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From Associationist to Social Sophisticate

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**ABSTRACT**—How do infants acquire their first words? Word *reference*, or how words map onto objects and events, lies at the core of this question. The emergentist coalition model (ECM) represents a new wave of hybrid developmental theories suggesting that the process of vocabulary development changes from one based in perceptual salience and association to one embedded in social understanding. Beginning at 10 months, babies learn words associatively, ignoring the speaker’s social cues and using perceptual salience to guide them. By 12 months, babies attend to social cues, but fail to recruit them for word learning. By 18 and 24 months, babies recruit speakers’ social cues to learn the names of particular objects speakers label, regardless of those objects’ perceptual attraction. Controversies about how to account for the changing character of word acquisition, along with the roots of children’s increasing reliance on speakers’ social intent, are discussed.

**KEYWORDS**—word learning; language development

There is power in language. It can start wars or ruin marriages. Readers of these words barely remember a time when they did not have language. But every word you know had to be learned. Imagine bending over your car engine with your mechanic and being told, “Your zorch is shot.” You follow your mechanic’s eyes and body orientation to the part he is examining. That rusty metal protrusion must be the *zorch*. How do we learn the mapping between words and the objects and events they represent?

### **THE WORD-LEARNING PROBLEM**

#### **Establishing a Word’s Referent: Perceptual, Social, and Linguistic Cues**

Infants are motivated to learn names for the same reason that adults are: Knowing what to call something allows one to share the contents of one’s mind with another person (Bloom & Tinker, 2001), even when the object is not present. Indeed, a great deal is known about the course of word learning. At 10 months, babies have an average comprehension vocabulary of 50 words, saying virtually nothing. By 30 months, average production vocabulary soars to 550 words (see Table 1; Fenson, Dale, Reznick, Bates, Thal, & Pethick, 1994), and children speak in full sentences.

Describing vocabulary growth, however, is only a first step toward unpacking the mechanisms behind word learning. How do words get “hooked” to objects and events? How do we (or children) learn that “zorch” refers to that whole rusty protrusion rather than to the object’s color or size? Any object presents an array of possible referents, a problem Quine (1960) called the indeterminacy of reference. A number of diverse theories have arisen to explain how children solve this problem.

One theory is that children approach the word-learning problem with a set of constraints or principles biasing them to entertain certain hypotheses about word reference over others. For example, children seem to attach names to whole objects rather than to parts (Markman, 1989; Golinkoff, Mervis, & Hirsh-Pasek, 1994).

A second theory dismisses Quine's conundrum, claiming that children map words onto the most salient objects or actions in the environment. Early word learning is but word-object associations (learned links) between noticeable (moving, brightly-colored) objects and concurrent sound sequences (words).

Finally, a third solution suggested by the family of social-pragmatic theories proposes that infants are attuned to the social cues speakers offer when labeling objects. Eighteen-month-olds, for example, only learn novel words when it is clear that objects are being labeled for their benefit (Baldwin, Markman, Bill, Desjardins, Irwin, & Tidball, 1996). If a speaker is on the telephone, toddlers resist learning a novel name for an object in front of them, even if the name is uttered with great excitement. This "failure" is adaptive: Fully 50% of parents' talk is not about the child's focus of attention (Baldwin et al., 1996). To learn words, children must note more than just the temporal contiguity between a verbal label and an object they are attending to.

Although the description of these theories is a bit of a caricature, each family of theories emphasizes only a part of the word-learning process and appeals to one causal mechanism as paramount. There have been a number of calls for hybrid theories that recognize the complexity of word acquisition and integrate diverse inputs (e.g., Waxman & Lidz, 2006). The emergentist coalition model (ECM; Hollich et al., 2000) offers one example that has yielded fruit.

## **Tracing the Changing Process of Word Learning**

The ECM recasts the issue of word learning by asking which components of which theories govern word learning at different phases of development; rather than providing an overall snapshot, it tracks changing strategies over time. Progress has been made in testing this more complex account (e.g., Hollich et al., 2000); in fact, the ECM is currently the only hybrid model that has been empirically evaluated. Here we present evidence illustrating how complex models of word learning can be put to the test. By examining infants' shifting use of associative and social strategies across time, we offer a glimpse of evidence for a piece of the ECM.

