. These included maternal speech in the four learning sessions, child action on objects in the four learning sessions, child performance on the scale of object permanence development (Miller et al., 1980), and child ability to form concepts of the experimental objects as measured by their behavior with the objects in the Extension/Overextension task. These will be discussed in turn. Before considering these variables, however, age of the child will be examined in relation to

word learning and generalization.

Age. To examine the relation between age of child and word learning and generalization, a correlation was computed collapsing across speaker groups. This analysis correlated each child's overall learning score with his age. This correlation was not significant, r = .24. To examine the relation between age of child and word generalization, a second correlation was performed, collapsing across speaker groups. This analysis correlated the percentage of labels generalized by each child to the extension objects in the Extension/Overextension task with age. This correlation was not significant, r = .20.

Maternal Speech. Maternal speech in the learning sessions was coded for the following semantic content:

1. Concept names - "sifter," "board," "rolling pin," "chopper," "baster"

2. Specific verbs - These were verbs describing a specific action (e.g., chop, sift, roll, baste, push, press, squeeze, squirt) in contrast to general verbs (e.g., try, do).

3. Relational statements - Relational statements were those which referenced event actions. There were 10 event actions: 1. put flour into sifter; 2. sift/shake flour out of sifter onto board; 3. put ball of dough on board; 4. roll dough flat with rolling pin; 5. put cheese in chopper; 6. chop cheese; 7. take cheese out of chopper; 8. put cheese on dough; 9. fill baster with water in bowl; 10. apply water onto dough with baster. References to event actions specify relations among actor, action, and object components.

Relational statements had to specify a relation between at least two components (e.g., action/object - chop cheese, actor/action - you roll), though they often included relations among more than two components (e.g., you have to sift the flour onto the board). Each statement was coded for which event action it referenced. These statements could be accomplished within a single utterance or across utterance boundaries.

4. Object-actional statements - These included statements describing how the objects worked (e.g., The flour goes through the bottom, or See you squeeze and the water goes up in here) and statements about the results of object-actions (e.g., The dough is flat now, or The cheese is in little tiny bits). These statements could cross utterance boundaries.

5. Naming requests - These statements included requests for names (e.g., What's this?), requests to confirm names (e.g., Is this the sifter?), and requests to repeat names (e.g., Can you say baster?).

6. Feature mentions - any mention of a perceptual feature of an object (e.g., the wooden board, take hold of the handle).

7. Semantic relation mentions - mention of objects which are similar to the experimental objects (e.g., the baster is like a straw) or different from the experimental objects (e.g., the sifter is not a cup).

Every occurrence of one of these semantic categories was noted for every mother for every learning session. The total number of occurrences for each category per mother was then summed across the

four learning sessions.

Group means for semantic categories are presented in Tables 7 and 8. These data reveal that concept names, specific verbs, and relational statements form the predominate speech categories. The considerably heavier usage of the verb and relational statements categories in contrast to feature and semantic relation mentions speaks to a greater emphasis in maternal speech on the funtional as opposed to perceptual aspects of these objects.

For the names, specific verbs, and relational statements categories, t-tests were computed between group means. The only significant difference between groups was found within the relational statements category and involved reference to one event action - number 7: taking the cheese out of the chopper, with mothers of Beginner speakers referencing this action to a greater extent, $t(18) = 2.46$, $p < .025$, for a two-tailed test. Since there were basically no differences between mothers of Beginner and Advanced speakers in the use of the predominate speech categories, maternal speech was ruled out as a factor accounting for the significant group differences in child word learning and generalization.

Additional analyses were performed to examine whether this variable was related to child word learning within speaker group. Correlations were computed between child word learning scores and maternal usage of names, specific verbs, and relational statements, as they applied to the appropriate objects. The following relational statements referencing event actions were correlated individually with learning scores for the following objects: sifter - 1, sifter - 2,

TABLE 7

Mean Number of Occurrences in Maternal Speech
in Semantic Categories
By Object and Speaker Group

Semantic Category	Sifter		Board		Rolling Pin		Chopper		Baster		Total	
	B*	A	B	A	B	A	B	A	B	A	B	A
Names	25.4	25.9	15.2	15.3	13.4	16.1	21.4	15.6	14.1	17.0	89.5	89.9
Specific Verbs	20.1	16.4	N/A	N/A	21.4	15.3	51.1	34.4	12.7	14.9	105.3	81.0
Object-Actional Statements	2.3	1.6	N/A	N/A	4.5	3.6	2.9	2.9	2.4	5.0	12.1	13.1
Naming Requests	1.1	2.0	.2	.2	.1	.1	1.2	1.2	.8	2.2	3.4	5.7
Feature Mentions	.1	.8	2.7	.6	.2	.8	.8	1.8	1.4	1.0	5.2	5.0
Semantic Relation Mentions	.1	0	0	0	0	.3	0	0	.2	.1	.3	.4

*B = Beginner, A = Advanced speaker group

TABLE 8

Mean Number of Maternal Event Action-Relational Statements By Speaker Group

Event Action	Beginner M	(SD)	Advanced M	(SD)
Put flour in sifter	16.4	(9.8)	14.9	(4.6)
Sift/shake flour on board	10.5	(9.7)	8.0	(4.9)
Put dough on board	6.9	(4.1)	6.2	(3.5)
Roll dough w/pin	16.5	(7.4)	13.4	(6.5)
Put cheese in chopper	11.3	(4.6)	9.3	(3.9)
Chop cheese	15.0	(6.8)	11.1	(3.8)
Take cheese out of chopper	5.8	(3.9)	2.5	(1.8)*
Put cheese on dough	14.9	(11.8)	13.4	(5.1)
Fill baster w/water	7.0	(5.6)	4.9	(2.9)
Put water on dough w/baster	9.9	(7.2)	7.7	(5.6)
TOTAL	114.2		91.4	

*$p < .025$

board - 3, rolling pin - 4, chopper - 5, 6, 7, baster - 9, 10.

Results are presented in Table A-1 in the Appendix. The following significant correlations were found. For Advanced speakers, learning scores for the sifter were correlated with relational statements referencing event action 1, $r = .66$, $p < .05$ and with relational statements referencing event action 2, $r = .68$, $p < .05$. For Beginner speakers, learning scores for the baster were correlated with names, $r = .74$, $p < .02$, and with specific verbs, $r = .86$, $p < .01$. Since so few correlations (4 out of 36) were significant, it can be concluded that the variable of maternal speech could not explain differences in child word learning either within or between groups.

