

couched in undefined folk-psychological terms. Because of this, none is a direct competitor of the associative-learning account; however, each could, instead, be realized in terms of associative mechanisms. Put another way, the associative-learning account resides at a different level of explanation than do the other accounts in this volume. It seeks to go behind folk-psychological terms to specify the processes and mechanisms out of which "beliefs" are made.

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**There Is No Silver Bullet for Word Learning:  
Why Monolithic Accounts Miss the Mark**

Because of its sheer complexity, language acquisition is a stunning achievement. Far from being a unitary phenomenon, language is the coming together of such varied streams as phonological structure, syntax, social and communicative knowledge, and conceptual structure. Nowhere is this more evident than in development, where the separate streams can be seen to emerge and converge. Because of the nature of words and the nature of the problem posed by learning them, word learning embodies the complexity of language.

Words are inherently multifaceted. They are social signals; therefore, understanding the behavior of other people is an important component of understanding language for adults. The fact that words are also units in a formal system sets them critically apart from other kinds of social behaviors or signals. Words are symbols that stand for concepts. In this respect, they have a life of their own; for example, adults can understand them perfectly well when they occur outside of social interactions. The same may well be true for 1- and 2-year-olds, who—many studies have found—can learn and respond to words played over audio speakers (e.g., Hirsh-Pasek & Golinkoff, 1996; Naigles, 1990; Schafer & Plunkett, 1998; Werker, Cohen, Lloyd, Casasolo, & Stager, 1998). The link between words and concepts means that conceptual structure is a critical component of word learning. Each of these elements is equally critical to an understanding of words. The absence of any one of them is grounds for questioning whether a form really is a word. Debates about the status of potential word forms that lack one of these aspects illustrate this fact. The topics of these debates have included, for example, a lack of understanding of the referential nature or communicative function of words, as has been argued to occur in autism or in animal "word learning"; a lack of the correct underlying conceptual structure, as may occur with complexive terms or performatives; and the lack of an arbitrary, formal relationship between word and referent, as in early iconic forms or prelinguistic gestures.

A child learning words draws on their multifaceted nature. Words seldom

come accompanied by an explicit account of their meanings. On the contrary, learners must puzzle out the meaning of a new word based on the available evidence. Words usually come embedded in rich linguistic social and physical contexts, providing some of the evidence that learners may recruit. It is clear that "expert" word learners, preschool-aged children, draw on these sources of information in word learning. Fifteen years of research has shown, moreover, that preschool-aged children have a set of default assumptions that inform their hypotheses about word meaning. These default assumptions, as well as the child's knowledge about syntax and communication, serve to constrain the problem space in word learning. Understanding the development of word learning, then, requires understanding how each of these sources of constraint arises. How does linguistic and social knowledge emerge and become recruited for word learning? Where do default assumptions come from? What is the nature of prelinguistic conceptual structure?

Several current accounts are at variance with this view of word learning. They propose, one way or another, that word learning is a monolithic phenomenon, which can be explained primarily in terms of only one kind of factor. One approach is to argue that only one of the many factors involved in word learning really matters. Another is to argue that all of the seemingly disparate factors that contribute to word learning are really instances of the same underlying factor or process. Both of these approaches threaten a comprehensive understanding of how children learn words.

**A Single Root for Word Learning**

The first approach is evident in chapter 5, where Akhtar and Tomasello make a strong argument that social-communicative understanding is the one critical factor behind word learning. While the authors grant, very reasonably, that other factors eventually contribute to word learning, they argue that these are "ancillary to the fundamental social-communicative process." They make this argument both definitionally, in terms of what words really are at the heart of it, and developmentally, in terms of the way in which words are first acquired. Yet it is not clear that this single-factor model works in either case. Words are, as I have noted, inherently multifaceted. If a baby had a "word" that she understood or used as a communicative signal but did not understand it as conceptually grounded or as a part of a formal symbol system, we would not be comfortable calling it a "word." Early nonlinguistic gestures are a case in point (see Petitto, 1988).