### **Three Fundamental Tenets of the ECM**

The model has three basic tenets. First, children are sensitive to multiple cues in word learning: perceptual, social, and linguistic (see Fig. 1). Second, word-learning cues change their relative importance over time. Although a range of cues in the coalition is always available, not all cues are equally utilized in the service of word learning. Children beginning to learn words rely on a perceptual subset of the available cues in the coalition. Only later do they recruit social cues like other people's eye gaze and handling of objects to learn words.

Third, the principles of word learning are emergent, changing over time. Infants may start with an immature principle of reference, such that a word will be mapped to the most salient object from the infant's point of view. Later, children sensitive to speaker intent map a word onto an object from the speaker's point of view.

## **CHANGING PROCESSES IN WORD LEARNING: THE EVIDENCE**

To investigate transformations in the word-learning process, a method was needed that could measure comprehension and that could succeed with children between 10 and 24 months. Comprehension provides a sensitive index of word-learning competence not restricted by factors that may limit language production, such as articulatory control or motivation to talk. Further, the method must permit the putative cues involved in word learning to be placed in competition so that infants' relative reliance on these cues can be gauged. Hollich et al. (2000) created just such a method using infant visual fixation on target objects as the dependent variable. Babies saw two objects, one interesting (more salient) and one boring (colorless and motionless). Standing between the objects, which were placed on a table out of the infant's reach, a speaker verbally labeled either the interesting or boring object and used social cues like eye gaze and sometimes handling to indicate which object they were labeling. The method ensured that children were learning words and not just examining interesting objects. After word training and a test to see if children learned the name of the target object, another new label was introduced that the child had not previously heard. This "new label" trial tested whether children would continue to stare at the named, target object even in the presence of another name or would look away or look at the alternative object upon hearing a new name. In a final "recovery trial," infants were asked to look again at the original object.

These different kinds of test trials in combination constitute a powerful test of word learning. If children are operating at the associative level, failing to use social cues, they should simply attach the label to the object they find most interesting. Alternatively,

children sensitive to social cues should learn the name for the object that the speaker labels, even if it is boring.

Hollich et al. (2000) found that, by 24 months, children convincingly used social information, learning the names for both the interesting and boring objects. Nineteen-month-olds were still attracted to perceptual cues even though they could use social information to learn the label for the boring object.

Twelve-month-olds showed an entirely different pattern. Social information was necessary, but not sufficient, to ensure word learning. They only learned the novel word when social and perceptual cues were “in alignment,” or when children heard the speaker label the interesting object. They failed to learn a word when the speaker labeled the boring object. Had 12-month-olds been pure associationists, they should have mismatched the word, thinking that the novel word labeled the interesting object regardless of speaker cues. The fact that they did not do this suggests they detected the speaker’s social cues.

Is there ever a time in word acquisition when children mismatch labels, relying totally on the use of perceptual salience? Pruden, Hirsh-Pasek, Golinkoff, and Hennon (in press) found that, unlike their older peers, 10-month-olds were pure associationists, mapping a novel word onto the object that they found the most interesting, regardless of which object the speaker labeled. Ten-month-olds acted as if social cues to reference did not exist.

These data suggest that the processes infants use for word learning change over time. Beginning as associationists, children move to attending to social cues, and then to recruiting the speaker’s social cues to decide which object is being named.

## WHAT CAUSES DEVELOPMENTAL CHANGE?

The discovery that word learning processes change across the first 2 years of life raises additional questions. How does the perceptually driven 10-month-old become the socially aware 19-month-old? One interesting possibility is that around the end of the first year, infants come to recognize people as intentional beings who have goals, act autonomously, and act rationally (e.g., Gergely & Csibra, 2003). Once infants understand other beings as having minds and intentions distinct from their own, they can recognize the relevance of those intentions for word learning. Noting speaker intent allows infants to tap into the lexicons of accomplished word learners so that they might add to their store of vocabulary items.

There is, however, another account of the shift to the use of social cues. As Perner and Ruffman (2005) argued, what appears to be sensitivity to social intent may be the ability to form an association between speaker gaze and speaker talk. With word-learning experience, children may note that people generally look at things they talk about. This may lead children to begin to use social cues like eye gaze for word mapping even before they understand the social intent behind the use of those cues. Even this more restrictive social sensitivity would confer advantages to learners. Once children restrict word-to-world mappings to those objects that adults look at, they have narrowed the range of word referents. Of course, this restricted range still leaves many alternative referents for a novel label (e.g., the shape, color, or size of the object). Here, principles or constraints such as “pay attention to shape” (Smith, 2000) or “label the whole object” (Markman, 1989) may also help children narrow their referent choices.