Child Action on Objects. Another variable examined was child action on the objects in the four learning sessions. There were 10 obligatory event actions, and these have been noted above. For each child in each learning session it was noted whether the child did or did not perform each of the ten event actions. Solo performance of an action as well as joint performance of an action with the mother counted as a child performed action. Within a learning session if the child performed an action a score of 1 was given, and if the child did not perform an action a score of 0 was given. Scores for each action were summed across learning sessions for each child. Thus the highest possible score per action was 4.

Certain child variations of the event actions were still counted as event actions because they maintained a relation among components. These variations included: sifting or shaking the flour from the sifter whether or not this was done over the board, rolling the pin

over the board whether or not the dough was continually underneath the pin, dunking the baster in the bowl of water whether or not the bulb was squeezed to draw the water, and applying the water to the board with the baster. A second judge independently coded 25% of the learning session videotapes, and an inter-rater reliability of 94.4% was achieved.

Group means for performance of event actions are presented in Table 9. The only significant difference between means was found for event action 1, putting flour into sifter, with Advanced speakers performing this action more than Beginner speakers, $t(18) = 2.41$, $p < .05$, for a two-tailed test. Since there was no learning difference between groups on the sifter this finding bears minimally on the group differences in learning and generalization reported earlier. In summary, these data indicate that Advanced and Beginner speakers perform event actions to a comparable degree, and, therefore, this factor does not account for the group differences in word learning and generalization.

As with the maternal speech variable, this variable was examined within speaker group to determine if it bore any relation to child word learning. The following correlations were computed between word learning scores and event actions: sifter - 1, sifter - 2, board - 3, rolling pin - 4, chopper - 5, 6, 7, baster - 9, 10. No significant correlations were found, indicating that child action on objects was not related to word learning within groups. See Table A-2 in the Appendix for a report of these data.

TABLE 9

Mean Number of Child Event Actions

Performed by Speaker Group

Event Action	Beginner M	Beginner (SD)	Advanced M	Advanced (SD)
Put flour in sifter	2.2	(1.3)	3.6	(1.3)*
Sift/shake flour on board	2.3	(1.7)	2.7	(1.6)
Put dough on board	1.4	(1.3)	2.0	(1.1)
Roll dough w/pin	2.4	(1.5)	2.6	(1.4)
Put cheese in chopper	1.6	(1.3)	2.5	(1.5)
Chop cheese	3.7	(.5)	3.9	(.3)
Take cheese out of chopper	2.5	(1.5)	1.8	(1.2)
Put cheese on dough	1.6	(1.6)	2.4	(1.3)
Fill baster w/water	3.2	(.9)	2.9	(1.4)
Put water on dough w/baster	3.3	(1.1)	3.2	(1.4)
MEAN	2.4		2.8	

*$p < .05$

Development of the Concept of Object Permanence. The next variable to be discussed in terms of its relation to child word learning and generalization is the level of object permanence development manifested by each child on the object permanence scale administered at the start of the study. Eighteen of the twenty children were found to be in Stage 5, with one child in Stage 4, and the remaining child in Stage 6. To examine the relation between level of development on the object permanence scale and child word learning, two correlations were performed collapsing over groups. One analysis correlated each child's overall learning score with their stage level of object permanence development. There was no significant correlation, $r = .17$. The second analysis correlated each child's overall learning score with the number of the highest item passed on the scale. Here again there was no significant correlation, $r = .11$.

In addition, in considering the mean learning scores of subjects capable of solving invisible displacements (items 5,6,7 on the scale), it was found that the mean learning score of the six children passing item 5 only, that is, single invisible displacements, was 12.0, whereas the mean learning score of a group of children consisting in eight who had passed items 5 and 6, and one who had passed items 5, 6, and 7, with items 6 and 7 involving sequential invisible displacements, was 7.4. The mean learning score of children solving complex invisible displacements was lower than the mean learning score of children solving single invisible displacements. This difference in means approached significance for a two-tailed t-test, $t(13) = 1.93$, $p < .10$.

To examine the relation between level of object permanence development and word generalization behavior two analyses were performed collapsing over groups. One analysis correlated the percentage of labels generalized by each child to the extension items, in the Extension/Overextension task, with their stage level of object permanence development. There was no significant correlation here, $r = .22$. A second analysis correlated for each child the percentage of labels generalized in the extension task with the number of the highest item passed on the scale. Again, no significant correlation was found, $r = .31$. Moreover, a third analysis compared the mean percentage of labels generalized in the extension task by those children solving single invisible displacements with those children solving sequential invisible displacements. The means were 55% and 71.1%, respectively. A t-test revealed that these means were not significantly different.

In addition, in considering these object permanence data in general, since eighteen of the twenty children were in Stage 5, it is clear that stage of object permanence development cannot account for the group differences in word learning and generalization. Thus, all the data reported on level of object permanence development support the position that such development is not related to the developmental differences in word learning and generalization found in this experiment.

Summary. Several variables were examined to determine if they could account for the group differences found in word learning and generalization. These variables included age of the child, maternal

speech, child action on the objects, and level of object permanence development. None of these variables served to explain word learning and generalization differences.

Concept Formation and Word Learning and Use

The last variable to be discussed in relation to child word learning and generalization is the child's ability to form concepts of the objects. Certain functional (actions on or with individual objects) and relational (actions involving two or more objects in relation to one another) behaviors performed spontaneously by the child with the extension and/or overextension objects during the interactive period of the Extension/Overextension task were considered to index conceptual knowledge of the objects. These behaviors, originally performed only with the learning session objects, are described below. Performing actions with the extension and overextension objects that were originally performed only with the learning session objects can be taken as indicative of concepts because it demonstrates similar responding to discriminable stimuli.

Performance of functional and relational behaviors indicate that this type of knowledge is constitutive of conceptual knowledge in terms of intension for the child. Their performance also indicates that knowledge of perceptual features constitutes conceptual knowledge of objects, in terms of intension, as well, in that recognition of the new objects as exemplars of the original, learning session objects, serves to elicit these behaviors. The application of behaviors performed only with the original learning session objects to these new objects, indicates also extensional conceptual knowledge, and a

coordination between intension and extension.

For the rolling pin, the following behaviors were defined as constitutive of conceptual knowledge: placing the pin and/or auto filter on the board and/or picture frame, rolling the pin and/or auto filter over the board and/or frame, rolling the pin and/or auto filter, and the mention of "dough". For the baster, the following behaviors were defined as constitutive of conceptual knowledge: squeezing the bulb of the baster and/or bulb syringe, shaking the baster and/or bulb syringe tips over the board and/or picture frame, running the baster and/or bulb syringe tips over the board and/or picture frame, and the mention of "water". Conceptual knowledge of the sifter was deemed evidenced by shaking the sifter and/or oil can, shaking the sifter and/or oil can over the board and/or picture frame, attempts to squeeze the handles of the sifter and/or oil can, and the mention of "flour" or "powder".

