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ABSTRACT

Two types of operating principles thought to play an important role in early lexical development are discussed. The principles are those concerned with: (1) assignment of reference or meaning to words; and (2) formation and evolution of categories. Discussion also addresses related issues, such as the developmentally important relationship between operating principles and environmental input, and the question of when principles become usable for the child. Concluding discussion stresses the importance of extensive observational research for investigations of the role of operating principles and environmental input in the process of early lexical development. The study of early lexical development cannot be limited to the study of operating principles or input alone. Progress is most likely to result from the study of the two together. (RH)

Operating Principles and Early Lexical Development

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Current models of early lexical development almost universally ascribe a crucial role to constraints, biases, or operating principles. In this paper, I discuss two types of operating principles which I consider to play an important role in early lexical development: (1) principles concerned with assignment of reference or meaning to words, and (2) principles concerned with formation and evolution of categories. As part of this discussion, I address the important interrelationship between operating principles and environmental input (both linguistic and nonlinguistic) in determining the course of early lexical development. I also consider the question of when the principles I have discussed become usable for the child. I conclude by stressing the importance of extensive observational research for addressing the role of operating principles and environmental input in the process of early lexical development.

Operating Principles Concerned with Determination of Reference or Meaning

Several principles concerned with determination of reference or meaning have been proposed. I will focus today on the Object Category as Referent principle (Mervis & Long, 1987). According to this principle, when a person points at or otherwise indicates an object for which the listener does not already have a name, he or she should assume that the accompanying word refers to the whole object, rather than to a part or attribute of that object or an action performed by that object. Furthermore, the name is assumed to refer to all members of the (basic level) category to which that object has been assigned. This principle is included (explicitly or implicitly) in virtually all models of early lexical development. Markman's Taxonomic principle (e.g., Markman & Hutchison, 1984) is very similar.

From a logical perspective, principles of this type clearly are necessary. For example, as has been pointed out by philosophers, linguists, and psychologists of a variety of persuasions, an infinite number of hypotheses concerning the referent of an ostensive definition can be generated. Therefore, to facilitate language development, it is crucial that the hypotheses that children entertain be limited. The Object Category as Referent principle provides one such form of limitation.

Emphasis on this principle will result in an early vocabulary that is object-name oriented. Indeed, the principle provides a basis for the results of studies by several researchers indicating that for many children, particularly first-borns, early lexicons are composed primarily of object names (see review in Mervis, in press). If the child weights this principle heavily, then in some cases he or she should incorrectly treat non-object labels as names for objects. Many such examples have been reported in the literature, documenting the use of adjectives, labels for object parts, interjections, and verbs as object labels (e.g., Macnamara, 1982; Mervis, 1987, 1988; Velleman, Mangipudi, & Locke, in press). Consider the example of "hot," based on diary entries of my sons' early lexical development. "Hot" was the second word produced by both Ari and Ethan. Both children often approached hot mugs; adults responded "That's hot!" while pointing at the mug. Because the children virtually never approached other hot objects, adults had no reason to use "hot" in reference to those objects. Within a day or so after Ari and Ethan first produced "hot," they had used the word in reference to cups containing hot liquids, cups containing cold liquids, empty cups, and more generally cups and glasses of a variety of shapes. At that time, neither child used "hot" in reference to other hot objects, such as stoves or fires.

The results of experimental studies conducted in my laboratory (Mervis & Long, 1987) and in Markman's (Markman & Hutchison, 1984; Markman & Wachtel, 1988) indicate that in general, toddlers and young preschoolers are able to use the Object Category as Referent principle to acquire object labels. Furthermore, the results of the observational studies I just described suggest that for many children, the Object Category as Referent principle plays a central role in their acquisition of labels for objects, from the onset of language acquisition. However, even for these children, whose initial vocabulary is heavily object-label based, other types of meanings are included as well. Principles to account for the acquisition of these other types of meaning have not yet been proposed.

For a second group of children, the Object Category as Referent principle does not appear to play a major role during the beginning of language development. Nelson (e.g., 1985) has argued that for the children she has studied, first words do not refer to object concepts, but instead concern event concepts. Dromi's (1987) daughter's early vocabulary also included many words that referred to event concepts. Note that in order for the Object Category as Referent principle to be used, verbal and nonverbal input must provide clear information concerning a referent object. For many of the children who participated in the Harris, Barrett, Jones, & Brookes (1988) study, for the children who participated in my longitudinal studies (Mervis, 1984, 1987), and for my sons (Mervis, 1987), this type of input generally was present. If this type of input is not provided, toddlers are unlikely to treat words as labels for object-based concepts. Instead, toddlers are likely to treat these words as labels for event-based concepts.

