Priming the Brain's Language Pump

Language "filters" begin helping babies learn their native tongue—before they can understand a single word

LEARNING A LANGUAGE IS DAUNTING ENOUGH for your average adult—even given the advantages of textbooks and teachers. So how do infants manage to sort through the jumble of spoken sounds bombarding them and tease out the ones that encode meaning? The answer may lie in events that occur surprisingly early in infantile development—indeed, months before infants actually begin to learn words.

A new study published on page 606 of this issue of *Science* makes the tantalizing suggestion that a neurological "priming" process teaches infants to ignore meaningless variations in the sound of speech from one speaker to another and focus instead on the critical distinctions that carry meaning. The novelty of the study isn't in the theory—linguists have long known that we pick up this sorting skill at some time in development—but until now evidence suggested that it comes hand in hand with word meaning. Linguists thought, for example, that learning the difference between the words "bit" and "beet" taught a child that, in English, the difference between the "i" and "ee" sounds is significant.

But Patricia Kuhl at the University of Washington and her colleagues have shown that this view isn't right, says psycholinguist Steven Pinker of the Massachusetts Institute of Technology. Their work, he says, indicates infants begin to sort out sound categories without word meaning, "simply on the basis of the distribution of sounds in the parents' speech."

The question Kuhl's team set out to answer is whether 6-month-olds can distinguish between meaningful and meaningless sound variations in their native language. But first they needed a way to tell when the infants were actually detecting a change in sound. They developed a test in which the infant sits on a parent's lap while a loudspeaker nearby continuously repeats a speech-sound, such as the "ee" from the word "fee." If the sound changes to some variation on the original sound, the infants are taught to look at the speaker, where they are rewarded by the appearance of an animated toy in a box on top of the speaker.

Once the infants have learned to turn their heads when they hear a phonetic change, Kuhl's team tests how sensitive they are to changes in their native versus a foreign language. To do this, they use the fact that key sounds vary between languages. For example, the "ee" sound common in English is not found in Swedish, and Swedish in turn has vowel sounds absent from English, such as the "y" in the Swedish word "fy," which is made by forming your lips into an "o" and saying the sound "ee." Kuhl's team built its test around this difference and tested both Swedish and American babies.

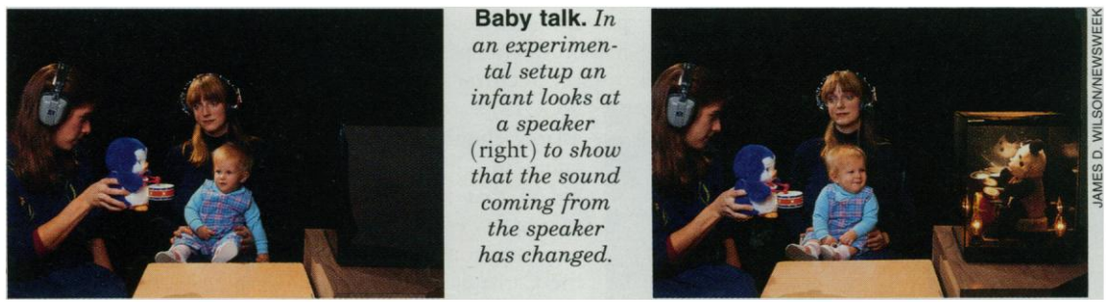
Half the babies in each group were tested on the English "ee" sound, and the other half were tested with the Swedish "y." In each test the sounds were changed in subtle ways that might resemble the various ways that real people would say the vowels. They found that American babies noticed slight variations from the ideal Swedish "y" more readily than they noticed deviations from the ideal pronunciation of their own native "ee." Conversely, Swedish infants noticed variations in the "ee" sound more easily than they noticed changes in the Swedish "y." The conclusion: at 6 months of age, the babies had already begun to learn critical information about their native languages: They were able to ignore meaningless pronunciation variations in those languages but were less able to filter out meaningless differences in another tongue.

According to Kuhl, this process turns babies from "universal linguists" who are able to distinguish between a wide range of spoken sounds into specialists in their native languages before they have learned the meaning of even a single word. "It's a passive effect," says Kuhl. "Language is affecting perception in the absence of any word meaning." Then, when it's time to learn words, having this mental filter in place to strip out meaningless distinctions may give babies a big leg up.

Kuhl's work follows up on experiments by University of British Columbia psychologist Janet Werker that were later repeated by others. In 1984 Werker and her colleague Richard Tees first reported that between 10 and 12 months of age, when infants are first learning word meaning, they lose the ability to distinguish between categories of consonants that don't play a role in their native language. These results were at first interpreted to suggest that infants don't tune out meaningless sound distinctions until they are learning words.

That might seem to contradict Kuhl's conclusion. But Brown University psycholinguist Peter Eimas doesn't see it that way. The two findings, he says, suggest overlapping processes in which infants first lose the ability to hear small variations on the ideal versions of sounds, and then the effect spreads to more distant members of the sound classes. Kuhl agrees, using for illustration the common Japanese confusion over the sounds "r" and "l." In Japanese, those two consonants are distant members of the same sound category—a category whose prototype, or ideal example, is midway between the two. "If a Japanese baby is developing a prototype for a sound that is between 'r' and 'l,' that has to get built up first," says Kuhl, "and then eventually you will see them fail to discriminate 'r' and 'l.' "

One question not answered by Kuhl's work is how babies manage to zero in on key sounds without the aid of meaning. They might get cues from "motherese," the slow, stylized way most people have of talking to babies, Kuhl suggests. Slow speech is often carefully pronounced, and Kuhl is analyzing motherese to see if it has super-clear pronunciation that might teach babies the ideal examples of sound categories. If the answer is yes, then all that exaggerated cooing and flirting we do with babies may rise in status from silly nonsense to a profound educational experience. ■ MARCIA BARINAGA



Baby talk. *In an experimental setup an infant looks at a speaker* (right) *to show that the sound coming from the speaker has changed.*

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