Conceptual knowledge of the chopper was considered evidenced by attempts to push down the handle of the chopper, and by the mention of "cheese". The overextension item for the chopper, the garden sprayer, was eliminated from this analysis because pushing the handle of the garden sprayer was a motion not identical to pushing the handle of the chopper. Conceptual knowledge of the board was considered evidenced by all behaviors previously mentioned involving the board or picture frame, and by the mention of "dough".

Whenever the child spontaneously performed one of these behaviors he was given credit for having an object concept. A second judge independently coded 40% of these data, that is, videotapes of the

interactive task for 8 of the 20 children. An inter-rater reliability of 83% was achieved. The total number of concepts per child was ascertained, and the mean number of concepts for the two speaker groups was calculated. Beginner speakers evidenced a mean number of 2.1 concepts, while Advanced speakers evidenced a mean number of 3.1. The difference between these means is significant, $t(18) = 1.82$, $p < .05$, for a one-tailed test.

These data indicate that both Beginner and Advanced speakers are capable of forming object concepts. The conceptual knowledge of both groups of children incorporated relational-functional information derived from the event activity, as when the present objects are related to one another in an event-appropriate way (e.g., rolling the pin over the board), and/or when reference is made to an absent object that is functionally related to a present object (e.g., "cheese" in response to chopper). Conceptual knowledge included also object-specific functional information, as when the child squeezes the sifter handle. Clearly, perceptual features also are constitutive of conceptual knowledge, because, as noted above, knowledge of such features enables the recognition of the new objects as exemplars of the original, learning session objects, and serves to elicit the functional and relational behaviors noted.

Two further analyses were conducted on the object concept data to ascertain the degree to which words for these concepts were learned, and if learned, generalized. As noted previously, a word was considered learned if it was used to correctly identify an object at least once across the four comprehension tasks. The looser criterion

of learning was employed in these analyses because, as noted earlier, single identifications were often due to late learning, and often served as a basis for generalization. Moreover, since Advanced speakers engaged in generalization behavior on the basis of one instance of learning to a very great extent, eliminating such instances would lead to misclassifications in the present analysis. A word was considered generalized if it was applied correctly to an item in any of the four types of generalization tasks.

One analysis involved calculating the total number of children from each speaker group falling into each of the following three categories: showed no learning of a concept word, showed no generalization of a learned concept word, and showed generalization of a learned concept word. It was possible for an individual child to fall into more than one category. For Beginner speakers, N = 9, since the data from one child had to be eliminated due to the mother's violation of the Extension/Overextension task instructions, for the interactive period of that task. These data are presented in Table 10.

Separate χ^2 analyses were performed on each of these categories, and results indicated that significantly more Beginner, than Advanced, speakers had concepts for which no word had been learned, $\chi^2(1) = 11.42$, $p < .001$. There was no significant difference in the number of speakers in each group showing no generalization of a learned concept word, although there were more Beginner speakers in this category. In addition, there was a trend approaching significance, $\chi^2(1) = 3.33$, $p < .10$, for more Advanced, than Beginner, speakers to show

TABLE 10

Total Number of Children Per Concept/Word Category

By Speaker Group

Speaker Group	Concepts Generalized Words	Concepts Non-Generalized Words	Concepts Non-Learned Words
Beginner	5	5	5
Advanced	10	2	0*

*differs from Beginner Group, $p < .001$

generalization of a learned concept word.

A second analysis involved the calculation per child of the percentage of concepts falling into the above-noted three categories, that is, the percentage of concepts per child for which no word had been learned, for which a learned word had been generalized, and for which a learned word had not been generalized. Group means are presented in Table 11. There were significant differences between groups in all three categories. Beginner speakers had a higher percentage of concepts for which no word had been learned, $t(17) = 2.74$, $p < .01$, and a higher percentage of concepts for which a learned word was not generalized, $t(17) = 2.38$, $p < .025$, both p's based on one-tailed tests. Advanced speakers had a higher percentage of concepts for which a learned word was generalized, $t(17) = 4.33$, $p < .005$, for a one-tailed test.

General Summary

The results indicated that Advanced speakers surpass Beginner speakers on every measure of learning behavior, showing higher overall learning, higher learning of each word, a higher number of distinct words learned, and improvement in learning over time. Moreover, Advanced speakers engaged in very broad generalization behavior, applying their newly-learned words to concept exemplars, on the basis of relational, functional, and/or perceptual information, as well as to non-exemplars, on the basis of partial featural information. Thus, their words can be said to index concepts of objects, and these concepts appear to have considerable breadth. On the other hand, Beginner speakers engaged in very restricted extension, and basically

TABLE 11

Mean Percentage of Concepts Per Word Category

By Speaker Group

Speaker Group	Concepts Generalized Words		Concepts Non-Generalized Words		Concepts Non-Learned Words	
	M	(SD)	M	(SD)	M	(SD)
Beginner	37.0	(42.3)	33.3	(37.3)	29.6	(35.1)
Advanced	95.0	(10.5)***	5.0	(10.5)*	0	(0)**

*differs from Beginner Group, $p < .025$
**differs from Beginner Group, $p < .01$
***differs from Beginner Group, $p < .005$

limited the application of their words to the original referents, the learning session objects. Variables such as child age, maternal speech, child action on objects, and level of object permanence development were found not to account for these differences in word learning and generalization.

An additional variable, the formation of object concepts, was studied in and of itself, as well as in its relation to word learning and use. While both speaker groups formed concepts of the to-be-learned objects, eliminating this as a factor in accounting for group differences in word learning and generalization, important group differences were found in the relation of these concepts to words. Advanced speakers, in contrast to Beginner speakers, had formed no concepts for which they had not learned a word, and the words associated with their concepts were virtually always generalized. The import of these findings in explaining developmental differences in word learning and generalization will be discussed in the following section.

Discussion

The first issue addressed by this research was the question of whether the lexical acquisition process is a single, unitary process occurring in the same way throughout development, or whether this process is affected by development, proceeding differently at different points due to developmental change. In the event of developmental differences, the aim was to specify the nature and cause of those differences.

The results clearly indicate developmental differences in word learning and use. Advanced speakers performed better than Beginner speakers on all indices of word learning, and extended or applied their words more broadly than Beginner speakers on each of the four types of generalization tasks. The word meaning of these two groups of speakers will be characterized.