From a developmental standpoint, it is clear that multiple factors contribute to word learning from the very beginning. Consider an example: At the zoo, a father points toward an animal and says, "A bear!" His intention in uttering "bear" is to draw the baby's attention to that particular animal. A baby who is

a skilled reader of intentions might thus hypothesize that "bear" named the specific intention of the moment (drawing attention to an item). If this were the case, then baby words would be very different from adult words, because the baby would not yet understand that particular words are independent of the particular communicative intentions they are used to convey. But, as it turns out, babies almost never make this error. Instead, they interpret "bear" as a category term, thus pulling away from the specific communicative interaction in which the word was introduced. They extend "bear" to other animals, not to other interactions, of the same kind. To do so, babies must draw on their category knowledge. This is true from the very beginning. Complexive terms and performatives may sometimes occur, but, as Huttenlocher and Smiley (1987) demonstrated, these are not typical of babies' first words. The vast majority of the time, young 1-year-olds use words as category terms. Clearly, more than an understanding of communicative intent must contribute to word learning from the beginning.

Even at the dawn of word learning, at 12–16 months of age, babies bring to the problem not only social knowledge but also an appreciation of the link between conceptual categories and names, as well as (the evidence suggests) assumptions about likely referents and the mutual exclusivity of forms. In fact, as it happens, there is more evidence for the use of the noun-category bias and default assumptions in word learning by babies under 18 months of age than there is for the use of social cues. By the time babies turn 2 years old, the age at which Akhtar and Tomasello's data (chapter 5) most clearly demonstrate the role of social knowledge in word learning—there is also clear evidence that babies, like older learners, have default assumptions about the likely meanings of new words and that they understand a number of the important formal features of words, including the fact that they constitute a distinct system in which different forms contrast in meaning and in which different form classes have different likely meanings. Each of these factors has been found to contribute to word learning in 2-year-olds. Therefore, at no point in early development are infants solely dependent on social-communicative knowledge in word learning. Multiple factors contribute from the start, which suggests that multiple factors are necessary to break into word learning. If babies had only the ability to read intentions, they might never successfully figure out what words do.

Questioning why word learning begins when it does, at the end of the 1st year of life, Akhtar and Tomasello conclude that the answer lies in developing social knowledge. This is certainly part of the answer, but within this same time-frame cognition is blooming across domains. There are developments in conceptual categories, problem-solving abilities, causal reasoning, and sensitivity to regularities in the speech patterns of their community. It could therefore be countered that this new richness in social, cognitive, and linguistic resources causes word learning to begin when it does.

### Seemingly Distinct Factors Reduce to a Single Root

A second approach to the idea of word learning as a monolithic phenomenon is to attempt a unified account of the various factors that are at work. This is the approach of Hirsh-Pasek, Golinkoff, and Hollich in chapter 6. The authors begin by noting the diversity of information that children bring to bear in word learning. The goal of these authors is to create a single theory that can account for this diversity. As their account plays out, however, important aspects of this diversity are lost. The authors focus on how infants learn to select among the many environmental stimuli—potential "cues"—that might be relevant for word meaning. To start, the only factor that distinguishes cues is salience; some aspects of the environment (bright colors, perhaps) catch babies' attention more than others. Infants select the right cues by distributional learning over multiple repetitions of a word. Babies come to focus on the cues that occur most reliably with the referent. This leads infants to come to attend more to some cues (e.g., gaze) than to others (e.g., the salience of the potential referent). That is, specific constraints on word learning (e.g., the use of social cues) are proposed as the product of general process learning that occurs in the context of learning about words.

This is essentially the account that Smith formulates in chapter 3 to explain the shape bias and the emergence of other expectations about word meaning. The prior contingencies of word learning shape children's reactions to words, thus yielding systematic expectations about form-referent relationships—for example, the expectations that count nouns are extended to items with the same shape and that mass nouns are extended to items made of the same substance. In Smith's account, this claim is quite concrete: Children's word-learning abilities at any point in time are literally the sum total of their prior word-learning experiences.

It is certainly true that associative learning is a powerful engine of development, and it could well account for many of the expectations that children bring to bear in word learning. My concern is with the claim that the relevant knowledge for word learning derives *only* from the prior contingencies of word learning. This claim disregards the role of knowledge and other sources of constraint that arise outside of the word-learning arena. There is little debate about the fact that the concepts and assumptions that babies apply in word learning develop. The question of interest and controversy is how they develop. Do they develop based on word-learning experience alone? Or are they the product of development across contexts? If the latter is the case, then some sources of constraint could be in place at the start of word learning and could, therefore, help to get word learning off the ground. Here are three examples.