A less restrictive social account that assumes children have access to speaker intent allows for more rapid word learning. Once children can make inferences about what the speaker intends to label, they can learn words incidentally, from conversation. Thus, the use of social information under either account enhances word learning.

Whether the use of social information is seen as accessing a speaker's intent or as a more restricted association of words with social cues, one can begin to explain why early word learning (at least production) is so slow (1 to 2 words per week) relative to the fast-paced learning that occurs around 19 months of age, when children use social information.

Is it ever possible to distinguish between the use of associative cues versus social intent? Finding definitive evidence to disconfirm reductionist views and affirm accounts that impute more sophisticated capabilities to children is not a simple problem. One preliminary way is to pit associative and social cues against each other, as is done in the ECM framework (Hollich et al., 2000). Another is to examine corollary findings suggesting children's sensitivity to social intent. That research is abundant. By 18 months, for example, children complete a task on which an adult has feigned failure. Successful completion depends on inferring adult intention (Meltzoff, 1995). Finally, studies involving autistic children allow us to separate the effect of attention to social cues from that of interpreting the intention behind them. Since autistic children appear not to have the ability to detect social intent, they learn words associatively (Hennon, 2002; Priessler & Carey, 2005). Perhaps autistic children's vocabularies fail to grow at a rapid rate for this reason.

Tests of hybrid models of word learning speak to much larger issues within developmental psychology. Word learning is deceptively simple, calling upon a range of

processes that seem to take on different values for the learner over time. The ECM provides a window onto cognitive complexity and onto the various routes by which word learning can occur. In this way, the ECM parallels current trends in the exploration of social development that take multiple levels of influence into account. In the study of cognitive development, this is rare. Understanding the various pathways to word learning has implications for crafting interventions that are targeted to the processes children actually use at different ages to learn words.

Considering word learning from this vantage point might also inform the controversy about how and when children develop an understanding of other minds (e.g., Perner & Ruffman, 2005). That is, children must come to appreciate that others have thoughts, feelings, and perceptions different from their own. In communication, this translates into the very motivation for learning language: Wanting to share what one knows with someone who does not yet know it (Bloom & Tinker, 2001). Concurrently, children should pay special attention to social cues used in the context of language, for these cues provide a conduit to what is on the mind of another person. In this sense, the study of word learning offers yet another inroad into the study of how children conceptualize other minds.

Since Plato's time, scholars have discussed how words map onto the world. We have witnessed unparalleled progress in understanding both the course of word learning and the mechanisms fueling that development. The birth of words is a psychological watershed in language acquisition. The research reviewed here suggests that competing theories are best united under a hybrid view that incorporates changing mechanisms of

development. Our next task is to understand how children who begin as associationists become social sophisticates.

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/tc/**TABLE 1**

***Median Number of Words (and Ranges) in the Comprehension and Production Vocabularies of Children at Different Ages, According to Parental Report From the MacArthur Communicative Development Inventory (CDI)***

| Age (months) | Comprehension* |          | Production |        |
|--------------|----------------|----------|------------|--------|
|              | Median         | Range    | Median     | Range  |
| 10           | 42             | 11 – 154 | 2          | 0 – 10 |

|    |    |          |     |           |
|----|----|----------|-----|-----------|
| 12 | 74 | 31 – 205 | 6   | 2 – 30    |
| 18 | –  | –        | 75  | 14 – 220  |
| 24 | –  | –        | 308 | 56 – 520  |
| 30 | –  | –        | 555 | 360 – 630 |

**Note.** From ages 18 to 30 months the CDI does not include comprehension vocabulary.

This table is adapted from figures in Fenson, Dale, Reznick, Bates, Thal, & Pethick (1994).

**Fig. 1.** The coalition of cues available for establishing word reference and utilized differently across developmental time. Children shift from Phase I, a reliance on attentional cues such as how compelling an object is (perceptual salience) and the coincident appearance of an object and a label (temporal contiguity), to Phase II, a greater dependency on social and linguistic cues like eye gaze and grammar. By 12 months, dependence on Phase I cues has begun to wane and shift to the social cues in Phase II.