Word meaning for Advanced speakers was constituted of perceptual, functional, and relational information about objects. Advanced speakers extended their words on the basis of perceptual features only, as in the photographic extension task, on the basis of both perceptual and functional information, as in the extension/overextension task, and on the basis of relational information, in the face of discrepant perceptual information, as in the relational overextension task. Thus, perceptual, relational, and functional information served as bases for word application for these children.

These findings contradict the claim that preschool children label objects according to their appearance but not their use (Anglin, 1977,

Clark, 1973; Gentner, 1978; Prawat & Wildfong, 1980; Tomikawa & Dodd, 1980). In addition, they contribute to the growing evidence that word meaning is comprised, in part, of functional information, as evidenced by functional overextensions unconfounded by perceptual similarity (Anglin, 1983; Bowerman, 1977; Gruendel, 1977; Rescorla, 1980).

The words of Advanced speakers can be said to signify object concepts. Conceptual knowledge of objects has been defined as consisting in functional, relational, and perceptual knowledge about objects, and knowledge of concept instances. Words acquired by Advanced speakers appear to represent this information.

Beginner speakers' words, in contrast to the words of Advanced speakers, appeared to be attached to, or referred to the original referents associated with the words. This is evidenced by Beginner speakers' learning and generalization performance. The comprehension tasks revealed their ability to associate their words with the learning session objects, in that they could make correct object identifications in response to the words. Their poor generalization behavior, even in the simple extension task, where under half of their words were applied to concept exemplars, revealed their inability to associate their words with non-learning session objects.

Their words serve as singular, definite, referring expressions, that is, they point out specific, individual items. Terrace (1985) notes that the act of reference involves the use of a name as a symbol, to inform or intentionally communicate to another that some feature of the environment has been noted. The words of Beginner speakers, then, are not simply features of objects, nor are they used

solely for concrete ends, to express demands. Rather they have indicating status, they signify objects. These data indicate that, during the one-word phase, the child has the knowledge that things have names.

Bowerman (1976; 1977) and Anglin (1977) proposed that children's words would initially be attached to one referent, either the first, or the most frequent, before being generalized, and this process seems to occur in word learning. The data from the present study indicate, however, that this process is applicable to word learning only as it occurs early in the one-word stage.

That Beginner speakers could identify the referents of the words in the comprehension tasks points to some level of context-independence, or de-contextualization, in their word use. These data reveal that Beginner speakers could apply words to referents apart from acting on them, and without the contextual support provided by the situational props (e.g., towel, spoon, bowl, dish, water, flour, dough, cheese). These identifications occurred outside of the pizza-making activity, that is, outside of the learning sessons.

This finding disputes the claim that words are initially bound to context, being attached to children's action schemes (Bates, 1979), to the enactment of particular events (Barrett, 1983b; Bloom, 1973; Nelson et al., 1978), or as proposed by Nelson (in press) and Nelson and Lucariello (in press), to specific objects only within specific situational contexts or to the representations of events. The likelihood that specific referents often appear in the same

situational context involving the performing of specific actions may account for their contextually-constrained look.

The learning and generalization data for Beginner speakers' words dispute the claims of semantically based theories, which argue that word meaning consists in featural knowledge abstracted from referents (Clark, 1973) or in contrasts along certain dimensions relevant to members/terms within a semantic field (Barrett, 1978). For words acquired at the one-word stage, meaning seems to consist in reference to the original unanalyzed referents. If features or contrasts had been abstracted from these referents and served to comprise word meaning, than generalization of words would have been expected.

It appears that the developmental shift in word meaning evident in these data can be characterized as a shift from referential to denotational meaning, where referential meaning is defined as the relationship holding between a term and a specific object (Lyons, 1977), and denotational meaning is defined as the relationship holding between a term and the class of objects to which it correctly applies (Lyons, 1977). Denotation specifies possible referents, and can be said to be equivalent to a concept including both intension and extension. Beginner speakers' words mean referentially, Advanced speakers', denotationally. A similar developmental shift in word meaning was proposed to occur by Nelson (in press) and Nelson and Lucariello (in press). The difference is that while Beginner speakers' words were attached to specific objects, the hallmark of referential meaning, this was not due to the words being related to those objects only within the situational/activity context.

Recognizing a shift in word meaning from referential to denotational, corresponding to the pre- and post-vocabulary spurt stages respectively, it is necessary to identify the factor(s) underlying this move. Several factors were examined as possibilities in accounting for this shift, and a brief evaluation of each will follow.

Maternal speech was one factor examined for its role in contributing to developmental differences in word learning and use. While there has been some research studying the maternal role in relation to child word learning (e.g., Bruner, 1983; Ninio & Bruner, 1978) and other research studying the maternal role in relation to child categorization (Mervis & Mervis, 1982), there has been little research investigating the maternal role in relation to the child's acquisition of words for concepts. A study by Nelson and Bonvillian (1973), however, investigated this issue and found almost no significant correlations between measures of mothers' verbal behavior and children's naming and manipulation of objects. Similarly in the present study, there were no differences between mothers of Advanced and Beginner speakers in terms of the object-related information they presented to their children in their speech. Thus, this factor cannot account for group differences in word learning and use.

These data do not necessarily indicate, however, that maternal speech plays no role in the child concept/word learning process. It is possible that some maternal support is required for child concept/word learning to occur, and that all mothers provided that "necessary" level of support, leading to a ceiling effect being

responsible for these findings.

Child action on objects also has been proposed as a potential factor underlying a shift in word meaning. This is because the function of objects has been found to play an important role in categorization, and concept and word learning (Nelson, 1979a; Nelson & Bonvillian, 1973; Nelson & Bonvillian, 1978; Ross et al., in press). Beginner and Advanced speakers, however, were not found to differ in the degree to which they acted on the objects. Thus, this factor could not account for group differences in word learning and use. In addition, this factor could not account for word learning within speaker groups.

At least two reasons may account for these findings. One is that the experimental objects were selected to be ones for which the child could apply many and distinctive actions, which may have resulted in the objects being generally equivalent on this dimension. Second, all children observed the many and distinctive actions performed with these objects, and observation alone may have been sufficient to enable learning. This would limit the impact on learning of actual performance of the actions with the objects.