Consider two examples from the diary data for my sons. The input situations in which Ari heard the word "bubbles" were referentially very clear.

In most cases, the referent was bubbles that formed during washing dishes or bathing Ari. Reference generally was indicated by pointing at the bubbles. From the beginning, Ari used "bubbles" only to refer to bubbles or foam. In contrast, the input situations in which Ethan heard the word "bubbles" were much more ambiguous. Ethan often heard Ari use the word to request that someone blow bubbles. Generally, this request occurred in the absence of bubbles or the materials needed to blow bubbles. In other cases, Ari or an adult would talk about blowing bubbles while holding the bottle of bubble soap or the bubble wand. The proportion of time that "bubble" was used when the referent clearly was a bubble was very small. Ethan used "bubble" to refer to the bubble-blowing event in general and to its separate components (e.g., bubble soap, bubble soap bottle, wand, bubbles), rather than just to bubbles.

In the event case as well as the object case, operating principles are needed to provide a basis for the child to narrow down the possible hypotheses governing reference. I recently have begun to consider the form that this principle might take. I would argue that the choice between an object or an event basis for a word is determined in large part by the type of input provided concerning the word. Children have available both prelinguistic object categories and prelinguistic event schemas. In cases in which the input is referentially clear and fits the Object Category as Referent principle, the child should treat the word as a label for an object category. However, for some words, the input provided is much less specific, and does not fit with the Object Category as Referent principle. For example, many potential referents belonging to different conceptual categories may be available, and/or the word may often be used in the absence of any visible referent. In these cases, an as yet unspecified Event Category as Referent principle is used. Accordingly, the child should treat the word as a label for an event-based category.

If correct, this hypothesis concerning the effect of input on the conceptual basis for children's earliest words will provide a point of integration across studies and models which have concluded that early words are referentially based (e.g., Clark, 1983; Huttenlocher & Smiley, 1987; Markman, 1987; Mervis, 1987) and studies and models which have considered that early words generally are event based (e.g., Nelson, 1985, 1968). The study of operating principles concerned with acquisition of the lexicon requires accounting for all of the types of early meanings that young children assign to words, along with the circumstances under which particular types of meanings result.

Operating Principles Concerned with Formation and Evolution of Categories

Operating principles concerned with assigning meaning or reference to a word generally incorporate a provision that the word refers to all members of the (basic level) category to which the referent object belongs. These principles rely on a separate set of operating principles concerned with formation and evolution of categories. In this part of the paper, I consider briefly two of the principles of this type that I have proposed previously, along with one other principle that has been discussed extensively in the literature. As with the Object Category as Referent principle, the category formation and evolution principles were developed for categories of concrete objects. Some of these principles may apply to other types of meanings as well. However, no relevant evidence is available. Thus, I offer the same caveat as for the first type of principle: models of early lexical development must be expanded to account for all of the types of categories that are represented in children's early vocabularies.

The most basic operating principle concerned with category formation is the Form-Function principle. According to this principle, the form and

function of objects generally are noticeably correlated, and this correlation should be used as the basis for categorization (Mervis, 1988, 1989). This principle becomes available to infants during the beginning of the fifth stage of the sensorimotor period. During this stage, infants begin to explore objects for the purpose of learning about their properties (Piaget, 1954). One result of these explorations is that infants begin to discover particular functions or characteristic actions of specific types of objects along with the form attributes that are correlated with (or afford) these activities. For example, infants discover that objects that are spherical generally can roll. More generally, infants begin to realize that form attributes usually have correlated function attributes. Younger & Cohen (1985, 1986) have shown that by age 10 months, infants take attribute correlations into account when making categorization decisions.

Operating principles, such as the form-function principle, are used by adults as well as by children in forming categories. However, because most objects afford more than one set of form-function correlations, the actual categories that people form on the basis of the form-function principle will vary because different groups notice or emphasize different attributes of the same object, due to different experiences or different degrees of expertise. Differences between children and adults often occur because children do not share adults' knowledge of culturally appropriate functions of objects and the correlated form attributes (Mervis, 1987, 1988). For example, consider the case of a spherical bank. Very young children do not have a concept of money or of saving money. Therefore, when confronted with a spherical bank, they will ignore the slot and keyhole. Instead, they will notice that the object is round and rolls, and classify it as a ball.