First, before infants learn words, certain aspects of the environment may stand out to them as readily extractable, informative, and useful units of analy-

sis. Objects may constitute such a unit, as is evidenced by the literature on infants' object perception. Therefore, babies may favor objects in word learning, which involves the task of linking units with units. Imai and Gentner (1997) illustrated this in a study in which Japanese-speaking and English-speaking babies found complex objects compelling units in a word-learning task.

Second, prelinguistic infants understand aspects of human behavior and communication. This is Akhtar and Tomasello's point in chapter 5: Prelinguistic knowledge about attentional states and intentions in other people provides an important source of initial constraint in word learning. Prelinguistic infants follow eye gaze and points and use pointing to direct others' attention. This helps to explain why gaze and other attentional behaviors are "salient" to young word learners. They are salient because babies understand something about the relationship of these behaviors to attentional states in other people. Thus, gaze may not begin as equivalent to any other potential cue in word learning (such as the salience of objects), but it may carry with it special significance. This possibility gains support from the findings that I outline in chapter 4. Near the onset of word learning, at 13 months of age, infants use gaze and pointing to inform word learning. This very early attention to relevant features indicates prior learning, but it is learning that occurs before infants have a history of word learning under their belts.

Third, infants can form categories at various levels of abstraction (Mandler & McDonough, 1993; Quinn, 1987). By 1 year of age, babies use categories in such nonlinguistic contexts as making inductive inferences about shared properties. Waxman and Markow's (1995) work has shown that infants as young as 12 months of age understand the link between words and categories. This is well before infants have the extent of word-learning experience that Smith describes in chapter 3 as being critical to setting up word-category relationships. Moreover, babies continue to learn about categories outside of word-learning contexts, and they bring this knowledge to bear in word learning. A recent finding by Goodman, McDonough, and Brown (1998) illustrated this point: In these studies, 2-year-olds inferred the meaning of a new word based on the semantic context and their knowledge about kinds. For example, having heard "Mommy feeds the ferret," babies inferred that a ferret is a kind of animal—that is, something that eats.

Of course, it could be argued that the knowledge that provides a starting basis for word learning is the result of the same associative-learning processes that Smith describes in chapter 3 as operating for word learning. This may be the case, but then what we need is an account of how knowledge gained in different domains and learning contexts interacts. Here we could enter a debate about the right level of analysis. Will such an account be possible at the level of simple associations; will we have to jump up to the level of existing knowledge structures; or, as Bloom argues in chapter 2, is even this level inadequate to

explain the integration of conceptual structure and the intentions of the child in word learning? At this point, our best accounts are at the middle level—that is, the level of knowledge and concepts.

### Conclusion

Each author in this book is onto a critical piece of the story. I agree completely with Bloom's argument in chapter 2 that children are active agents in their own word learning. What needs to be determined is the tools they have at their disposal to achieve this learning. Akhtar and Tomasello are certainly right in positing in chapter 5 that one very important tool is social-communicative knowledge. Smith is certainly correct in positing in chapter 3 that another critical tool is the ability to derive expectations based on prior learning episodes. Hirsh-Pasek, Golinkoff, and Hollich rightly point out in chapter 6 the need for accounts of how word-learning abilities develop.

The problem arises from the natural tendency to search for a simple cause and to stretch it to account for as much of the data as possible. This approach will not succeed for word learning. Learning a word involves tying together different kinds of knowledge—social knowledge, knowledge about language, and knowledge about the world. Monolithic accounts are pleasing and elegant. However, this elegance comes at a high cost when it deals with an inherently multifaceted phenomenon such as word learning. If we accept these accounts, we run the risk of missing the richness that gives rise to the really impressive human cognitive achievements. In short, I wholeheartedly agree with Hirsh-Pasek, Golinkoff, and Hollich's conclusion in chapter 6 that a "smoking gun" will never be found for word learning.

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### MICHAEL TOMASELLO & NAMEERA AKHTAR: Five Questions for Any Theory of Word Learning

For our commentary on the chapters in this volume, we would like to ask five very basic questions about the process of word learning, in each case contrasting our own views (also known as social-pragmatic theory) with those of the other theorists.

#### (1) Why Does Language Emerge When It Does?

Perhaps surprisingly, none of the theorists in this volume—nor any others we know of—has a concrete proposal for why language acquisition begins when it does. Could it be due to associative learning? The problem here is that human infants are very good at associative learning from very early in development—