A third factor examined for its role in causing a shift in word meaning, or developmental differences in how word acquisition proceeds, was the child's level of object knowledge, in terms of the concept of object permanence. This factor, as measured in an objective scale, was not found to account for the differences between groups in word learning and use. No significant correlations were found between performance on this scale and word learning and

generalization. Moreover, virtually all the children in the study (18 of 20) were found to be in the same stage of object permanence development, as measured by this scale. These findings appear to eliminate stage or level in the development of the object concept as playing any meaningful role in the developmental differences in word learning and use found in this experiment. These data are in line with the findings from previous research suggesting that object permanence development is not related to early language in terms of the onset of single-word utterances (Corrigan, 1978), the onset of multi-word utterances (Corrigan, 1978; Ingram, 1978), production measures (Bates et al., 1977), and comprehension (Miller, et al., 1980).

Nelson (in press) and Nelson and Lucariello (in press), operating on the thinking that the cognitive bases of language reside in the child's knowledge of a class of objects, in contrast to knowledge about objects in general, proposed a different explanation to account for a developmental shift in word meaning from referential to denotational. Nelson (1982; 1983; in press) proposed that children in the first half of the second year of life would not have formed discrete concepts of objects, independent of the system of relationships of which they are a part. Event schemas were hypothesized to be the primary form of conceptual representation until the second half of the second year when such schemas were thought to be subjected to cognitive analysis resulting in the partitioning of the schema into parts, such as concepts of objects and actions.

Accordingly, the proposal was made (Nelson, in press; Nelson &

Lucariello, in press) that words acquired and used in the first half of the second year of life could mean only referentially, because object concepts would be required for denotational meaning. Words could mean denotationally after the proposed analytic process occurred during the second half of the second year of life, resulting in the formation of object concepts.

The data from the present study do not support this proposal. Infants in both speaker groups were capable of forming some concepts of objects, as evidenced by their behavior with the extension and overextension items during the interactive period of the Extension/Overextension task. Therefore, the finding that the words of Beginner speakers bear only referential meaning cannot be explained by a conceptual inability on their part to form discrete object concepts. Whether event schemas are a primary or sole form of representation at some earlier point in infancy, thus, calling into play some analytic processing of these schemas, resulting in the formation of concepts of objects and actions, prior to the word-learning period, is still an open question.

To explain the developmental differences in word learning and use found in this research it is necessary to consider the conceptual system and the language system, and their relation in development. The conceptual system in general may be thought to consist in many forms of knowledge organization, such as schematic and categorical, though perhaps not throughout development. One type of knowledge organization relevant to the context of early word learning is that of the object concept. Conceptual knowledge of objects for the young

word-learning child has been defined here to include intension, that is, knowledge of properties or features, relational, functional and perceptual, of concept members, and extension, that is, knowledge of concept instances or members. The language system will be defined here as receptive word learning, as opposed to prelexical language phenomena (e.g., babbling, or word-like sounds).

The data from the present study indicate that during the first half of the second year of life children both acquire words and form concepts of objects. Thus, neither word nor concept can be said to have primacy. Rather, the conceptual system and the language system co-exist, but independently of each other, that is, with no coordination between them. This accounts for referential word meaning.

The lack of coordination between the conceptual and language systems in the Beginner speaker is evidenced in two ways. First, for one-third of their concepts Beginner speakers had learned the appropriate word, but did not use the word to refer to other concept exemplars, but only to refer to the original referents associated with the words, the learning session objects. In these cases, Beginner speakers evidenced knowledge of concept exemplars, through their nonverbal behavior, in terms of actions, functional and relational, performed with the extension and overextension objects while interacting with them, and through their verbal behavior during those interactions, when such behavior involved reference to objects associated with those items (e.g., "cheese" said in response to the generalization chopper), but not through their <u>naming</u> behavior. They

failed to apply their words to these exemplars. Thus, in the one-word phase, words often did not signify concepts, as evidenced by the lack of word generalization.

A second index of the lack of coordination between the conceptual and language systems in the Beginner speaker is the finding that for almost 30% of their concepts, they had not learned the associated word. The acquisition of words for pre-existing concepts appears not to be readily accomplished in the one-word phase. In summary then, Beginner speakers can be largely, though not fully, characterized as having concepts without words, and words without concepts.

In contrast, Advanced speakers show a coordination, an intimate relation, between their conceptual and language systems. They had no concepts for which they had not learned a word, and only 5% of the words associated with their concepts were not generalized, that is, were attached to the original referents. Words acquired in the post-vocabulary spurt/early multi-word utterance phase do not exist independent of conceptual knowledge, but almost always signify such knowledge, thereby bearing denotational meaning. What appears, then, to happen with development is that two systems of knowledge, the conceptual and language, become coordinated or related to one another.

What is not clear is the factor or factors responsible for the coordination of the conceptual and language systems characteristic of the later word-learning period. For example, whether knowledge about language, such as the insight that words signify concepts, causes the coordination of the systems, or whether some other factor(s) causes the coordination, and this coordination enables the realization that

words signify concepts, is not known.

Concurrent with this coordination is a vocabulary spurt. Advanced speakers learn significantly more words than Beginner speakers. It may be speculated, though the present data do not allow a test, that the coordination of the conceptual and language systems somehow serves as a basis for a vocabulary spurt, thereby explaining the spurt noted to occur midway through the second year of life (Bloom, 1973; Bloom et al., in press; Dore, 1978; McShane, 1979; Nelson, 1973b; Stern, 1930). The reasoning here would be that it is somehow easier to make a word-concept link, than a word-world link. In other words, it may be a more facile process to link words with concepts, than to link words with objects in the world.

One possible reason for this is that word-world links appear to involve two things. One is attaching words to a segregated world, that is, to nameable things. Second, such attachments may require all kinds of entailments and support (e.g., social, contextual, pragmatic).

As for the first point, some insight has been gained as to how the world is segregated and what constitutes nameable things early on in life. It appears that, perceptually, infants are able to recognize objects as such. Among objects, it appears that parents play a role in segregating the world for the child. Parents can establish joint regard of particular objects with their children through eye gaze and pointing, for example (see Bruner, 1983). Joint attention to objects is often established in pre-verbal interactions, and with the onset of language these objects often become verbally marked, labeled with a

conventional symbol. Additionally, Nelson (1973b) reported that the vast majority of objects named by young children were dynamic, functionally-salient, as opposed to static, objects. Moreover, as noted earlier, since children in the one-word phase understand that things have names, words themselves may invite and help the child to segregate the world by indicating objects in the surround.

Regarding the second point, on the extent and nature of the support needed for early word learning to occur, some research on child word learning seems to indicate that extensive support may be needed. For example, the work of Bruner and his colleagues on the child's acquisition of labels within a book-reading context, during the latter half of the first year and the early half of the second year, indicates the workings of a very elaborate, long-developing, social-interactive support-system (Bruner, 1983; Ninio & Bruner, 1978).