For categories that initially are overextended or overlapped, the process of category evolution depends on the child becoming aware of additional form-function correlations. Indications of these new correlations often are provided by adults. As I have argued previously (Mervis, 1984, 1987, 1988), the most effective way to point out a new correlation is to show the child the critical form and function attributes at the same time as providing a verbal description of these attributes, accompanied by the name for the relevant category. In the case of the spherical bank, the adult might run a finger along the slot, drop in a coin, and tell the child that this is a slot (or hole) into which you put money. As part of this explanation, the adult would label the object "bank."

A second important operating principle for category formation and evolution is the Additional Category principle (Mervis, 1988, 1989). According to this principle, a category member should be assigned to an additional newly formed category if the listener is given concrete evidence of a new form-function attribute correlation. Note that this principle allows for the simultaneous assignment of an object to more than one category; objects can be assigned to as many categories as meet the requirements of the form-function principle. For example, based on this principle, if the form-function correlation that makes the spherical bank a bank is successfully pointed out to a toddler, he or she should then consider the object to be both a ball and a bank. Thus, this principle conflicts with Markman's (e.g., 1987) Mutual Exclusivity principle and with Tversky & Hemenway's (1984) Mutual Exclusivity of Basic Level Categories principle.

What evidence is there to support the Additional Category principle, particularly the simultaneous assignment implication? In three extensive studies, as well as in preliminary analyses of the diary data for my older son,

toddlers consistently have demonstrated simultaneous assignment of objects to old and new categories when the new category first was acquired. Simultaneous assignment persisted for several weeks or even months in some cases. The first study was a longitudinal study of normally developing children between the ages of 9 and 24 months and young children who had Down syndrome. The comprehension test results on the day that the child first demonstrated comprehension of a new label for an object that previously had been included in a category labeled by a different name, indicated that membership in the old and new categories almost always overlapped. Overlap occurred in 96% of the test cases for the normally developing children and in 93% of the test cases for the children with Down syndrome (Mervis, 1984). In the second, cross-sectional study, Banigan & Mervis (1988) again found initial overlap in 96% of the test cases for normally developing 24-month olds. The results of a longitudinal study by Chapman & Mervis (in press) and the preliminary analyses of Ari's diary data (Mervis, 1987) replicated this finding for production data. The results of several new studies by Merriman & Bowman (in press) provide further evidence of simultaneous category assignment for toddlers.

The results of these studies call into question the availability of mutual exclusivity principles concerned with category formation and evolution during the second year of life. Eventually, this type of mutual exclusivity principle is acquired; as Tversky & Hemenway (1984) have shown, basic level categories are mutually exclusive for adults. Observations of older siblings in my studies suggest that most 3-year olds also consider basic level categories to be mutually exclusive. Thus, this type of mutual exclusivity principle provides an example of an operating principle that is ultimately important for lexical development but is not available when lexical development begins. As I indicate below, the study of how such relatively late-acquired principles

become available to children (including what the prerequisites for the individual principles are), is an important area for research.

Conclusion

To document the complete set of operating principles used during the period of early lexical development, to the extent that is possible, in depth longitudinal studies are crucial. Comparative studies of children who have demonstrated different patterns of early lexical acquisition should highlight the types of individual differences in input and types of meaning acquired. Etti Dromi and I are beginning to plan such a comparison, using the diary records of our children's early lexical development. Consideration of the different patterns should offer valuable suggestions for potential operating principles which could then be tested experimentally. The same type of studies, but during the third year of life, should offer clues concerning the ontogenesis of operating principles which become available after lexical development already has begun.

In developing models of early lexical development, it is important to keep in mind the interrelationship between the input and the set of available operating principles in determining which principle will be invoked in a particular situation. For example, the same verbal input can lead to the use of different operating principles, depending on the nonlinguistic context. Consider again the two types of input I described for the word "bubble." In both cases, the linguistic input consisted of the speakers saying "bubbles" on several occasions. In one case, the accompanying nonlinguistic input conformed with that required for the Object Category as Referent principle. Thus, the child treated "bubble" as the label for the 'bubble' object category. In the other case, the accompanying nonlinguistic input was variable. In that case, the child followed the Event Category as Referent principle, treating the word

as a label for the event of blowing bubbles and the components of that event. Regardless of the input provided, however, without the limitations on potential hypotheses provided by the operating principles, the child would have been unable to determine the referent of the word. Thus, the study of early lexical development cannot be limited to the study of operating principles alone or input (or caregiver-child interaction) alone. Instead, progress is most likely to result from the study of the two together.

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