Another important finding of the present research was that Advanced speakers learned significantly more concepts than Beginner speakers. The factors examined here - maternal speech, child action on objects, level of object permanence development - cannot account for this difference. However, there appear to be two possible explanations for this finding. One is that once words come to signify concepts, the potential for an additional process in lexical acquisition is realized. Words may become empowered to drive concept formation. This proposal receives support from the finding that Advanced speakers had no concepts for which they had not learned a word, suggesting that words may be leading the concept formation

process. The proposed capacity of words to evoke concepts in the Advanced speaker would attest to the intimate coordination or relation between the conceptual and language systems hypothesized to exist at this point in development.

The notion of words enabling thought to come into existence has its roots in the thinking of Vygotsky (1962). Recent theories of word learning have employed such a notion. Bloom et al. (in press) suggested that words might guide children's continuing development of knowledge about objects. Furthermore, while Clark (1983) argued that in the early word learning period words signified pre-existing categories, a position that appears to be incorrect based on the present data, she proposed also that once language was established the process could operate in the other direction, that is, that words would trigger the formation of concepts.

A second possibility accounting for the increased number of concepts learned by Advanced speakers may be developments within the cognitive system itself. The concept formation process may somehow operate, quantitatively or qualitatively, in an improved fashion with age and/or development. What these improvements would consist in, and what would underlie such improvements, however, are open questions.

In summary then, these data suggest the following course and processes in lexical acquisition. During the first half of the second year, the conceptual and language systems co-exist, but in an independent and uncoordinated manner. Children acquire object words, and form object concepts, but not in synchrony. During the one-word phase, it is often the case that words are not attached to associated,

existent conceptual knowledge, which accounts for referential word meaning, and much of conceptual knowledge about objects is not tagged by a word.

During the second half of the second year, a coordination between these systems is achieved, and denotational word meaning becomes possible. Words acquired after the vocabulary spurt and in the early multi-word utterance phase are linked to conceptual knowledge. What causes this coordination is not yet clear, however, one hypothesis is that the child comes to understand or know something about language itself. This knowledge consists, at least in part, of the insight that words signify conceptual knowledge.

Once these systems, the conceptual and language, become inter-related, it is possible that an additional process occurs in lexical acquisition. Words, themselves, may elicit the formation of concepts, that is, concepts may be formed in response to words.

These data support a developmental model of the lexical acquisition process. What underlies developmental differences in lexical acquisition, then, is not social factors, in terms of maternal speech, nor the child's action on objects, nor cognitive factors, such as the ability to form object concepts, or the development of the concept of object permanence. What does appear to underlie developmental differences in the lexical acquisition process is a progression in child thought from a point where knowledge systems exist in isolation from one another, to a point where relationships between systems of knowledge are established.

Future research questions involve a direct examination of the

question of whether words do, in fact, drive concept formation, and, if so, at what point(s) in development. This would involve study of the concept formation process itself, with an eye toward possible developmental changes in the process, including changing susceptibility to the influence of other factors (e.g., language).

A second major issue for future research is understanding the events surrounding the proposed coordination in the conceptual and language systems midway through the second year of life. Does this coordination reflect a major re-organization on the cognitive level, which may affect other systems as well? An additional question is what precipitates a re-organization of any scale? Do language and other factors play a role?

A third major question involves examining the similarity and differences in the lexical acquisition process as it occurs for object words and other word types, such as relational words, with an aim to determine whether there are general principles of lexical acquisition that apply across form classes. Recent research by Gopnik and Meltzoff (in press) points to some similarities. For example, early relational terms, as with the object terms in this experiment, were not context-bound, that is tied to specific "event schemas" or to the enactment of specific events or action schemes. In addition, relational terms were found to undergo a developmental sequence in use, involving the use of such terms in social contexts, for social purposes, before their use in relation to conceptual knowledge.

These are just some of the questions raised by the present research.

Appendix A:

Maternal Interview Forms

MATERNAL INTERVIEW

DATE_____ MOTHER'S NAME_____

ADDRESS/PHONE_____

_____

CHILD'S NAME_____ CHILD'S DATE OF BIRTH_____

1. Mother's Educational History (post high school)

2. Father's Educational History (post high school)

3. Did you have any major medical problems during pregnancy or childbirth? If "yes", briefly specify.

4. Has your child had any major illnesses or traumatic experiences of any kind? If "yes", briefly specify.

5. Does your child participate in any playgroups, programs or special activities? If "yes", briefly specify.

6. How often in the course of a week is your child in the care of someone other than yourself? Specify any regular arrangements.

7. Does your child have any familiarity with any of these objects?
   a.) baster
   b.) rolling pin
   c.) board
   d.) sifter
   e.) chopper

8. At what age did you feel that your child first began to comprehend language, that is, understand what you were saying?

9. At what age did your child first begin to use words?

10. Can you list some of the words your child says along with some information about how they were used (e.g., all of the time, only in particular situations, have some dropped out of use, any differences in how they were used when first acquired and after they had used words for awhile, any incorrect usages).

11. Was there a point at which your child seemed to undergo a spurt or explosion in word learning where he or she seemed to acquire a lot of words all at once or was there a more steady, gradual increase in vocabulary? If there was a spurt, specify the age of the child at the time.

12. At what age did your child first begin to put words together, that is, say small sentences? Does he or she have a handful of sentences which are used very frequently or does he or she put many different words together often producing new sentences?

13. Compared to other children of the same age would you say your child talks:

_____Less _____About the same _____A great deal more

Appendix B:

Object Permanence Scale

NAME_____ DATE_____

OBJECT PERMANENCE SCALE
(from Miller et al., 1980)

1. One Vertical Screen - Stage IV

   Source: E

   As C is watching object or perhaps even reaching for it, put screen in front of object so that it is no longer visible.

   PR_____ NPR_____

2. Visible Displacement (One Screen) - Stage IV

   Source: E, UH, CS, MW

   When C is watching, take the object and cover it completely with the screen. Do two times.

   PR_____ NPR_____

3. Visible Displacement (Two Screens) - Stage V

   Source: E, UH

   After C has uncovered the toy twice in preceding item, add second screen (B) to left or right of original screen (A) in front of C. As C watches, hide object under the new screen (B). To repeat, hide the object once more under B and then switch it back to A. To pass, C finds object under correct screen without looking under other screen.

   PR_____ NPR_____

4. Sequential Visible Displacements (Two Screens) - Stage V

   Source: UH, CS, MW

   Place two screens in front of C. As C watches, move object under screen A, out the other side and under B where it should be left. To repeat, move object under B, out the side, and under A, where it should be left. To pass, C searches directly under screen where object last disappeared.

   TRIAL 1 (B) PR___ NPR___ TRIAL 2 (A) PR___ NPR___

5. Single Invisible Displacement (Two Screens) - Stage V

Source: UH

Two screens in front of C. As C watches, place the object in your hand so that it is hidden. Then put your hand under a screen and while hidden, leave the object under the screen. Do not show C empty hand, but leave your hand closed. Ask C to find the object. To repeat, hide the object under the other screen. To pass C finds object. May look in hand or under either screen first.

PR_____ NPR_____

6. Sequential Invisible Displacement (Three Screens) - Stage V

Source: UH

As C watches, place object in your hand so that it is hidden. Then move your hand under each screen, leaving the object under one screen. Do not show the C your empty hand, but leave hand closed. Ask C to find object. To repeat hide object under another screen while moving hand in reverse direction. To pass C finds object. May look in hand or under any of screens first.

PR_____ NPR_____

7. Sequential Invisible Displacement (Object Left In Hand) - Stage VI

Source: P

As C watches put object in your hand so that it is not visible. Move your hand under each of the screens, as if hiding the object, but keep the object in your hand. Keeping your hand closed, ask C to find the object. To pass, C looks in E's hand and finds object. May look in hand or under any of screens first.

PR_____ NPR_____

PR = Passing Response
NPR = Non-Passing Response

Appendix C:

Tables of Results

TABLE A-1

Correlations Between Children's Word Learning Scores

and Occurrences in Maternal Speech in Semantic Categories

By Speaker Group

Maternal Speech Category	Word Learning Scores: Sifter B	Sifter A	Board B	Board A	Rolling Pin B	Rolling Pin A	Chopper B	Chopper A	Baster B	Baster A
Names	.13	.16	.01	.41	.37	.06	.46	.31	.74**	.48
Specific Verbs	.11	.46	N/A	N/A	.23	.03	-.12	-.20	.86***	.50
Relational Statements:										
Event Action 1	.21	.66*								
Event Action 2	.21	.68*								
Event Action 3			.24	.38						
Event Action 4					.11	.02				
Event Action 5							.06	.20		
Event Action 6							.18	.07		
Event Action 7							.19	.52		
Event Action 9									.45	.49
Event Action 10									.53	.13

*p .05
** p .02
***p .01

TABLE A-2

Correlations Between Children's Word Learning Scores

and Number of Child Event Actions by Speaker Group

Child Actions	Word Learning Scores: Sifter B	Sifter A	Board B	Board A	Rolling Pin B	Rolling Pin A	Chopper B	Chopper A	Baster B	Baster A
Event Action 1	.05	.25								
Event Action 2	.49	.42								
Event Action 3			.51	.55						
Event Action 4					.21	.41				
Event Action 5							.19	.30		
Event Action 6							.31	.22		
Event Action 7							.49	.24		
Event Action 9									.04	-.45
Event Action 10									-.15	-.05

References

Anglin, J. (1977). Word, object, and conceptual development. New York: Norton.

Anglin, J. (1983). Extensional aspects of the preschool child's word concepts. In T. Seiler & W. Wannenmacher (Eds.), Concept development and the development of word meaning (pp. 247-266). Berlin: Springer-Verlag.

Ashmead, D., & Perlmutter, M. (1980). Infant memory in everyday life. In M. Perlmutter (Ed.), Children's memory (pp. 1-16). San Francisco: Jossey-Bass.

Barrett, M. (1978). Lexical development and overextension in child language. Journal of Child Language, 5, 205-219.

Barrett, M. (1983a). The course of early lexical development: A review and an interpretation. Early Child Development and Care, 11, 19-32.

Barrett, M. (1983b, September). Scripts, prototypes and the early acquisition of word meaning. In L. French (Chair), The cognitive context of language use. Symposium conducted at the meeting of the British Psychological Society Developmental Section Annual Conference, Oxford.

Bates, E. (1979). The emergence of symbols. New York: Academic Press.

Bates, E., Benigni, L., Bretherton, I., Camaioni, L., & Volterra, V. (1977). From gesture to first word: On cognitive and social prerequisites. In M. Lewis & L. Rosenblum (Eds.), Interaction, conversation, and the development of language (pp. 247-307). New York: Wiley.

Bloom, L. (1973). One word at a time: The use of single word utterances before syntax. The Hague: Mouton.

Bloom, L., Lifter, K., & Broughton, J. (in press). The convergence of early cognition and language in the second year of life: Problems in conceptualization and measurement. In M. Barrett (Ed.), Children's single-word speech. Chichester, England: Wiley.

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 (pp. 99-179). Baltimore: University Park Press.

Bowerman, M. (1977). The acquisition of word meaning: An investigation of some current conflicts. In P. N. Johnson-Laird & P. C. Wason (Eds.), Thinking (pp. 239-253). Cambridge: Cambridge University Press.

Brown, R. (1956). Language and categories. In J. S. Bruner, J. Goodnow, & G. Austin, A study of thinking (pp. 247-312). New York: Wiley.

Brown, R. (1958). How shall a thing be called? Psychological Review, 65, 14-21.

Bruner, J. S. (1978, March). The acquisition of language: The Berlyne Memorial Lecture. University of Toronto, Toronto.

Bruner, J. S. (1983). Child's talk: Learning to use language. New York: Norton.

Chatelanat, G., & Schoggen, M. (1975). An observation system of assessment of spontaneous infant behavior. Unpublished manuscript, George Peabody College, Nashville, Tennessee.

Clark, E. V. (1973). What's in a word? On the child's acquisition of semantics in his first language. In T. Moore (Ed.), Cognitive development and the acquisition of language (pp. 65-110). New York: Academic Press.

Clark, E. V. (1983). Meanings and concepts. In J. H. Flavell & E. M. Markman (Eds.), Cognitive development. Vol. 3 of P. Mussen (Ed.), Manual of child psychology (4th ed., Vol. 3, pp. 787-840). New York: Wiley.

Corman, H., & Escalona, S. Albert Einstein Scales of Sensorimotor Development. Unpublished, A. Einstein College of Medicine, New York.

Corman, H., & Escalona, S. (1969). Stages of sensorimotor development: A replication study. Merrill-Palmer Quarterly, 15, 351-361.

Corrigan, R. (1978). Language development as related to stage 6 of object permanence development. Journal of Child Language, 5, 173-189.

Daehler, M., Lonardo, R., & Bukatko, D. (1979). Matching and equivalence judgments in very young children. Child Development, 50, 170-179.

Dore, J. (1978, September). Concepts, communicative acts and the LAD. Paper presented at the Boston Child Language Meetings, Boston.

Freeman, N., Lloyd, S., & Sinha, C. (1980). Infant search tasks reveal early concepts of containment and canonical usage of objects. Cognition, 8, 243-262.

Fremgen, A., & Fay, D. (1980). Overextensions in production and comprehension: A methodological clarification. Journal of Child Language, 7, 205-211.

Gentner, D. (1978). What looks like a jiggy but acts like a zimbo? A study of early word meaning using artificial objects. Papers and Reports on Child Language Development, 15, 1-6.

Gopnik, A., & Meltzoff, A. (in press). From people, to plans, to objects: Changes in the meaning of early words and their relation to cognitive development. Journal of Pragmatics.

Gruendel, J. (1977). Referential extension in early language development. Child Development, 48, 1567-1576.

Horton, M. S., & Markman, E. M. (1980). Developmental differences in the acquisition of basic and superordinate categories. Child Development, 51, 708-719.

Ingram, D. (1978). Sensori-motor intelligence and language development. In A. Lock (Ed.), Action, gesture and symbol: The emergence of language (pp. 261-290). London: Academic Press.

Lyons, J. (1977). Semantics (Vol. 1). Cambridge: Cambridge University Press.

McShane, J. (1979). The development of naming. Linguistics, 17, 879-905.

Mehrabian, A., & Williams, M. (1971). Piagetian measure of cognitive development for children up to age two. Journal of Psycholinguistic Research, 1, 113-124.

Mervis, C. B., & Crisafi, M. A. (1982). Order of acquisition of subordinate-, basic-, and superordinate-level categories. Child Development, 53, 258-266.

Mervis, C. B., & Mervis, C. A. (1982). Leopards are kitty-cats: Object labeling by mothers for their thirteen-month-olds. Child Development, 53, 267-273.

Miller, J., Chapman, R., Branston, M., & Reichle, J. (1980). Language comprehension in sensorimotor stages V and VI. Journal of Speech and Hearing Research, 23, 284-311.

Nelson, K. (1973a). Some evidence for the cognitive primacy of categorization and its functional basis. Merrill-Palmer Quarterly, 19, 21-39.

Nelson, K. (1973b). Structure and strategy in learning to talk. Society for Research in Child Development Monographs, 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. (1978). How young children represent knowledge of their world in and out of language. In R. S. Siegler (Ed.), Children's thinking: What develops? (pp. 255-273). Hillsdale, NJ: Erlbaum.

Nelson, K. (1979a). Explorations in the development of a functional semantic system. In W. Collins (Ed.), Children's language and communication (Vol. 12) (pp. 47-81). Hillsdale, NJ: Erlbaum.

Nelson, K. (1979b). Features, contrasts and the F.C.H.: Some comments on Barrett's lexical development hypothesis. Journal of Child Language, 6, 139-146.

Nelson, K. (1982). The syntagmatics and paradigmatics of conceptual representation. In S. Kuczaj (Ed.), Language development: Language, thought and culture (pp. 335-364). Hillsdale, NJ: Erlbaum.

Nelson, K. (1983). The derivation of concepts and categories from event representations. In E. Scholnick (Ed.), New trends in conceptual representation: Challenges to Piaget's theory? (pp. 129-149). Hillsdale, NJ: Erlbaum.

Nelson, K. (in press). Making sense: The acquisition of shared meaning. New York: Academic Press.

Nelson, K., & Lucariello, J. (in press). The development of meaning in first words. In M. Barrett (Ed.), Children's single-word speech. Chichester, England: Wiley.

Nelson, K., Rescorla, L., Gruendel, J., & Benedict, H. (1978). Early lexicons: What do they mean? Child Development, 49, 960-968.

Nelson, K. E., & Bonvillian, J. D. (1973). Concepts and words in the 18-month-old: Acquiring concept names under controlled conditions. Cognition, 2-4, 435-450.

Nelson, K. E., & Bonvillian, J. D. (1978). Early language development: Conceptual growth and related processes between 2 and 4 years of age. In K. E. Nelson (Ed.), Children's language (Vol. 1) (pp. 467-556). New York: Gardner Press.

Ninio, A., & Bruner, J. (1978). The achievements and antecedents of labelling. Journal of Child Language, 5, 1-16.

Oviatt, S. (1982). Inferring what words mean: Early development in infants' comprehension of common object names. Child Development, 53, 274-277.

Piaget, J. (1952). The origins of intelligence in children. New York: Norton.

Piaget, J. (1954). The construction of reality in the child. New York: Ballatine.

Piaget, J. (1962). Play, dreams and imitation in childhood. New York: Norton.

Prawat, R., & Wildfong, S. (1980). The influence of functional context on children's labeling responses. Child Development, 51, 1057-1060.

Ratner, N., & Bruner, J. (1978). Games, social exchange, and the acquisition of language. Journal of Child Language, 5, 391-402.

Rescorla, L. (1980). Overextension in early language development. Journal of Child Language, 7, 321-335.

Rosch, E., Mervis, C. B., Gray, W. D., Johnson, D. M., & Boyes-Braem, P. (1976). Basic objects in natural categories. Cognitive Psychology, 8, 382-439.

Ross, G., Nelson, K., Wetstone, H., & Tanouye, E. (in press). Concept acquisition by young language learners. Journal of Child Language.

de Saussure, F. (1959). Course in general linguistics. New York: McGraw-Hill. (Original work published 1915.)

Schank, R. C., & Abelson, R. P. (1977). Scripts, plans, goals and understanding. Hillsdale, NJ: Erlbaum.

Smith, E., & Medin, D. (1981). Categories and concepts. Cambridge, Mass: Harvard University Press.

Stern, W. (1930). Psychology of early childhood. New York: Holt.

Sugarman, S. (1983). Children's early thought: Developments in classification. New York: Cambridge University Press.

Terrace, H. S. (1985). In the beginning was the "name". Unpublished manuscript, Columbia University, New York.

Thomson, J., & Chapman, R. (1977). Who is 'Daddy' revisited: The status of two-year-olds' over-extended words in use and comprehension. Journal of Child Language, 4, 359-375.

Tomikawa, S., & Dodd, D. (1980). Early word meanings: Perceptually or functionally based. Child Development, 51, 1103-1109.

Uzgiris, I., & Hunt, J. McV. (1975). Assessment in infancy: Ordinal scales of psychological development. Urbana, Ill: University of Illinois Press.

Vygotsky, L. S. (1962). Thought and language. Cambridge, Mass: M.I.T. Press.

Werner, H. (1948). Comparative psychology of mental development. New York: Science Editions.